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ELISHA KENT KANE, M.D., U.S.N.

MADE DURING THE SECOND GRINNELL EXPEDITION IN SEARCH OF SIR JOHN FRANKLIN, IN 1853, 1854, AND 1855, AT VAN RENSSELAER HARBOR, AND OTHER POINTS ON THE WEST COAST OF GREENLAND.

REDUCED AND DISCUSSED,

FOR THE SMITHSONIAN INSTITUTION.

BY

CHARLES A. SCHOTT,

ASSISTANT U. S. COAST SURVEY.

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II. METEOROLOGY.
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INTRODUCTORY LETTER.

WASHINGTON, *May* 17, 1858.

PROFESSOR JOSEPH HENRY, LL.D.,

Secretary of the Smithsonian Institution:

DEAR SIR: The records of the magnetic observations made under the direction of Dr. Kane, in the second expedition to the Arctic regions, were placed in my hands by his late lamented father, Judge Kane, in December last.

Dr. Kane had selected Assistant Charles A. Schott, of the Coast Survey, for the reduction of a considerable portion of the observations made in that expedition; and I, therefore, placed these in Mr. Schott's possession for reduction and discussion. The work has been faithfully performed, and I recommend it for publication in the "Smithsonian Contributions to Knowledge." It is proper to state that the instruments were furnished by the Coast Survey and the Smithsonian Institution, and that the computations have been made at the expense of the latter.

Very respectfully, yours,

A. D. BACHE.

SECTION I.

MAGNETIC DECLINATION.

1854.

COMMENTS AND ADJUSTMENTS.

Instruments.—The observations for diurnal inequality as well as those for absolute declination, were made with a Jones unifilar magnetometer (No. 3), kindly loaned by Prof. A. D. Bache, Superintendent U. S. Coast Survey. The azimuth circle reads to 20″ and the centre division of the scale reads 280. The magnet was suspended by means of a silk thread 9½ inches in length. Several trials to determine the effect of torsion gave such small quantities that it was not considered necessary to take the same into account. The instrument was not originally intended to give absolute declinations, but at the Winter Quarters the observer succeeded in obtaining a few values for absolute declination by detaching the box, containing the magnet, from the circle which bears the telescope. The same was then moved in azimuth until a well defined object within the small range of its vertical motion could be observed. The focus of the telescope was adjusted to the distance. We find the instrument "perched on a pedestal of frozen gravel," the contents of two barrels. This mounting was considered as stable as the rock underneath. On the 9th of June, 1854, Mr. Sonntag examined the instrument in reference to local disturbance, and found no sensible deviation arising from such a source. "The local deviation seems to have corrected itself; the iron in our comfortless little cell seems to have been so distributed that our results were not affected by it." (Narrative, vol. I.) The adjustments were made according to Riddel's magnetical instructions. The mirror attached to the suspended magnet faces the magnetic north. The following are the determinations for the angular value of a scale division:—

Circle.	Scale.	Circle.	Scale.	
Readings; January 13, 1854.		Winter Quarters, Van Rensselaer Harbor.		
120° 60′–58′	45ᵈ.5	118° 11′–07′	253ᵈ.0	Taking alternate means, we obtain from each set the values:— $1^d = 0'.797$.
120 16—14	100.7	117 34—30	303.0	
120 16—14	92.5	117 34—30	303.2	
119 30—27	153.5	116 49—46	351.0	
119 30—27	148.0	116 49—46	354.5	
118 48—45	199.0	116 13—10	394.0	
118 48—45	201.0	116 05—00	405.5	
118 11—07	250.5	115 31—29	451.0	

Circle.	Scale.	Circle.	Scale.	
Readings; January 16, 1854.				(Dr. Hayes, observer.)
119° 31′–31′	452^d	121° 53′–55′	256^d	$1^d = 0'.741$.
120 48—46	350	123 19—18	150	
120 48—46	353	123 19—18	149	
122 09—06	251	124 42—40	42	
Readings; February 16, 1854.				
127° 04′–04′	62^d.5	121° 34′–34′	453^d.0	$1^d = 0'.839$.
125 55—56	153.0	122 55—56	356.0	
125 55—56	136.0	122 55—56	360.0	
124 18—17	257.0	124 23—24	249.0	
124 18—17	259.7	124 23—24	254.0	
123 00—00	355.0	125 47—47	150.0	
123 00—00	354.5	125 47—47	145.5	
121 34—34	463.0	127 05—05	42.0	

Value resulting, equal mean of all or one division of scale = 0′.804.
Value adopted = 0′.80.

An {increase / decrease} of scale readings indicates a movement of the north end of the magnet to the {east / west}.

A well rated pocket chronometer, nearly showing Greenwich mean time, was used for noting the time.

Diurnal Variation.—The observations for changes of magnetic declination were made during the months of January, February, and March, 1854, at the following dates:—

January	10–11	and	February 10–11
"	13–14	"	" 14–15
"	24–25	"	" 17–18
"	27–28	"	" 21–22
"	31–32	"	" 28–29
February	3–4	"	March 3–4
"	7–8	"	" 7–8

To these must be added the term days during the same period of the year, viz: January 18–19, February 24–25, and March 22–23. The remaining three terms in April, May, and June, of the same year, furnish values of the change of the diurnal inequality at a later season. Readings (the mean of two extremes during a vibration when the magnet was in motion) were taken every sixth minute, commencing, with but one exception, between 4 and 5 o'clock in the afternoon. The error of the chronometer has been applied and the time in the abstracts is given in local mean (astronomical) time. The readings are, as stated above, uncorrected for torsion, and are expressed in scale divisions. In regard to the observers, Dr. Kane remarks in his narrative: "It was not until the close of the winter that I was able to take my share in the preceding (the observations for variation) or the term-day observations; and I desire to express my obligations to Dr. Hayes and

Mr. Bonsal, as well as to George Stephenson, for their zealous and intelligent co-operation with Mr. Sonntag and myself." Each set of observations extends over twenty-four hours; they were taken nearly one minute earlier (between 56^s and 40^s) than indicated in the abstract. The general remark on page 435 of the second volume of the Narrative, "the scale reading 280 corresponds to a magnetic declination of 108° 3′ west, etc.," appears to leave no doubt that the instrument was left undisturbed, and there being no statement to the contrary, we can assume the hourly and daily means at the several days of observation to refer to the same zero or to be comparable amongst themselves. At a later period in June, 1854, the azimuth circle appears to have turned about 19 minutes.

Term-day Observations.—There were six in number. The observations commence at 10 P. M., mean Göttingen time, or about $4^h\ 37^m\ 34^s$ mean Fern Rock time, the difference of longitude being assumed to equal $5^h\ 22^m\ 26^s$. The observations were not taken at the precise instant as indicated in the abstracts; the small deviation is noted at the head of each table.

Absolute Declination.—The expedition not being provided with a proper instrument, the magnetometer was temporarily converted into a declinometer by Mr. Sonntag, who determined the declination on June 9th, the 14th, and the 26th, 1854. The top of a mountain was used as a mark; it bore south 22° west (magnetic).

The mirror attached to the magnets can be inverted so that the mean reading of mirror direct and mirror reversed corresponds to the reading of the magnetic axis of the magnet.

Geographical Position of Observatory.—The latitude and longitude of the astronomical observatory has been determined as follows: Lat. 78° 37′.0 north, Long. 70° 40′ west of Greenwich. (See p. 305, vol. II. of the Narrative, also pp. 385 and 387 of the same volume.) The island (Observatory Island) on which the observatory (Fern Rock Observatory) was placed, was some fifty paces long by perhaps forty broad. (See p. 116, vol. I. of Narrative.) The magnetic observatory was adjoining; it was of stone, ten feet square, with a wooden floor as well as roof, and supplied with a copper fire grate. No iron was used in its construction.

The following is an extract of note 56, p. 464, of vol. I. of the Narrative: "The subjoined are given as aids to physical inquiry on the part of future travellers: Directions to sites of Rensselaer harbor. The observatory was placed upon the northernmost of the rocky group of islets that formed our harbor. It is seventy-six English feet from the highest and northernmost salient point of this island, in a direction S. 14° E., or in one with said point and the S. E. projection of the southernmost islet of the group. A natural face of gneiss rock formed the western wall of the observatory. A crevice in this rock has been filled with melted lead, in the centre of which is a copper bolt. Eight feet from this bolt, and in the direction indicated by the crevice, stood the magnetometer. This direction is given in case of local disturbance from the nature of the surrounding rocks."

The highest point of the island was about thirty feet above the mean tide level of the harbor. The observatory was known by the name of "Fern Rock Observatory."

OBSERVATIONS FOR CHANGES OF THE MAGNETIC DECLINATION AT VAN RENSSELAER HARBOR, 1854.

Mean local time.	36m.	42m.	48m.	54m.	00m.	06m.	12m.	18m.	24m.	30m.	Mean local time.	Hourly means.
Fern Rock Observatory, January 10 and 11, 1854.												
4h	300d	300d	299d.3	299d	295d.5	294d	294d	294d	293d	291.d5	5h	296d.0
5	291	290.8	290.7	300	295.2	292.8	292	290.8	289	288.4	6	292.1
6	290.2	292	290.6	288	290	287.5	284	282.5	281	280	7	286.6
7	280	279	277	276	277.5	278	279.5	280	280.5	281	8	278.9
8	282	283	284	284	285	285	287	286	286	285	9	284.7
9	286	287	286	288	290	289	292	290	287	286	10	288.1
10	289	292	294	295	295	297.5	298	303	304	303	11	297.0
11	300.5	300	300	299	298	298	297	298.5	303	304	12	299.8
12	304	306	307	308	310	307.5	311	311.5	310	310.2	13	308.5
13	310	309	308.5	308.2	309.3	310	309.8	306	313	314	14	309.8
14	312	310	310	309	308	306	303.3	303.5	306	308	15	307.6
15	309.5	308	305.8	306	304.5	303	301.5	306	306	305	16	305.5
16	304	302	298	298	301	301	295	290	289	289	17	296.7
17	289	286	287	288	292	287	302	299	297	299	18	292.6
18	287	285	283	283	282	268	252	241	244	246	19	267.1
19	249	255	256	254	257	270	291	295	294	298	20	271.9
20	290	277	273	271	273	250	275	270	260	251	21	269.0
21	260	266	257	249	248	247	251	253	255.3	248.6	22	253.5
22	246.3	255	260	258	256.5	254	256.5	258.5	257	256	23	255.8
23	258	262	267.5	270	272	278.5	282.3	279.0	280	273.5	0	272.3
0	272	270	263	259	253	251	250	246	254	252	1	257.0
1	252	360	265	268	269	271	273	273	274	274	2	267.9
2	274	279	275	274	278	276	275	276	276	280	3	276.3
3	291	289	294	297	300	301	302	304	304	305	4	298.7
4	312	314	310	312	314						Mean	284.7
Fern Rock Observatory, January 13 and 14, 1854.												
								300d	299d	295d	4h	
4h	302d	304d	308d	311d	314d	317d	315d	313	316	319	5	311d.9
5	317	314	311	313	315	319	322	328	335	337	6	321.1
6	339	340	336	331	326	330	328	316	329	335	7	331.0
7	340	338	344	346	348	343	342	342	345	349	8	343.7
8	350	364	371	371	368	366	358	356	350	349	9	360.3
9	344	338	334	329.5	329	327	330	336	342	342	10	335.1
10	339	339.5	335.5	340	347.5	350	349	348.7	350.2	354.8	11	345.4
11	354	352	350.8	353	351	347	343	343	344.8	342.8	12	348.1
12	341	342	343.8	344	343.5	343	342	340.5	340	341	13	342.1
13	341	342	343	347	346	346	347	357	352	348	14	346.9
14	355	352	354	356	352	348	345	344	346	349	15	350.1
15	350	351	352	358	362	371	377	378	374	372	16	364.5
16	370	368	371	374	374	374	371	365	359	358	17	368.4
17	352	352	346	341	339	330	328	325	324	320	18	335.7
18	321	323	330	335	345	347	337	330	293	295	19	325.6
19	295	292.5	288	280	260	263.5	269.5	274	269.8	272	20	276.4
20	274	284	254	263	257.7	266.5	272.5	270	267	285	21	269.4
21	295	297	285	271	272.8	276	271.5	270	266	266	22	277.0
22	265	264	265.5	267	269	270	270	269	266	264	23	267.0
23	261	267	274	275	277	269	262	250	246	242	0	262.3
0	212	218	224	231	242	252	252	255	264	273	1	242.3
1	276	277	278	278	278	276.5	276	277	282	289	2	278.8
2	290	287	288	288	292	301	311	310	305.8	309	3	298.2
3	306	299	296.5	297.5	299.5	300.5	307	318	319.5	315.5	4	305.9
4	315	319	316								Mean	317.0

Value of a division of the scale 0′.80.

Increase of scale readings corresponds to a movement of the north end of the magnet to the east.

Fern Rock Observatory, January 24 and 25, 1854.

Mean local time.	36m.	42m.	48m.	54m.	00m.	06m.	12m.	18m.	24m.	30m.	Mean local time.	Hourly means.
								305d	305d	305d	4h	
4h	307d.3	310d	313d	315d	317d	318d	323d	326	331	333	5	319d.3
5	337	340	342	346	348	350	353	355	353.5	354	6	347.8
6	355	355	357	357	359	360	361.5	363	361	369	7	359.7
7	373	371	366	363	368	367	366	367	367	366	8	367.4
8	364	363	362	357	356	358	360	362	364	365	9	361.1
9	364	361	358	362	365	367	363	359	357	356.5	10	361.2
10	355	354	354.5	357	356	358	358.5	360.5	359	358.5	11	357.1
11	356.5	354	356	358.5	359	361	363	364	359	352	12	358.3
12	350	352	353.5	351.5	352	354	356	359.5	361	363	13	355.2
13	360	355	359	368	370	370	373	366	361	358	14	364.0
14	360	366	365	361	359	353	351	350.8	350	349	15	356.5
15	347	348	347	344	344	344.5	342	343	340	340	16	344.0
16	340	342	344	344	344	344	343	343	343	342	17	342.9
17	340	338	338	337	337	338	338	339	341	342	18	338.8
18	344	345	348	348	347	346	346	346	347	347	19	346.4
19	347	348	348	349	350.5	350	349.5	348	346	336	20	347.2
20	322	316	318	318.5	320	321	308	305	304	301	21	313.3
21	301.5	300.5	292	291	286	291.5	304	302	310	314	22	299.2
22	317	315	315	314	316	316	318	316	314	314	23	315.5
23	315	313	312	313	314	310	309	309	308	300	0	310.3
0	298	301	304	302	292	287	282	285	288	294	1	293.3
1	300	305	300	294	292	304	304	311	309	310	2	302.9
2	312	314	316	312	308	310.5	314	315	315	314.5	3	313.1
3	316	316.5	318	316	310.5	310	310	312	315.6	318.5	4	314.3
4	311.5	310.5									Mean	337.0

Fern Rock Observatory, January 27 and 28, 1854.

4h	306d	305d	307d	313d	320d	327d	321d	315d	312d	308d	5h	313d.4
5	304	302	302	306	307	308	306	308	314	316	6	307.3
6	320	325	330	332	328	326	324	323	325	326	7	325.9
7	326	328	323	324	324	325	325	320	319	320	8	323.4
8	319	319	319	319	318	319	320.5	321	322	322	9	319.8
9	322	322	322	322	323	324	323.7	324	323	323	10	322.9
10	322	320	322	323.7	325.8	326.5	327	327.3	325	328	11	324.7
11	329	329.8	330	329	328	326	326	337	338	334.7	12	330.7
12	332	342	342.2	341	339.5	334	331	328	330	331	13	335.1
13	331.4	336	337	334	330	336	334	332	331	330	14	333.1
14	330	332	334	330	338	347	357	353	348	344	15	341.3
15	346	348	348	346	345	345	346	351	356	350	16	348.1
16	346	345	347	348	349	355	359	364	368	370	17	355.1
17	378	380	384	386	388	389.5	388	387	387.5	386	18	385.4
18	386	386	386	386	385	381	378	375	375	374	19	381.2
19	374	373	370.8	365	365	360	355	355.5	352	349.5	20	362.0
20	360	365	362	360	356	353	352	351.5	353	356	21	356.8
21	354.5	356	357.5	360	362	364.5	365	365.5	363	361	22	363.8
22	359	360	361	362	363	365	367	368	365	363	23	363.3
23	360	356	341	346	341.5	336	337	338	338	335	0	342.8
0	332	335	339	342	341	340	340	341	342	346	1	339.8
1	351	356	360	359	358	363	355	362	357	354	2	357.5
2	350	350	350	348	346	350	345	344	349	350	3	348.2
3	352	352	353	355	358	359	354	340	333	332	4	348.8
4	336	340	343	345	345						Mean	342.9

Value of a division of the scale 0′.80.

Increase in scale readings corresponds to a movement of the north end of the magnet to the east.

Aurora visible on the 27th and 28th.

Fern Rock Observatory, January 31 and February 1, 1854.

Mean local time.	36m.	42m.	48m.	54m.	00m.	06m.	12m.	18m.	24m.	30m.	Mean local time.	Hourly means.
								304d	306d	325d	4h	
4h	332d.5	340d	341d.5	335d.5	345d	333d.5	334d.5	330	330	328	5	335d.0
5	326	327	328.5	324	318	311	313	320	325	330	6	322.2
6	338	344	348	356	358	359.5	356	357	358	358	7	353.2
7	359	359	360	360.5	361	362	363.5	365	367	368.5	8	362.5
8	370	372	372	374	371	370	371	371	371	372	9	371.4
9	372	372	373	373	374	372	372	372	371	370	10	372.1
10	368	368	367	364	361	365	371	370	369	367	11	367.0
11	365	366	370	377	376	377	380	387	384	382	12	376.4
12	379	374	375	376	374	373	370	368	374	375	13	373.8
13	376	376	380	384.5	385	384	383.5	382	380	378	14	380.9
14	379	381.5	383	384	385.5	383	380	379	376	370	15	380.1
15	368	365	364	365	367	369	371	373.5	374	375	16	369.1
16	374.5	375	375	374.5	374	375	374	374	373	373	17	374.2
17	373	374	374.5	375	374	374	374	375	378	382	18	375.3
18	385	387	390	389	388	388	389	390	385	386	19	387.2
19	387	388	389.8	387	389	389	389	387	387	386	20	387.9
20	385	385	385	384.5	383	382	382	382	376	370	21	381.4
21	367	369	370	370	292	288	278	284	285	291	22	319.4
22	294	297	311	328	338	348	359	359.5	351	350	23	333.5
23	342	338	334	318.5	314	312	311	314	318	323	0	322.4
0	329.5	331	322	332	333	342	346	350	359	365	1	340.9
1	370	370	370	375	381	379	375	372	368	364	2	372.4
2	359	356	355	354	352	351	351	350	363	373	3	356.4
3	375	377	377	380	383	376	376	378	380	386	4	378.8
4	390	396	400	398	396	407	419	430	440		5	
											Mean	362.2

Fern Rock Observatory, February 3 and 4, 1854.

Mean local time.	36m.	42m.	48m.	54m.	00m.	06m.	12m.	18m.	24m.	30m.	Mean local time.	Hourly means.
								336d	335d	342d	8h	
8h	348d	353d	358d	363d.5	367d.5	372d	374d	374	374	376	9	366d.0
9	377	376	375	373	370	365	363	362	362	363	10	368.6
10	369	370	372	372.5	374	377	378	378.7	379	385	11	375.5
11	386	388	390	393	400	408	407	404	402	398	12	397.6
12	403	408	406	407	410	408	406	405	408	410	13	407.1
13	413	410	411	415	435	450	454	456	457	430	14	433.1
14	425	415	412	411	411	410	406	405	400	400	15	409.5
15	400.5	400	398	397	396	394	390	385	392	408	16	396.0
16	411	414	418.5	408	397	393	389	389.5	389	389	17	399.8
17	390	392	393	391	389	388	378	362	342	337	18	376.2
18	335.5	336	342	351	362	380	386	409	367	350	19	361.8
19	339	320	308	323	316	309	296	285	270	262	20	302.8
20	261.5	260	258	261	262	275	270	274	278	287	21	268.6
21	295	302	303	299	296	300	303	320	334	340	22	309.2
22	355	354	344	332	340	362	350	342	340	344	23	346.3
23	348	352	345	341	330	320	315	314	314	315	0	329.4
0	320	332	336	340	345	340	339	350	348	346	1	339.6
1	346.5	346	345	350	340	332	340	346	325	305	2	337.5
2	298	308	315.5	316	314	311	311	310	308.5	306	3	309.8
3	304	302	300	294	286	294	301	307	319	333	4	304.0
4	345	349	349	353	358	361	362	364	364	362	5	356.7
5	360	358	356	359	362	362	364	362	368	370	6	362.1
6	369	366	371	375	378	377	375	380	390	389	7	376.0
7	389	379	373	371	370	370	370	371	371		8	(373.5)
											Mean	358.6

Value of a division of the scale 0′.80.

Increase in scale readings corresponds to a movement of the north end of the magnet to the east.

NOTE.—Another stove had been put up temporarily; it was removed at the close of the observations.

Fern Rock Observatory, February 7 and 8, 1854.

Mean local time.	36m.	42m.	48m.	54m.	00m.	06m.	12m.	18m.	24m.	30m.	Mean local time.	Hourly means.
								316d	317d	317d	4h	
4h	316d.5	317d	317d	316d	314d	314d	315d	315	316	317	5	315d.7
5	319	320	322	323	322	320	321	323	326	329	6	322.5
6	333	336	339	342	344	345	347	349	345	339	7	341.9
7	341	345	349	355	355	361	454	346	352	356	8	351.4
8	357	356.5	356	355	354	354	355	355	355	356	9	355.3
9	356	356	356	355	354	352	352	354	355	360	10	355.0
10	369	370	369	368	368	369	370	372	374	375	11	370.4
11	377	379	375	370	367	368	368	368	368	368	12	370.8
12	367	367	368	369	370	372	375	377	380	383	13	372.8
13	386	389	392	395	396	394	392	389	389	390	14	391.2
14	389	387	386	384	381	378	375	372	369	365	15	378.6
15	362	359	355	350	346	342	337	336	334	333	16	345.4
16	333	334	334	335	336	338	339	339	338	336	17	336.2
17	330	325	320	314	311	308	304	302	301	302	18	311.7
18	302	302	298	294	290	287	284	280	276	273.5	19	288.6
19	271	270	268	266.5	274	283	287	290	294	294	20	279.7
20	295	297	298	300	301	305	307	310	313	313	21	303.9
21	313	312	312	311	303	295	287	294	294	295	22	301.6
22	297	298	296	295	293	294	301	310	319	326	23	302.9
23	322	323	325	323	322	321	319	318	314	312	0	319.9
0	306	299	300	301	303	306	310	320	328	334	1	310.7
1	335	336	337	336	332	329.5	330	332	332	330	2	332.9
2	327.5	320	313	308	301	296	288	291	308	315	3	306.7
3	317	315	312	309	313	320	329	333	333	334	4	321.5
4	336	341	347	350	352						5	
											Mean	332.8

Fern Rock Observatory, February 10 and 11, 1854.

Mean local time.	36m.	42m.	48m.	54m.	00m.	06m.	12m.	18m.	24m.	30m.	Mean local time.	Hourly means.
								251d	254d	256d	4h	
4h	261d	266d	272d	284d	294d	300d	306d	312	318	323	5	293d.6
5	330	340	352	366	368	362	354	352	355	362	6	354.1
6	360	358	357.5	360	366	365	365	364	366	368	7	362.9
7	371	373	376	378	380	384	385	385	390	396	8	381.8
8	396	395.5	394	392.7	394	390	390	389	387	387	9	391.4
9	387	386	386	386	380	382	382	382	382	382	10	383.5
10	382	381	380	378	377	376	376	375	374	374	11	377.3
11	376	380	383	385	385	385	386	386	386	387	12	383.9
12	388	389	389	392	393	392	390	390	392	394	13	390.9
13	396	397	396	394	392	400	412	420	424	422	14	405.3
14	422	430	444	460	464	470	487	480	493.5	498	15	464.8
15	501	504	503	499	479	460	448	429	417	407	16	464.7
16	405	400	398	397	395	389	383	379	371	368	17	388.5
17	362	370	377	373	369	365	357	348	348	350	18	361.9
18	350	329	329	325	321	317	312.5	297	288	280	19	314.8
19	272	265	263	261	261	262	262	263	265	266	20	264.0
20	267	268	269	270	273	276	279	274	270	265	21	271.1
21	261	256	251	246	240	238	225	231	239	235	22	242.2
22	216	196	196	193	203	203	202	201	206	211	23	202.7
23	215	216	215	215	211	208	205	203	200	195	0	208.3
0	200	203	201	201	200	199	203	211	215	220	1	205.3
1	227	232	239	254	280	300	314	325	320	320	2	281.1
2	319	319	319	321	327	331	345	350	362	369	3	336.2
3	353	359	361	363	365	365	361	364	365	364	4	362.0
4	361	361	354	351	347						5	
											Mean	337.2

Value of a scale division 0′.80.

Increase of scale readings corresponds to a movement of the north end of the magnet to the east.

Fern Rock Observatory, February 14 and 15, 1854.

Mean local time.	36m.	42m.	48m.	54m.	00m.	06m.	12m.	18m.	24m.	30m.	Mean local time.	Hourly means.
4^h			304^d	303^d	304^d	303^d	307^d	311^d	316^d	324^d	5^h	($307.^d0$)
5	331^d	339^d	343	347	350	352	355	358	359	360	6	349.4
6	362	362	365	369	372	380	387	396	401	410	7	380.4
7	393	398	398	401	417	449	440	435	440	440	8	421.1
8	435	434	428	420	420	412	405	408	413	422	9	419.7
9	439	450	470	478	487	486	486	494	482	465	10	473.7
10	462	458	451	443	438	432	426	431	443	457	11	444.1
11	472	483	494	493	491	487	483	477	458	436	12	477.4
12	434	414	410	409	410	407	406	408	413	419	13	413.0
13	428	441	452	456	459	462	473	464	465	462	14	456.2
14	458	454	450	449	447	446	458	473	478	481	15	459.4
15	486	489	491	492	490	492	494	494	490	485	16	490.3
16	478	470	468	460	452	444	434	430	428	420	17	448.4
17	416	420	414	414	409	404	401	399	396	394	18	406.7
18	391	376	376	377	378	392	391	366	359	356	19	376.2
19	349	344	338	320	312	334	340	336	329	329	20	333.1
20	331	339	350	356	359	354	349	345	331	317	21	343.1
21	296	292	289	292	292	291	289	287	284	278	22	289.0
22	275	273	258	246	244	238	234	228	223	218	23	243.7
23	212	208	211	186	160	138	146	136	132	129	0	165.8
0	131	144	159	171	181	192	203	211	218	226	1	183.6
1	236	244	245	246	247	257	269	252	236	238	2	247.0
2	241	242	240	243	247	254	249	249	251	254	3	247.0
3	257	266	278	292	316	322	316	311	319	332	4	300.9
4	331	351	360									
											Mean	360.7

Fern Rock Observatory, February 17 and 18, 1854.

								193^d	193^d	194^d	4^h	
4^h	190^d	184^d	172^d	172^d	169^d	172^d	181^d	188	196	198	5	$182^d.2$
5	193	183	185	188	180	182	185	195	207	208	6	190.6
6	208	230	258	298	296	286	272	271	270	270	7	265.9
7	265	258	252	244	237	230	227	225	226	228	8	239.2
8	232	235	238	242	249	255	260	260	261	262	9	249.4
9	262	263	265	268	273	276	279	281	291	300	10	275.8
10	302	300	280	273	260	249	242	236	228.5	237	11	260.7
11	241	247.5	245	240	236	231	232	230	229	227.8	12	235.9
12	225	222	240	238	242	239	236	230	247	253	13	237.2
13	261	248	240	231	233	237	250	244	242	240	14	242.6
14	238	236	235	238	243	242	240.5	237	234	231	15	237.4
15	229	229.5	234	239.5	239	238	240	241	243	247	16	238.0
16	249	251	250	247	245	242	237	233	228	223	17	240.5
17	218	220	223	228	232	235	237	238	239	240	18	231.0
18	235	232	230	233	235	237	233	228	234	237	19	233.4
19	240	234	228	220	204	166	164	147	130	152	20	188.5
20	179	188	206	230	256	250	241	236	226	217	21	222.9
21	218	221	224	221	217	208	221	237	244	245	22	225.6
22	244	248	254	250	247	244	242	241	240.5	240	23	245.0
23	240	250	252	247.5	238	227	220	219	216	214	0	232.3
0	214	215	216	220	226	232	236	240	247	255	1	230.1
1	262	271	180*	190	187	184	181	177	175	174	2	198.1
2	169	163	156	150	144	146	148	147	152.5	151	3	152.6
3	154	151	161	175	187	192	201	202	202	208	4	183.3
4	210	209	226	233								
											Mean	226.6

Value of a scale division $0'.80$.

Increase of scale readings corresponds to a movement of the north end of the magnet to the east.

NOTE.—The mean in brackets includes two interpolated values.

* A sudden change of 90^d occurring at $6^h\ 30^m$ chronometer time (Greenwich time nearly).

Fern Rock Observatory, February 21 and 22, 1854.

Mean local time.	36m.	42m.	48m.	54m.	00m.	06m.	12m.	18m.	24m.	30m.	Mean local time.	Hourly means.
								270d	269d	268d	4h	
4h	268d	268d	273d	276d	271d	260d	252d	252	252	252	5	262d.4
5	252	253	256	256	253	254	256	257	258	260	6	255.5
6	261	263	263	265	267	267	268	269	271	273	7	266.7
7	274	275	276	277	280	282	286	291	296	301	8	283.8
8	302	302	303	303	302	302	301	302	301	299	9	301.7
9	296	293	290	289	287	286	284	283	283	283.5	10	287.4
10	282.5	280.5	278.5	276	274	274	274	279	284	287	11	278.9
11	288	289	290	294	297	299	300	296	294	293	12	294.0
12	292	292	290	287	284	281	276	276	275	280	13	283.3
13	285	287	290	293	297	290	282	280	278	276	14	288.3
14	276	278	282	282	284	285	287	287	287	288	15	283.6
15	288	288	289	290	293	293	294	294	296	296	16	292.1
16	295	295	293	292	291	291	293	290	287	283	17	291.0
17	280	278	275	272	271	268	267	266	265	263	18	270.5
18	261	260	258	255	254	255	257	260	262	263	19	258.5
19	264	262	259	260	261	261	260.5	260	259	256	20	260.2
20	251	244	240	242	230	218	216	212	205	203	21	226.1
21	206	210	216	221	223	224	230	237	250	250	22	226.7
22	250	250	254	257	258	262	260	260	261	263	23	257.5
23	261	260	260	258	260	261	262	262	262	262	0	260.8
0	262	262	262	262	263	263	262	261	261	260	1	261.8
1	259	259	258	257	258	259	259	260	261	263	2	259.3
2	264	266	269	271	273	275	277	280	278	274	3	272.7
3	274	275	278	290	294	304	293	286	282	280	4	285.6
4	283	282	279	276								
											Mean	271.2

Fern Rock Observatory, February 28 and March 1, 1854.

Mean local time.	36m.	42m.	48m.	54m.	00m.	06m.	12m.	18m.	24m.	30m.	Mean local time.	Hourly means.
								220d	220d	219d	4h	
4h	218d	216d	213d	207d	200d	191d	183d	179	180	182	5	196d.9
5	184	186	189	191	192	193	193	192	193	193	6	190.6
6	195	198	202	210	219	227	230	244	256	260	7	224.1
7	272	274	280	278	242	226	220	250	300	320	8	266.2
8	344	333	321	310	306	322	335	341	350	362	9	332.4
9	353	352	350	355	368	365	360	370	371	372	10	361.6
10	374	378	399	402	408	404	398	394	390	400	11	394.7
11	398	396	397	402	405	408	407	421	436	440	12	411.0
12	452	476	484	483	450	438	418	400	390	381	13	437.2
13	372	363	354	343	337	343	347	352	357	364	14	353.2
14	372	355	340	324	315	320	326	330	333	335	15	335.0
15	331	327	325	324	322	325	314	320	315	314	16	321.7
16	326	338	346	363	362	356	348	342	342	339	17	346.2
17	325	322	324	318	316	324	312	310	318	322	18	319.1
18	319	318	317	314	312	316	317	314	314	317	19	315.8
19	320	315	314	310	308	309	308	307	308	308	20	310.7
20	306	306	302	298	297	299	302	302	301	301	21	301.4
21	298	299	300	301	296	284	274	269	264	268	22	285.3
22	272	278	280	283	286	288	284	279	276	280	23	280.6
23	285	303	320	332	341	350	362	374	366	356	0	338.9
0	345	333	321	310	296	293	305	296	289	280	1	306.8
1	274	276	266	264	258	256	252	259	251	255	2	261.1
2	278	260	261	262	265	268	276	280	286	291	3	272.7
3	299	301	299	302	306	310	314	316	317	320	4	308.4
4	319	317	318	315	312						5	
											Mean	311.3

Value of a scale division 0′.80.

Increase of scale readings corresponds to a movement of the north end of the magnet to the east.

Fern Rock Observatory, March 3 and 4, 1854.

Mean local time.	36m.	42m.	48m.	54m.	00m.	06m.	12m.	18m.	24m.	30m.	Mean local time.	Hourly means.
								250d	247d	246d	4h	
4h	248d	249d	240d	238d	242d	245d	248d	250	260	265	5	248d.5
5	258	269	281	284	380	279	277	274	275	277	6	275.4
6	280.5	279	272.5	275	270	280	286	290	298	296	7	282.7
7	283	311	315	332	329	326	321	329	347	349	8	324.2
8	356	356	360	352	347	346	330	302	291	283	9	332.3
9	287	290	282	286	275	264	265	267	269	270	10	275.5
10	272	274	276	278	280	282	285	287	290	292	11	281.6
11	295	298	302	306	313	318	322	325	327	329	12	313.6
12	330	337	345	349	352	350	348	345	343	336	13	343.5
13	325	321	313	302	295	299	308	314	309	302	14	308.8
14	297	294	288	292	286	284	280	276	272	285	15	285.4
15	291	294	291	289	282	276	268	264	260	258	16	277.3
16	257	257	256	258	259	260	262	260	258	258	17	258.5
17	257	255	251	244.5	238	230	220	205	190	172	18	226.2
18	152	144	133	134	136	140	143	160	174	198	19	151.4
19	209	216	210	205	201	195	190	186	181	177	20	197.0
20	173	170	167	164	171	178	184	189	193	199	21	178.8
21	206	200	194	188	183	178	172	170	169	164	22	182.4
22	152	160	156	156	153	155	157	154	150	150	23	154.3
23	156	176	195	184	155	160	125	131	131	134	0	154.7
0	135	137.5	155	179	195	184	187	200	197.5	192	1	176.2
1	195	200	190	185	182	179	150	136	150	156	2	172.3
2	173	190	200	206	217	204	196	190	186	183	3	194.5
3	189	192	199	204	209	216	222	229	234	243	4	213.7
4	249	251	254	257								
											Mean	242.0

Fern Rock Observatory, March 7 and 8, 1854.

Mean local time.	36m.	42m.	48m.	54m.	00m.	06m.	12m.	18m.	24m.	30m.	Mean local time.	Hourly means.
									190d	202d	4h	
4h	218d	223d	213d	218d	228d	224d	221d	231d	230	235	5	224d.1
5	242	243	246	247	251	270	275	275	274	274	6	259.7
6	269	261	268	260	273	270	269	255	268	271	7	266.4
7	275	271	279	284	278	269	281	282	281	286	8	278.6
8	292	304	294	302	303	312	306	299	297	293	9	300.2
9	284	288	286	287	291	294	300	305	298	290	10	292.3
10	287	280	276	270	277	280	286	281	278	273	11	278.8
11	269	272	267	270	272	274	267	268	272	280	12	271.1
12	273	279	284	290	289	291	294	291	283	274	13	284.8
13	290	288	285	282	283	291	297	300	296	291	14	290.3
14	285	278	281	284	298	291	289	286	284	283	15	285.9
15	281	282	285	288	290	292	295	297	298	298	16	290.6
16	299	300	302	297	291	285	280	278	283	288	17	290.3
17	292	296	299	297	295	293	289	287	281	275	18	290.4
18	269	264	260	256	260	255	258	260	266	270	19	261.8
19	275	272	277	264	270	268	270	259	271	268	20	269.4
20	264	276	278	270	264	260	268	282	284	286	21	273.2
21	280	278	281	285	287	274	291	297	295	291	22	285.9
22	284	276	274	268	263	257	264	271	286	293	23	273.6
23	300	299	287	285	281	274	278	271	267	265	0	280.7
0	261	246	252	245	247	243	242	246	250	252	1	248.4
1	252	252	250	250	249	250	252	255	256	258	2	252.4
2	260	265	270	272	275	276	276	280	285	280	3	273.9
3	285	284	274			258	242	247	258	263	4	(264.3)
4	262	265	268	258	245						5	
											Mean	274.5

Value of a scale division 0′.80.

Increase of scale readings corresponds to a movement of the north end of the magnet to the east.

NOTE.—The mean in brackets includes two interpolated values.

Diurnal Range of the Declination.—The diurnal range being an index to the magnitude of the diurnal excursions, is best presented before the examination of the diurnal inequality. The following table contains the highest and lowest scale readings in the hourly series, and the maximum and minimum values observed, together with the corresponding ranges. One division of scale = 0′.80.

DAILY RANGE OF THE DECLINATION.

DATE.	IN HOURLY SERIES.		OBSERVED.		RANGE.	
1854.	Highest.	Lowest.	Maximum.	Minimum.	In hourly series.	Total observed.
January 10–11	309d.8	253d.5	314d.0	241d.0	56d.3	73d.0
" 13–14	368.4	242.3	378.0	212.0	126.1	166.0
" 18–19	357.9	109.7	369.0	85.0	248.2	284.0
" 24–25	367.4	293.3	373.0	282.0	74.1	91.0
" 27–28	385.4	307.3	389.5	302.0	78.1	87.5
" 31–32	387.9	319.4	440.0	278.0	68.5	162.0
February 3– 4	433.1	268.6	457.0	258.0	164.5	199.0
" 7– 8	391.2	279.7	396.0	266.5	111.5	119.5
" 10–11	464.8	202.7	504.0	195.0	262.1	309.0
" 14–15	490.3	165.8	494.0	129.0	324.5	365.0
" 17–18	275.8	152.6	302.0	130.0	123.2	172.0
" 21–22	301.7	226.1	304.0	203.0	75.6	101.0
" 24–25	531.3	321.4	558.5	268.0	209.9	290.5
March 0– 1	437.2	190.6	484.0	179.0	246.6	305.0
" 3– 4	343.5	151.4	360.0	125.0	192.1	235.0
" 7– 8	300.2	224.1	312.0	190.0	76.1	122.0
" 22–23	290.5	238.8	304.0	228.0	51.7	76.0

The mean diurnal total range observed during the above period becomes 2° 28′.6, and the maximum diurnal range observed took place on the 14–15 February, and amounted to 4° 52′.0. For comparison with similar quantities at other high latitude stations we may take Lake Athabasca, where the greatest range in any one day between October, 1843, and February, 1844, was 2° 35′, it happened October 16, 1843; at Fort Simpson the maximum range was 7° 27′, observed on the 16th of April, 1844, in a series of observations extending over April and May, 1844. The mean diurnal range during January and February, 1844, at Lake Athabasca, was 31′.4, and the mean range at Fort Simpson in April and May of that year was 1° 12′, these two quantities, however, were taken from the hourly series.

If we classify the ranges according to this magnitude we obtain the following results:—

Daily range less than	1°	1
" " between	1 and 2°	6
" " "	2 and 3	4
" " "	3 and 4	3
" " "	4 and 5	3
" " greater than	5	0

The diurnal range in the winter months, January, February, and March, when compared with its annual fluctuation, is probably below the mean value of the year.

Diurnal Inequality of the Declination.—The following table contains the hourly means of all observations at the Winter quarters, between January 10 and March 23, 1854. The remaining observations on term-days at a later season have been excluded on account of their isolation. The above period includes the coldest season of the year, and during more than one-half of the period the sun was below the horizon.

The hourly means were made out separately for each month, the general mean includes seventeen values for each of the twenty-four hours. In January we have complete observations on six days, in February on seven, and in March on four days. The table also contains the monthly means, and all numbers are expressed in scale divisions (one division = 0′.80).

ABSTRACT OF HOURLY MEANS DURING THE MONTHS OF JANUARY, FEBRUARY, AND MARCH, 1854, OBSERVED AT FERN ROCK MAGNETIC OBSERVATORY.

(The readings are given in scale divisions; the values taken from the term-day observations embrace the same number of single readings between the same times.)

Fern Rock mean time.	5h.	6h.	7h.	8h.	9h.	10h.	11h.	12h.	13h.	14h.	15h.	16h.	17h.
Fern Rock Observatory, January and March, 1854.													
Jan'y 10–11	296.0	292.1	286.6	278.9	284.7	288.1	297.0	299.8	308.5	309.8	307.6	305.5	296.7
" 13–14	311.9	321.1	331.0	343.7	360.3	335.1	345.4	348.1	342.1	346.9	350.1	364.5	368.4
" 18–19	308.2	316.9	317.3	313.3	319.9	321.8	343.3	346.7	338.4	345.3	347.8	353.8	357.9
" 24–25	319.3	347.8	359.7	367.4	361.1	361.2	357.1	358.3	355.2	364.0	356.5	344.0	342.9
" 27–28	313.4	307.3	325.9	323.4	319.8	322.9	324.7	330.7	335.1	333.1	341.3	348.1	355.1
" 31–32	335.0	322.2	353.2	362.5	371.4	372.1	367.0	376.4	373.8	380.9	380.1	369.1	374.2
Means	313.9	317.9	329.0	331.5	336.2	333.6	339.1	343.3	342.2	346.7	347.2	347.5	349.2
Feb'y 3– 4	*356.7	*362.1	*377.0	*(373.5)	366.0	368.6	375.5	397.6	407.1	433.1	409.5	396.0	399.8
" 7– 8	315.7	322.5	341.9	351.4	355.3	355.0	370.4	370.8	372.8	391.2	378.6	345.4	336.2
" 10–11	293.6	354.1	362.9	381.8	391.4	383.5	377.3	383.9	390.9	405.3	464.8	464.7	388.5
" 14–15	(307.0)	349.4	380.4	421.1	419.7	473.7	444.1	477.4	413.0	456.2	459.4	490.3	448.4
" 17–18	182.2	190.6	265.9	239.2	249.4	275.8	260.7	235.9	237.2	242.6	237.4	238.0	240.5
" 21–22	262.4	255.5	266.7	283.8	301.7	287.4	278.9	294.0	283.3	288.3	283.6	292.1	291.0
" 24–25	344.7	429.6	461.2	514.1	531.3	526.4	491.8	498.3	498.2	496.2	501.2	512.4	520.8
Means	294.6	323.4	350.9	366.4	373.5	381.5	371.3	379.7	371.8	387.6	390.7	391.3	375.0
March 0– 1	196.9	190.6	224.1	266.2	332.4	361.6	394.7	411.0	437.2	353.2	335.0	321.7	346.2
" 3– 4	248.5	275.4	282.7	324.2	332.3	275.5	281.6	313.6	343.5	308.8	285.4	277.3	258.5
" 7– 8	224.1	259.7	266.4	278.6	300.2	292.3	278.8	271.1	284.8	290.3	285.9	290.6	290.3
" 22–23	261.3	246.3	258.5	258.6	240.9	238.8	270.1	280.3	274.3	266.7	260.8	269.6	269.8
Means	232.7	243.0	257.9	281.9	301.5	292.1	306.3	319.0	334.9	304.8	291.8	289.8	291.2
General means	286.9	302.5	321.3	334.2	343.3	343.5	344.6	352.6	352.7	353.5	352.0	352.1	346.2

Fern Rock mean time.	18h.	19h.	20h.	21h.	22h.	23h.	Noon. 0h.	1h.	2h.	3h.	4h.	Daily means.
Jan'y 10–11	292.6	267.1	271.9	269.0	253.5	255.8	272.3	257.0	267.9	276.3	298.7	284.7
" 13–14	335.7	325.6	276.4	269.4	277.0	267.0	262.3	242.3	278.8	298.2	305.9	317.0
" 18–19	347.7	327.9	348.1	336.3	306.4	236.2	109.7	246.6	289.3	333.1	321.3	313.9
" 24–25	338.8	346.4	347.2	313.3	299.2	315.5	310.3	293.3	302.9	313.1	314.3	337.0
" 27–28	385.4	381.2	362.0	356.8	363.8	363.3	342.8	339.8	357.5	348.2	348.8	342.9
" 31–32	375.3	387.2	387.9	381.4	319.4	333.5	322.4	340.9	372.4	356.4	378.8	362.2
Means	345.9	239.2	332.3	321.0	303.2	295.2	270.0	286.7	311.5	320.9	328.0	326.8
Feb'y 3– 4	376.2	361.8	302.8	268.6	309.2	346.3	329.4	339.6	337.5	309.8	304.0	358.6
" 7– 8	311.7	288.6	279.7	303.9	301.6	302.9	319.9	310.7	332.9	306.7	321.5	332.8
" 10–11	361.9	314.8	264.0	271.1	242.2	202.7	208.3	205.3	281.1	336.2	362.0	337.2
" 14–15	406.7	376.2	333.1	343.1	289.0	243.7	165.8	183.6	247.0	247.0	300.9	360.7
" 17–18	231.0	233.4	188.5	222.9	225.6	245.0	232.3	230.1	198.1	152.6	183.3	226.6
" 21–22	270.5	258.5	260.2	226.1	226.7	257.5	260.8	261.8	259.3	272.7	285.6	271.2
" 24–25	492.4	494.0	448.1	433.8	321.4	401.2	(389.9)	378.7	377.7	407.7	443.7	454.8
Means	350.1	332.5	296.6	295.6	273.7	285.6	272.3	272.8	290.5	290.4	314.4	334.6
March 0– 1	319.1	315.8	310.7	301.4	285.3	280.6	338.9	306.8	261.1	272.7	308.4	311.3
" 3– 4	226.2	151.4	197.0	178.8	182.4	154.3	154.7	176.2	172.3	194.5	213.7	242.0
" 7– 8	290.4	261.8	269.4	273.2	285.9	273.6	380.7	248.4	252.4	273.9	(264.3)	274.5
" 22–23	255.0	286.0	(285.0)	(275.8)	254.7	287.0	290.1	287.0	247.3	244.8	290.5	266.6
Means	272.7	253.8	265.5	257.3	252.1	248.9	266.1	254.6	233.3	246.5	269.2	273.6
General means	330.4	316.3	302.0	295.5	279.0	280.3	270.0	273.5	284.4	290.8	308.6	317.3

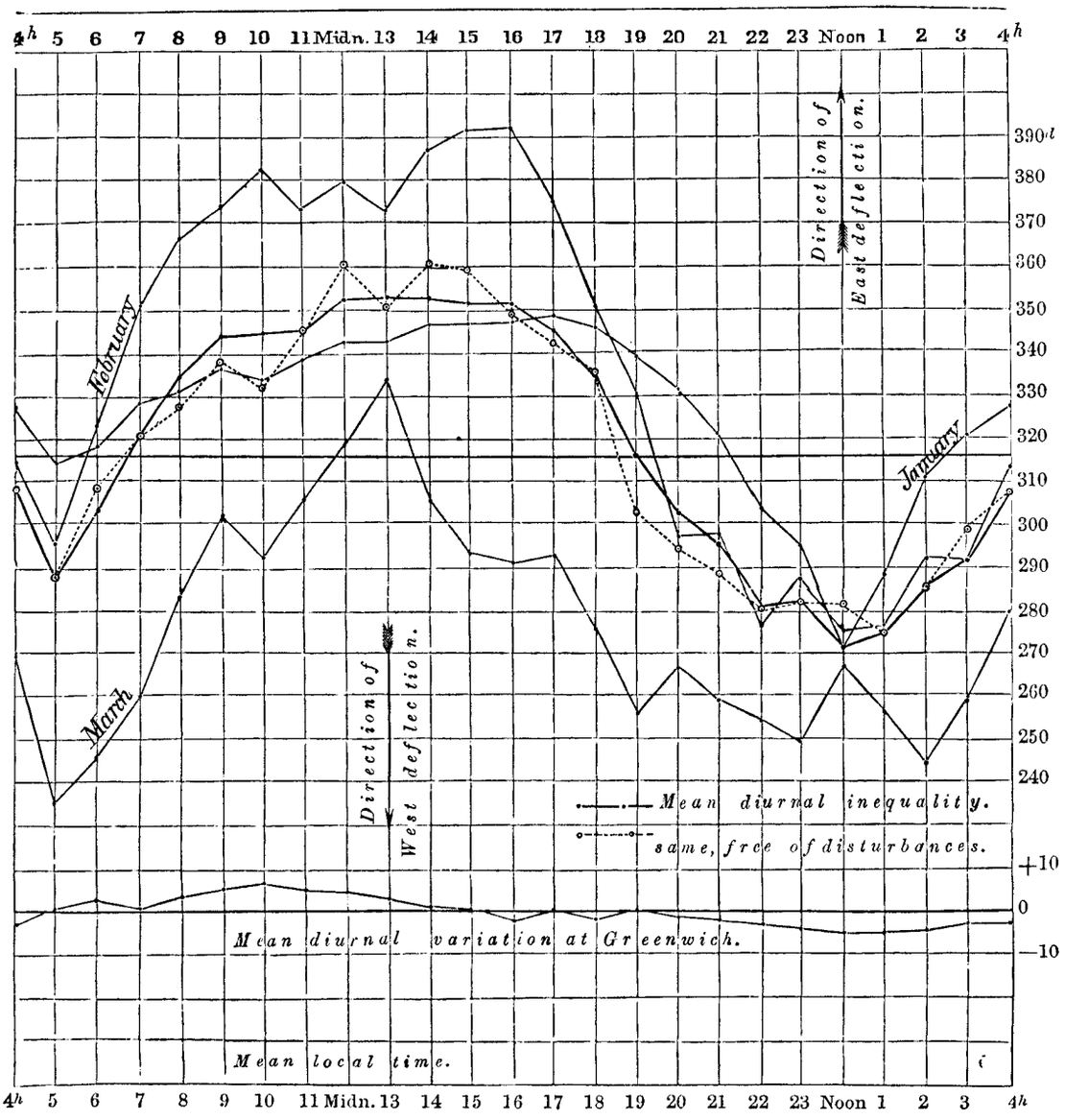
The values in the above table do not refer exactly to the even hour but to 3^m later.

Figures between brackets ( ) are means derived from less that ten readings.

* These four values were observed on the 4th at the hours indicated.

MEAN MONTHLY CURVES OF THE DIURNAL CHANGES OF THE MAGNETIC DECLINATION AT VAN RENSSELAER HARBOR, 1854.

AND SIMULTANEOUS MEAN DIURNAL VARIATION AT GREENWICH.



The irregularities in the daily curves compared on succeeding days are very considerable, as may be seen by glancing the eye over the last column of the preceding table, headed "daily means." No observations on account of disturbances have been excluded from the table, and the following mean diurnal inequality, therefore, contains their full effect. Comparing each hourly mean in the last horizontal line of the above table with the general mean, the following figures represent the resulting diurnal inequality of the declination during the first three months of the year 1854. For the sake of comparison the diurnal inequality observed at Greenwich during the same seventeen days has been made out and is given in the last column.

MEAN DIURNAL INEQUALITY OF DECLINATION DURING SEVENTEEN DAYS IN JANUARY, FEBRUARY, AND MARCH, 1854, AT VAN RENSSELAER HARBOR, AND AT GREENWICH DURING THE SAME DAYS; EXPRESSED IN MINUTES OF ARC.

Local mean time.	Van Rensselaer.	Greenwich.	Local mean time.	Van Rensselaer.	Greenwich.	Local mean time.	Van Rensselaer.	Greenwich.	Local mean time.	Van Rensselaer.	Greenwich.
5^h	+24′.3	—0.′5	11^h	—21′.8	—4′.5	17^h	—23′.1	—0′.3	23^h	+29′.6	+3′.5
6	+11.8	—2.5	Midn.	—28.2	—4.1	18	—10.5	+0.6	Noon	+37.8	+5.8
7	— 3.2	—1.6	13	—28.3	—3.1	19	+ 0.8	—0.4	1	+35.0	+5.8
8	—13.5	—3.9	14	—29.0	—0.8	20	+12.2	+0.5	2	+26.3	+5.0
9	—20.8	—4.5	15	—27.8	—0.3	21	+17.4	+1.0	3	+21.2	+3.9
10	—21.0	—5.1	16	—27.8	+0.5	22	+30.6	+2.3	4	+ 7.0	+2.6

A negative sign indicates a deflection to the east, a positive one a deflection to the west of the mean position.

The diurnal inequality at the two stations presents in general the same characteristic features, namely, the principal deflection to the west shortly after noon, and the opposite eastern position about midnight; in regard to the diurnal inequality, therefore, the motion of the magnet at Van Rensselaer Harbor follows in general the same law as recognized in lower geographical latitudes.

The extreme westerly position is attained at noon; after this hour the westerly declination diminishes gradually, with an exception of a period of opposite motion of very limited range between the hours of four and five. The easterly extreme is reached two hours after midnight. Whether the small irregularity just noticed, producing apparently a secondary minimum and maximum, is real or only caused by the accidental deviations of the few observations under discussion, it is not easy to decide with certainty. The motion from 14 hours to 24 hours is performed with great uniformity. Thus, while the diurnal motion agrees with that observed at Lake Athabasca, Fort Simpson, Sitka, Toronto, etc., it shows no trace of that marked deviation observed at Reikiavik, in Iceland, or at Fort Confidence. In 1824 (June), at the Whalefish islands the maximum westerly deviation happened about a quarter past one o'clock P. M.; the time of the maximum eastern deflection was not determined. At Port Bowen the maximum westerly variation appears to have occurred between the hours of 10 A. M. and 1 P. M., the mean result being $11^h\ 49^m$; the greatest deflection of the north end of the needle to the eastward took place between 8 P. M. and 2 A. M., the mean hour being 10 P. M. These observations were made during January, February, March, and April, 1825.

The range of the mean diurnal inequality is 1° 06′.8, when it is at Greenwich during the same time 10′.9.

Analysis of Disturbances of the Declination.—The declination at the commencement and end of the observations appears to have remained nearly the same; the daily and monthly means indicate at first a gradual decrease of westerly declination, which motion, however, is speedily overcome in the month of March. No further attention need be paid to this circumstance in the following discussion of the disturbances, and of their effect upon the diurnal inequality.

The mean disturbance for each of the 24 hours has been obtained by comparing the monthly mean with each hourly reading; let Δ equal this difference, n the

number of hourly readings (equal to 17), and m the mean disturbance, then $m = \pm \sqrt{\frac{\Sigma \Delta^2}{n-1}}$. This quantity is analogous to the mean error of an observation. In the following comparisons we must always bear in mind that the observations for the present discussion are rather limited, and that the comparisons with results at Lake Athabasca and Fort Simpson are of a date nearly ten years earlier. This interval is perhaps favorable to the comparison.

At Van Rensselaer Harbor the mean disturbance force is greater than at either place just named, and pretty regular during two well-marked periods, as shown by the following table:—

TABLE OF THE MEAN DISTURBANCE OF THE DECLINATION AT VAN RENSSELAER HARBOR, TAKEN WITHOUT REGARD TO DIRECTION, FOR EACH OF THE OBSERVATION HOURS, AND EXPRESSED IN MINUTES OF ARC.

Local Mean Time.

5h.	6h.	7h.	8h.	9h.	10h.	11h.	Midn.	13h.	14h.	15h.	16h.
±31′	41	37	47	49	50	46	52	51	47	50	±53′
17h.	**18h.**	**19h.**	**20h.**	**21h.**	**22h.**	**23h.**	**Noon.**	**1h.**	**2h.**	**3h.**	**4h.**
±49′	42	54	48	46	31	46	60[1]	46	39	45	±41′

The disturbing force is least during the day (if such an expression is admissible in this case), from 10 A. M. to 7 P. M., and greater and equally regular during the hours of the night (?), from 8 P. M. to 8 or 9 A. M. At Lake Athabasca the hours of least disturbance are between 9 A. M. and 7 P. M., and at Fort Simpson from 10 A. M. to 7 P. M. Captain Lefroy, in his discussion of the disturbances of the declination remarks: "There are indications in each of the three curves (for Lake Athabasca, Toronto and Sitka) of a small increase in the mean disturbance about noon." At Van Rensselaer Harbor we find the maximum disturbance at this very hour preceded and followed by quite small values; this circumstance certainly deserves our particular attention. Further coincidences of the disturbing force can be noticed at 5 P. M., at which hour at Van Rensselaer, Lake Athabasca, and Sitka the minimum disturbance has been observed. At Fort Simpson, in April and May, 1844, the mean disturbance was but one-fourth of that observed in January, February and March at Van Rensselaer, and the ratio of the minimum to the maximum value was 5.6 and 2.0 at the two places respectively.

By adding the squares of the differences for each hour of the day and month, we find the mean monthly disturbance by the formula $\sqrt{\frac{[\Sigma \Delta^2]}{N-24}}$. The mean disturbance for each month is as follows:—

In January, 1854	±30′
In February, "	±65
In March, "	±40

[1] Principally due to a very large disturbance.

The month of February was, therefore, that of the maximum amount of disturbance. At Lake Athabasca the greatest mean disturbance occurred in January (from observations between October and February inclusive). At Toronto,[1] on the contrary, the months of January and June are those of least disturbance. It is quite possible that at Van Rensselaer the above values are surpassed in other months of the year, yet relatively February contains the greatest mean disturbance during the period of observations.

Hitherto the recognition and separation of the disturbed observations have been effected by an arbitrary process of fixing upon a certain deviation from the mean as the greatest allowable departure, and regarding all observations beyond this limit as disturbances. In the present case, I have sought to introduce a more definite idea by the application of Pierce's criterion for the rejection of doubtful observations,[2] or what is equivalent—for the recognition of the disturbances—they following a different law from the general one. The average mean deviation of the readings composing an hourly mean I find = $\pm$ 46′, and for 17 values $x^2 = 4.55$; hence readings deviating from the mean more than 1° 38′ or 123d are to be recognized as disturbances.

The table of hourly readings contains 23 such values, or one disturbed observation for every 18 ordinary readings. In the five years of hourly observations ending June 30, 1848, at Toronto, the disturbances averaged one in 17 of the whole body. Excluding the above 23 values from the mean, the diurnal inequality freed of the disturbances undergoes no material change, as shown by the following table:—

5h.	6h.	7h.	8h.	9h.	10h.	11h.	Midn.	13h.	14h.	15h.	16h.
+23′.7	+6.0	—3.8	—9.3	—16.4	—12.5	—22.5	—34.7	—27.3	—35.1	—34.1	—26′.0
17h.	18h.	19h.	20h.	21h.	22h.	23h.	Noon.	1h.	2h.	3h.	4h.
—20′.1	—8.0	+9.0	+19.0	+23.3	+30.0	+29.0	+29.2	+34.4	+25.7	+13.6	+6′.9

The maximum west deflection is displaced from noon to one o'clock. The general mean changed from 317.3^d to 316.5^d, and the range of the mean inequality from 1° 06′.8 to 1° 09′.5. Eleven deflections were towards the east and twelve towards the west. The limited number of observations renders it necessary to conclude the foregoing examination of the disturbances.

Aurora Borealis.—In connection with the disturbances, a short notice of the auroral displays witnessed at the winter quarters will here find an appropriate place. In conformity with the supposed periodicity of this phenomenon, as recognized by Prof. Olmstead, no brilliant and complete auroras have been seen; with an exception of a very few, they may all be placed in his fourth class, to which the most simple forms of appearances have been referred. The aurora of October 24, 1854,

[1] See Vol. III. of the Magnetical and Meteorological Observations at Toronto, Canada. Discussion by Major-General E. Sabine. London, 1857.

[2] See Gould's Astronomical Journal, Nos. 45 and 83.

at 9 P. M. (see first volume of the Narrative), appears to have been one of the more conspicuous displays. A full record of the rest will be found in the 8th volume of the Smithsonian Contributions to Knowledge, in the collection made by Peter Force, Esq. There are 19 in number. The following statement is given in a foot-note: "The processes have no apparent connection with the magnetic dip, and in *no* case did the needle of our unifilar indicate disturbance."

Term-day Observations for Change of Magnetic Declination.—These observations were made at the following dates: January 18–19, February 24–25, March 22–23, April 19–20, May 26–27, and June 21–22, 1854. The readings are given in the following tables:—

TERM-DAY OBSERVATIONS FOR CHANGES OF MAGNETIC DECLINATION AT VAN RENSSELAER HARBOR, 1854.

Fern Rock Observatory, January 18 and 19, 1854.
Readings taken $2^m\ 14^s$ earlier than indicated.

Göttingen mean time.	0m.	06m.	12m.	18m.	24m.	30m.	36m.	42m.	48m.	54m.	Fern Rock mean time. (to 0m.)
10^h	305^d	305^d	305^d	307^d	308^d	312^d	$311^d.8$	$306^d.5$	$309^d.5$	$312^d.5$	$4^h\ 37^m.5$
11	311.2	313	314	315.8	318.5	317	317	319.7	320.5	322.5	5 "
12	320	314.8	315	315.7	317	320	321	320	316	314	6 "
13	311	307	309	311	313	315	317	318	317	315	7 "
14	320	322	319	316	320	320	322	318	320	322	8 "
15	321	323	323.3	322.3	320	319	320	320	325	325	9 "
16	329	329	330	330	327	336	350	366	367	369	10 "
17	362	354	353	347	347	346	346	341	337	334	11 "
18	330	332	335	338	338	340	342	343.5	342	344	12 "
19	344	346.5	345	344	344	345	346	346.5	347	345	13 "
20	346	345	345.5	345	348	347.5	349	351.5	351.5	349.5	14 "
21	349	354	359	363.5	359.5	351	350	351	350.8	351	15 "
22	356	358	359	361.5	361	355	352.3	357.8	358	360.5	16 "
23	360.5	358	355	351.5	350	349	346	340	332	335	17 "
0	336	333	330.5	326	320	320	323	226	328	337	18 "
1	343	352	350	346	340	348	353	357	349	343	19 "
2	337	332	328	324	332	336	340	343	346	345	20 "
3	342	339	329	320	313	300	292	284	277.5	268	21 "
4	251	244.5	240.5	250	261	254	243	230	235	155	22 "
5	115	90	89	96	88	85	105	129	145	155	23 "
6	163	180	193	220	254	290	291	307	298	270	0 "
7	268	254	240	266	289	297	320	318	320	321	1 "
8	336	336	336	331	337	337	337	330	327	324	2 "
9	314	326	332	338	323	318	316	316	316	314	3 "
10	312	310									4 "

The series commences with readings 304^d, 303^d, and 304^d, at $9^h\ 42^m$, 48^m, and 54^m.

Fern Rock Observatory, February 24 and 25, 1854.
Readings taken $2^m\ 15^s$ earlier than indicated.

Göttingen mean time.	0m.	06m.	12m.	18m.	24m.	30m.	36m.	42m.	48m.	54m.	Fern Rock mean time. (to 0m.)
10^h	312^d	322^d	329^d	338^d	$341^d.5$	$319^d.5$	342^d	359^d	377^d	407^d	$4^h\ 37^m.5$
11	408	411	405	418	437	445	445	447	441	439	5 "
12	438	438	440	432	460	482	477	471	480	494	6 "
13	490	493	506	520	516	509	519	531	530	527.5	7 "
14	541	558.5	532	527	518	511	521	532	538	535	8 "
15	532	529	527	528	530.5	542	526	521	516	513	9 "
16	510	508	506	504	493	483	446	470	503	495	10 "
17	490	493	496	498	500	502	500	500	501	503	11 "
18	503	502	502	502	503	500	494	490	492	494	12 "
19	496	495	495	492	488	499	506	498	492	501	13 "
20	514	509	502	506	509	501	491	490	492	498	14 "
21	504	509	517	516	514	512	511	512	512	517	15 "
22	521	529	535	536	529	508	510	516	514	510	16 "
23	511	507	490	491	489	489	488	488	486	485	17 "
0	502	499	496	489	496	500	499	500	484	475	18 "
1	456	448	440	435	442	447	451	457	456	449	19 "
2	445	440	425	412	427	438	449	445	440	417	20 "
3	370	312	284	289	268	298	326	332	360	375	21 "
4	390	400	415	408	405	404	392	396	401	401	22 "
5	404	408	390	375	370	372	—	393	403	402	23 "
6	402	407	390	374	370	358	355	370	381	380	0 "
7	376	377	379	380	382.5	365	370	373	380	395	1 "
8	381	385	372	386	398	406	435	437	438	439	2 "
9	438	438	437	442	446	444	455	448	446	443	3 "
10	450	469	482	497							4 "

The series commences with readings 290^d, 288^d, 282^d, at $9^h\ 42^m$, 48^m, and 54^m.

* Value of a scale division 0′.80.
Increase of scale readings denotes a movement of the north end of the magnet to the east.

Göttingen mean time.	0m.	06m.	12m.	18m.	24m.	30m.	36m.	42m.	48m.	54m.	Fern Rock mean time. (to 0m.)
Fern Rock Observatory, March 22 and 23, 1854. Readings taken $1^m\ 34^s$ earlier than indicated.											
10^h	269^d	262^d	265^d	272^d	285^d	295^d	250^d	232^d	228^d	255^d	$4^h\ 37^m.5$
11	240	261	243	246	232	228	236	260	259	258	5 "
12	258	256	254	256	258	258	259	260	263	263	6 "
13	262	253	258	264	263	267	265	256	251	247	7 "
14	235	237	239	239	240	244	243	247	245	240	8 "
15	240	238	239	237	234	233	234	237	245	251	9 "
16	268	265	267	279	280	277	272	264	260	269	10 "
17	275	279	277	282	279	280	282	284	283	282	11 "
18	281	280	278	277	275	273	272	270	269	268	12 "
19	269	268	268	268	267	267	268	266.5	264	262	13 "
20	261	261	262	261	261	258	258	259	262	265	14 "
21	269	267	266	264	264.5	262	269	273	278	284	15 "
22	283	282	278.5	275	270.5	263	265	260	260	261	16 "
23	260	257	256	250	253	256	248	250	257	263	17 "
0	272	280	283	285	292	288	289	287	290	294	18 "
1	300	302	291	290	292	283	277	273	271	[1]—	19 "
2	—	—	—	—	—	280	284	278	271	269	20 "
3	267	267	263	255	248	247	252	249	248	251	21 "
4	260	265	274	292	296	295	298	298	297	295	22 "
5	291	290	290	293	292	294.5	291	292	288	290	23 "
6	293	291	291	290	294	295	290	281	276	269	0 "
7	264	252	250	249	242	239	235	242	252	248.5	1 "
8	246	245	243	242	240	239	241	244	250	258	2 "
9	270	282	284	286.5	288	292	297	300	304	302	3 "
10	301	300	299								4 "
Fern Rock Observatory, April 19 and 20, 1854. Readings taken $2^m\ 14^s$ earlier than indicated.											
10^h	—	—	—	—	—	—	—	—	—	—	$4^h\ 37^m.5$
11	—	—	—	—	—	—	—	—	—	—	5 "
12	—	—	—	—	—	—	—	—	—	—	6 "
13	—	—	—	—	—	—	—	—	—	—	7 "
14	—	—	—	—	—	—	—	—	—	—	8 "
15	—	—	—	—	—	—	—	—	—	—	9 "
16	—	—	—	272^d	271^d	275^d	273^d	$272^d.5$	278^d	282^d	10 "
17	289^d	299^d	298^d	312	310	305	301	296	299	262	11 "
18	271	287	294	290	289	286	280	268	254	230	12 "
19	236	250	245	242	239	234	229	230	242	256	13 "
20	265	262	260	256	252	247	243	236	231	228	14 "
21	225	224	230	236	229	226	231	233	230	227	15 "
22	226	222	218	215	213	189	187	183	190	187	16 "
23	184	182	194	220	221	223	218	220	222	225	17 "
0	231	236	242	236	238	240	235	224	215	203	18 "
1	194	190	187	184	181	180	178	178	168	164	19 "
2	175	208	236	242	212	205	202	190	190	193	20 "
3	194	196	199	200	210	192	180	175	164	152	21 "
4	140	137	139	148	147	160	164	152	140	121	22 "
5	107	113	116	136	145	132	130	120	90	63	23 "
6	+62	+43	+30	+32	—	—	—4	—7	+4	+8	0 "
7	+30	+23	+16	+12	+16	+11	+5	—2	+25	+58	1 "
8	71	67	73	77	79	81	75	73	76	80	2 "
9	75	74	97	110	128	132	138	147	142	134	3 "
10	126	122	128	132							4 "

Value of a scale division 0′.80.

Increase of scale readings denotes a movement of the north end of the magnet to the east.

[1] Watch stopped.

Fern Rock Observatory, May 26 and 27, 1854.
Readings taken $1^m\ 34^s$ earlier than indicated.

Göttingen mean time.	0m.	06m.	12m.	18m.	24m.	30m.	36m.	42m.	48m.	54m.	Fern Rock mean time. (to 0m.)
10^h	244^d	243^d	258^d	262^d	278^d	280^d	279^d	276^d	292^d	304^d	$4^h\ 37^m.5$
11	330	345	357	365	372	369	365	360	364	368	5 "
12	360	355	345	342	350	348	341	333	330	338	6 "
13	349	356	364	359	354	351	355	360	381	395	7 "
14	403	413	411	408	400	389	395	400	407	410	8 "
15	414	423	428	436	442	443	442	438	436	433	9 "
16	435	434	440	450	476	490	520	555	570	575	10 "
17	593	600	575	548	533	523	516	506	498	492	11 "
18	485	482	479	477	477	476	475	475	477	480	12 "
19	483	487	493	495	488	495	527	552	568	587	13 "
20	595	612	624	630	633	631	625	620	612	604	14 "
21	599	603	609	612	615	626	633	635	644	650	15 "
22	663	667	665	661	658	659	653	646	640	637	16 "
23	639	641	632	618	595	590	583	572	559	541	17 "
0	543	545	546	546	544	540	537	536	535	537	18 "
1	538	525	523	539	527	520	515	513	480	479	19 "
2	487	493	498	503	506	509	509	533	562	571	20 "
3	573	553	537	517	495	489	486	488	496	510	21 "
4	512	510	507	513	514	512	511	506	497	487	22 "
5	486	485	483	484	480	477	476	476	477	463	23 "
6	449	443	442	440	441	443	447	454	463	470	0 "
7	478	483	487	489	488	483	471	459	457	446	1 "
8	435	447	460	468	475	490	487	478	485	491	2 "
9	493	513	525	530	533	535	534	515	500	—	3 "
10	—										4 "

Observations commence at $9^h\ 24^m$, scale readings 280^d, 271^d, 266^d, 235^d, 231^d, 240^d, corresponding to $9^h\ 24^m$, 30^m, 36^m, 42^m, 48^m, and 54^m respectively.

Fern Rock Observatory, June 21 and 22, 1854.
Readings taken $1^m\ 34^s$ earlier than indicated. (Magnet suspended, I. 7.)[1]

10^h	—	—	—	—	—	—	—	—	—	295^d	$4^h\ 37^m.5$
11	297^d	299^d	300^d	302^d	305^d	309^d	312^d	313^d	313^d	314	5 "
12	315	315	314	314	313	312	310	316	325	333	6 "
13	337	340	344	347	351	352	350	350	351	352	7 "
14	348	346	343	337	333	334	338	348	350	355	8 "
15	354	355	358	364	366	374	374	374	373	367	9 "
16	366	367	366	370	373	377	377	377	378	383	10 "
17	384	385	379	379	379	381	383	384	383	384	11 "
18	387	384	385	382	384	386	386	382	385	387	12 "
19	384	382	383	385	387	386	387	390	392	396	13 "
20	400	402	400	396	394	394	388	376	384	394	14 "
21	390	383	382	381	379	370	364	368	372	370	15 "
22	367	363	358	355	357	361	367	369	367	364	16 "
23	364	363	361	355	350	350	352	355	359	362	17 "
0	363	363	370	369	367	368	370	363	355	351	18 "
1	348	343	337	335	333	329	330	331	331	328	19 "
2	322	318	320	322	325	327	328	328	326	324	20 "
3	322	318	319	322	323	323	322	324	326	331	21 "
4	326	315	334	330	326	326	319	318	318	318	22 "
5	312	316	318	317	323	321	317	310	312	308	23 "
6	306	320	316	316	318	323	304	303	312	290	0 "
7	291	287	286	286	291	283	275	281	283	288	1 "
8	289	290	292	289	291	293	297	298	302	304	2 "
9	304	309	313	312	308	303	295	290	282	273	3 "
10	264	257	245	283	232	230	234	239	242	228	4 "
11	212	207									5 "

Value of a division of the scale 0′.80.
Increase of scale readings denotes a movement of the north end of the magnet to the east.

[1] This magnet I. 7 was undoubtedly used on all previous occasions. Mark reads on circle 338° 22′, circle reads 314° 12′.

The results of the preceding tables have been thrown into curves, to which the corresponding readings at Greenwich and Washington have been added.[1] These readings have all been referred to the same scale, and thus present at a glance the great difference in the magnitude of the diurnal motion as well as that of the disturbances. The Greenwich observations were taken by means of photography; the Washington corresponding observations were also obtained by means of Brooke's automatic photographic registration, and have as yet only been published in the 6th volume of the Astronomical Expedition to Chili, under the direction of Lieut. Gilliss, U. S. N.; Washington, D. C., 1856.

For the Greenwich curves the zero line corresponds to 22° west declination. A remarkable absence of disturbances of any magnitude as well as a small diurnal range of motion at the time of the vernal equinox, is shown by the March curves both for Van Rensselaer and Greenwich.

There appear to be some disturbances common to both places, and if these indications should not be accidental they are of an opposite character, that is, a magnetic east deflection is presenting itself as a magnetic west deflection at the other station, and *vice versa*. For this the reader may examine hours 17 and 5½ of the curve for January 18 and 19, hours from 6 to 8, April 20th, and one or two other less striking cases. The needle at Van Rensselaer Harbor actually points with its north end to the south of the astronomical west, and its meridional component of the direction is pointing in a southern or opposite direction to the same component at Greenwich or Washington.

Absolute Declination.—The magnetic declination at Van Rensselaer Harbor was determined on three occasions in the summer of 1854. Two different magnets were used.

Determination of June 9th. Magnet A 68, mirror facing magnetic north.

Position.	Circle reads. Mark.		P.	Circle reads. Magnetic meridian (south).		P.	Circle reads. Mark.	
I.	338°	06′	I.	316°	01′	I.	338°	02′
		06′			00			01
II.	338	00	II.	315	57	II.	338	05
	337	59			56			04
Means	338	02.8		315	58.5		338	03.0
				at 6h 35m Green. t.				

Mean reading on mark	338° 03′
Astronomical bearing (N.)	93 29 E.
Reading of meridian (N.)	244 34
Magnetic meridian (N.)	135 59
Declination	108° 35′

W. (of north) at 1h 52m P. M. local time.

[1] See accompanying plates 1 and 2.

Determination of June 14. Magnet I. 10. Mirror facing magnetic north.

	Mark.		Magnetic south meridian.		Mark.
I.	338° 09′	I.	317° 10′	I.	338° 04′
	08		at 5h 12m Gr. t.		02
II.	338 05		09	II.	338 09
	04	II.	317 02		08
			01		
Means	338 06.5		317 05.5		338 05.8

Mean reading on mark	338° 06′
Astronomical bearing (N.)	93 29 E.
Reading of true meridian	244 37
Reading of magnetic meridian	137 05
Declination	107° 32′

W. at 0h 29m P. M. local time.

The magnet showed considerable agitation during the day.

Determination of June 26. Mirror facing magnetic north.

Magnetic south meridian.			Mark.		Magnetic south meridian.	
I.	315° 49′	I.	338° 24′	I.	315° 52′	
	47		23		50	
II.	316 18	II.	338 20	II.	315 40	
	17		19		38	
Means	316 02.7		338 21.5		315 45.0	
at 1h 3m P. M. local time.					at 2h 0m P. M. local time	

Mark reads	338° 21′
Astronomical bearing (N.)	93 29 E.
N. meridian (true)	244 52
Magnetic meridian	135 53
Declination	108° 59′

W. at 1h 31m P. M.

Resulting mean declination (for June 16) 108° 22′ W.; if we omit the 2d determination on account of disturbance, and apply a correction for diurnal change to the mean of the first and last determination, we find 108° 12′ W.

SECTION II.

OBSERVATIONS OF THE MAGNETIC INCLINATION.

1853, 1854, AND 1855.

SECTION II.

MAGNETIC INCLINATION.

Instrument and Remarks.—The observations for dip were made by Mr. Sonntag by means of a Barrow dip circle received from Prof. Henry, of the Smithsonian Institution, through the courtesy of Col. Sabine. The inclinometer was supplied with Lloyd needles, for determining the total intensity, but unfortunately the complete record of these observations could not be recovered; the absence of the record for determining the constants necessary for their reduction being wanted, no use could be made of these observations, even for relative intensity at Saikatle and Marshall Bay, and the partial results given in Appendix XV., vol. II. of the Narrative, must, therefore, remain fruitless for the present. There is likewise a deficiency in the record of the dip observations at Van Rensselaer Harbor after February 23, 1854; the results, however, are all preserved in the Appendix just mentioned.

In regard to the index error of the dipping needles, we can only make an approximate comparison. The observations at New York, where the dip has been represented by the formula

$$I = 72^\circ.69 - 0.00491\,(t - 1845) + 0.00114\,(t - 1845)^2,$$

with a probable error of any single observation[1] of $\pm 3'.3$, would apparently produce a correction to needle 1 of $-9'$, and to needle 2 of $-14'$, the changes, however, from one station to another in the immediate vicinity of the city are much greater, and these quantities may, therefore, as well indicate local deviation as index error. The polarity of the needles has been reversed at each station, the effect of this operation upon the resulting dip is somewhat irregular, and will be found exhibited in tabular form.

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[1] See Coast Survey Report of 1856, p. 240. The formula includes dip observations taken between December, 1822, and August, 1855 (exclusive of the observations of the present expedition).

STATION No. I. NEW YORK, AT MR. RUTHERFORD'S OBSERVATORY.
Latitude 40° 43′.8. Longitude 73° 58′.9. W. of G.

May 18, 1853. 4h P. M. Needle No. 2. Poles direct. Magnetic meridian reads 248° 10′.

CIRCLE EAST.				CIRCLE WEST.			
Face east.		Face west.		Face east.		Face west.	
a	b	a	b	a	b	a	b
72° 57′	72° 37′	73° 08′	73° 27′	72° 51′	72° 52′	72° 53′	73° 25′
72 56	72 35	73 05	73 24	72 54	72 54	72 56	73 29
72 56.5	72 36.0	73 06.5	73 25.5	72 52.5	72 53.0	72 54.5	73 27.0
72 46.2		73 16.0		72 52.7		73 10.7	
73 01.1				73 01.7			
73 01.4							

Needle No. 2. Poles reversed.

CIRCLE WEST.				CIRCLE EAST.			
Face west.		Face east.		Face west.		Face east.	
a	b	a	b	a	b	a	b
72° 08′	72° 16′	72° 17′	73° 17′	73° 20′	72° 38′	73° 00′	73° 05′
72 10	72 18	72 30	73 30	73 19	72 36	73 00	73 06
72 09.0	72 17.0	72 23.5	73 23.5	73 19.5	72 37.0	73 00.0	73 05.5
72 13.0		72 53.5		72 58.2		73 02.8	
72 33.2				73 00.5			
72 46.8							

May 18, 1853. 22h 30m. Needle No. 2. Poles reversed. Magnetic meridian reads 248° 10′.

CIRCLE EAST.				CIRCLE WEST.			
Face east.		Face west.		Face east.		Face west.	
a	b	a	b	a	b	a	b
73° 07′	73° 28′	72° 42′	72° 44′	72° 50′	73° 11′	72° 37′	72° 37′
73 03	73 26	72 40	72 47	72 54	73 13	72 40	72 34
73 05.0	73 27.0	72 41.0	72 45.5	72 52.0	73 12.0	72 38.5	72 35.5
73 16.0		72 43.2		73 02.0		72 37.0	
72 59.6				72 49.5			
72 54.6							

Needle No. 2. Poles direct.

CIRCLE WEST.				CIRCLE EAST.			
Face west.		Face east.		Face west.		Face east.	
a	b	a	b	a	b	a	b
72° 52′	72° 51′	72° 49′	72° 54′	73° 37′	73° 51′	72° 58′	73° 20′
72 55	72 55	72 52	72 59	73 34	73 48	72 57	73 17
72 53.5	72 53.0	72 50.5	72 56.5	73 35.5	73 49.5	72 57.5	73 18.5
72 53.2		72 53.5		73 42.5		73 08.0	
72 53.4				73 25.2			
73 09.3							

May 20, 1853. 4h. Needle No. 1. Poles direct.

CIRCLE EAST.				CIRCLE WEST.			
Face east.		Face west.		Face east.		Face west.	
a	b	a	b	a	b	a	b
71° 37′	72° 00′	75° 55′	76° 22′	73° 11′	73° 02′	73° 41′	74° 04′
71 34	71 59	75 52	76 21	73 13	73 04	73 45	74 06
71 35.5	71 59.5	75 53.5	76 21.5	73 12.0	73 03.0	73 43.0	74 05.0
71 47.5		76 07.5		73 07.5		73 54.0	
73 57.5				73 30.7			
73 44.1							

Needle No. 1. Poles reversed.

CIRCLE WEST.				CIRCLE EAST.			
Face west.		Face east.		Face west.		Face east.	
a	b	a	b	a	b	a	b
69° 58′	70° 10′	73° 17′	72° 52′	72° 32′	73° 08′	72° 56′	73° 09′
70 00	70 13	73 16	72 55	72 30	73 06	72 53	73 06
69 59.0	70 11.5	73 16.5	72 53.5	72 31.0	73 07.0	72 54.5	73 07.5
70 05.2		73 05.0		72 49.0		73 01.0	
71 35.1				72 55.0			
72 15.1							

May 20, 1853. Needle No. 1. Poles direct.

CIRCLE EAST.				CIRCLE WEST.			
Face east.		Face west.		Face east.		Face west.	
a	b	a	b	a	b	a	b
71° 48′	72° 03′	74° 18′	74° 48′	72° 38′	72° 33′	74° 26′	74° 27′
71 45	72 01	74 17	74 45	72 40	72 35	74 29	74 31
71 46.5	72 02.0	74 17.5	74 46.5	72 39.0	72 34.0	74 27.5	74 29.0
71 54.2		74 32.0		72 36.5		74 28.2	
73 13.1				73 32.3			
73 22.7							

Needle No. 1. Poles reversed.

CIRCLE EAST.				CIRCLE WEST.			
Face west.		Face east.		Face west.		Face east.	
a	b	a	b	a	b	a	b
72° 47′	73° 21′	73° 13′	73° 32′	69° 55′	69° 48′	72° 24′	72° 27′
72 45	73 19	73 11	73 30	69 59	69 51	72 28	72 29
72 46.0	73 20.0	73 12.0	73 31.0	69 57.0	69 49.5	72 26.0	72 28.0
73 03.0		73 21.5		69 53.2		72 27.0	
73 12.2				71 10.1			
72 11.2							

STATION No. II. FISKERNAES, FLAGSTAFF NEAR THE GOVERNOR'S HOUSE.
Latitude 63° 05′.3. Longitude 50° 34′4. W. of G.

June 29, 1853. Needle No. 2. Poles reversed. Meridian reads 106° 01′.

CIRCLE EAST.				CIRCLE WEST.			
Face east.		Face west.		Face east.		Face west.	
a	b	a	b	a	b	a	b
80° 07′	80° 05′	82° 08′	81° 59′	80° 28′	80° 36′	80° 30′	80° 50′
80 11	80 07	82 08	81 58	80 25	80 34	80 28	80 49
80 09.0	80 06.0	82 08.0	81 58.5	80 26.5	80 35.0	80 29.0	80 49.5
80 07.5		82 03.3		80 30.7		80 39.2	
81 05.4				80 34.9			
80 50.2							

Needle No. 2. Poles direct.

CIRCLE EAST.				CIRCLE WEST.			
Face east.		Face west.		Face east.		Face west.	
a	b	a	b	a	b	a	b
80° 47′	80° 38′	80° 28′	80° 29′	80° 13′	80° 24′	80° 42′	80° 41′
80 46	80 41	80 28	80 29	80 10	80 22	80 40	80 39
80 46.5	80 39.5	80 28.0	80 29.0	80 11.5	80 23.0	80 41.0	80 40.0
80 43.0		80 28.5		80 17.2		80 40.5	
80 35.7				80 28.9			
80 32.3							

STATION No. III. FISKERNAES HARBOR, ON A SMALL ISLAND ON THE NORTH SIDE OF HARBOR.

July 1, 1853. Needle No. 2. Poles direct. Meridian reads 150° 22′.

CIRCLE WEST.				CIRCLE EAST.			
Face west.		Face east.		Face west.		Face east.	
a	b	a	b	a	b	a	b
82° 24′	83° 01′	79° 54′	80° 03′	81° 59′	82° 05′	80° 53′	79° 49′
82 27	83 04	79 57	80 06	81 59	82 03	80 50	79 51
82 25.5	83 02.5	79 55.5	80 04.5	81 59.0	82 04.0	80 51.5	79 50.0
82 44.0		80 00.0		82 01.5		80 20.7	
81 22.0				81 11.1			
81 16.6							

Needle No. 2. Poles reversed.

CIRCLE WEST.				CIRCLE EAST.			
Face east.		Face west.		Face east.		Face west.	
a	b	a	b	a	b	a	b
81° 07′	81° 23′	79° 52′	80° 00′	80° 49′	80° 52′	79° 54′	79° 54′
81 11	81 23	79 55	80 02	80 46	80 58	79 53	79 53
81 09.0	81 23.0	79 53.5	80 01.0	80 47.5	80 55.0	79 53.5	79 53.5
81 16.0		79 57.2		80 51.2		79 53.5	
80 36.6				80 22.3			
80 29.4							

STATION No. IV. SAIKATLE, ISLAND SOUTH FROM SUKKERTOPPEN.

(Latitude and longitude not determined.)

The magnetic station was on a small bay on the southeast side of the island, and is covered with water at high tide. The Lloyd needles only were used.

STATION No. V. SUKKERTOPPEN, IN THE GARDEN NEAR THE GOVERNOR'S HOUSE.

(Latitude and longitude not determined.)

July 9, 1853. 15h. Needle No. 2. Poles reversed. Meridian reads 75° 20′.

CIRCLE WEST.				CIRCLE EAST.			
Face east.		Face west.		Face east.		Face west.	
a	b	a	b	a	b	a	b
80° 30′	80° 43′	81° 15′	81° 48′	80° 46′	80° 30′	81° 20′	81° 20′
80 28	80 46	81 15	81 45	80 46	80 33	81 20	81 21
80 29.0	80 44.5	81 15.0	81 46.5	80 46.0	80 31.5	81 20.0	81 20.5
80 36.7		81 30.7		80 38.8		81 20.2	
81 03.7				80 59.5			
81 01.6							

81 03.7
81 11.8
162 15.5
81 07.75

80 59.5
80 03.8
63.3
80 31.6

Needle No. 2. Poles direct.

CIRCLE WEST.				CIRCLE EAST.			
Face east.		Face west.		Face east.		Face west.	
a	b	a	b	a	b	a	b
81° 30′	82° 25′	80° 17′	80° 40′	80° 53′	80° 42′	79° 31′	79° 04′
81 28	82 24	80 14	80 37	80 57	80 45	79 34	79 05
81 29.0	82 24.5	80 15.5	80 38.5	80 55.0	80 43.5	79 32.5	79 04.5
81 56.7		80 27.0		80 49.2		79 18.5	
81 11.8				80 03.8			
80 37.8							

80 37.8
81 01.6
161 39.4
80 49.7

STATION No. VI. PROVEN, GROUND NEAR THE GOVERNOR'S HOUSE.
Latitude 72° 25′.9. Longitude 55° 25′ (both approximate).

July 19, 1853. Needle No. 2. Poles direct. Magnetic meridian 0° 33′.

CIRCLE EAST.				CIRCLE WEST.			
Face east.		Face west.		Face east.		Face west.	
a	b	a	b	a	b	a	b
82° 35′	82° 45′	83° 16′	83° 19′	82° 38′	82° 41′	83° 44′	83° 44′
82 34	82 44	83 14	83 17	82 40	82 43	83 47	83 47
82 34.5	82 44.5	83 15.0	83 18.0	82 39.0	82 42.0	83 45.5	83 45.5
82 39.5		83 16.5		82 40.5		83 45.5	
82 58.0				83 13.0			
83 05.5							

Needle No. 2. Poles reversed.

CIRCLE EAST.				CIRCLE WEST.			
Face east.		Face west.		Face east.		Face west.	
a	b	a	b	a	b	a	b
83° 15′	83° 14′	83° 11′	83° 30′	83° 30′	83° 19′	82° 14′	82° 23′
83 14	83 12	83 10	83 28	83 30	83 21	82 17	82 25
83 14.5	83 13.0	83 10.5	83 29.0	83 30.0	83 20.0	82 15.5	82 24.0
83 13.7		83 19.7		83 25.0		82 19.8	
83 16.7				82 52.4			
83 04.5							

Needle No. 2. Poles direct. Meridian reads 0° 33′.

CIRCLE EAST.				CIRCLE WEST.			
Face east.		Face west.		Face east.		Face west.	
a	b	a	b	a	b	a	b
83° 10′	83° 02′	81° 30′	81° 35′	82° 22′	82° 27′	83° 28′	83° 41′
83 08	83 01	81 30	81 34	82 23	82 29	83 29	83 44
83 09.0	83 01.5	81 30.0	81 34.5	82 22.5	82 28.0	83 28.5	83 42.5
83 05.2		81 32.2		82 25.2		83 35.5	
82 18.7				83 00.3			
82 39.5							

Needle No. 2. Poles reversed.

CIRCLE EAST.				CIRCLE WEST.			
Face east.		Face west.		Face east.		Face west.	
a	b	a	b	a	b	a	b
83° 13′	83° 20′	82° 57′	82° 52′	83° 03′	83° 19′	82° 30′	82° 32′
83 15	83 19	82 55	82 49	83 05	83 20	82 32	82 34
83 14.0	83 19.5	82 56.0	82 50.5	83 04.0	83 19.5	82 31.0	82 33.0
83 16.7		82 53.3		83 11.7		82 32.0	
83 05.0				82 51.8			
82 58.4							

STATION No. VII. UPERNAVIK, STATION IN GARDEN NEAR THE GOVERNOR'S HOUSE.
(Latitude and longitude not determined.)

July 22, 1853. Needle No. 2. Poles direct. Magnetic meridian reads 239° 18′.

CIRCLE EAST.				CIRCLE WEST.			
Face east.		Face west.		Face east.		Face west.	
a	b	a	b	a	b	a	b
82° 42′	82° 43′	84° 22′	84° 21′	83° 13′	83° 33′	83° 59′	84° 12′
82 39	82 40	84 21	84 18	83 16	83 36	84 01	84 14
82 40.5	82 41.5	84 21.5	84 19.5	83 14.5	83 34.5	84 00.0	84 13.0
82 41.0		84 20.5		83 24.5		84 06.5	
83 30.7				83 45.5			
83 38.1							

Needle No. 2. Poles reversed.

CIRCLE EAST.				CIRCLE WEST.			
Face east.		Face west.		Face east.		Face west.	
a	b	a	b	a	b	a	b
84° 15′	84° 40′	83° 22′	83° 20′	83° 33′	83° 44′	83° 40′	83° 28′
84 13	84 37	83 20	83 18	83 34	83 45	83 42	83 30
84 14.0	84 38.5	83 21.0	83 19.0	83 33.5	83 44.5	83 41.0	83 29.0
84 26.2		83 20.0		83 39.0		83 35.0	
83 53.1				83 37.0			
83 45.0							

STATION No. VIII. BEDEVILLED REACH, FORCE BAY. STATION HALF A MILE EAST OF ANCHORAGE(?).
Latitude 78° 34′.5. Longitude 71° 33′.6.

August 12, 1853. Needle No. 2. Poles direct. Meridian reads 248° 30′.

CIRCLE EAST.				CIRCLE WEST.			
Face east.		Face west.		Face east.		Face west.	
a	b	a	b	a	b	a	b
84° 54′	85° 03′	86° 12′	86° 35′	84° 16′	84° 17′	86° 18′	86° 02′
84 48	84 59	86 17	86 30	84 14	84 14	86 19	86 04
84 51.0	85 01.0	86 14.5	86 32.5	84 15.0	84 15.5	86 18.5	86 03.0
84 56.0		86 23.5		84 15.2		86 10.7	
85 39.7				85 12.9			
85 26.3							

Needle No. 2. Poles reversed.

CIRCLE WEST.				CIRCLE EAST.			
Face west.		Face east.		Face west.		Face east.	
a	b	a	b	a	b	a	b
84° 15′	84° 04′	84° 55′	85° 04′	84° 13′	84° 43′	85° 44′	85° 43′
84 20	84 10	84 55	85 03	84 09	84 38	85 40	85 39
84 17.5	84 07.0	84 55.0	85 03.5	84 11.0	84 40.5	85 42.0	85 41.0
84 12.2		84 59.3		84 25.8		85 41.5	
84 35.8				85 03.6			
84 49.7							

STATION No. IX. NEAR MARSHALL BAY.

Latitude 78° 52′. Longitude 69° 01′.[1]

The observations on September 3d, 1853, were made with the Lloyd needle, No. 1, Box B. The dip by the statical needle is 85° 26′, and the resulting corrected dip 84° 49′. See Narrative, vol. I. p. 99.

STATION No. X. VAN RENSSELAER HARBOR, WINTER QUARTERS. MAGNETIC OBSERVATORY ON FERN ROCK.

Latitude 78° 37′. Longitude 70° 40′. W. of G.

January 26, 1854. Needle No. 2. Poles direct. Magnetic meridian reads on circle 9° 02′.

CIRCLE WEST.				CIRCLE EAST.			
Face east.		Face west.		Face east.		Face west.	
a	b	a	b	a	b	a	b
83° 05′	83° 02′	83° 48′	85° 06′	82° 53′	82° 30′	85° 16′	85° 22′
83 05	83 03	83 47	85 05	82 47	82 26	85 10	85 17
83 05.0	83 02.5	83 47.5	85 05.5	82 50.0	82 28.0	85 13.0	85 19.5
83 03.7		84 26.5		82 39.0		85 16.2	
83 45.1				83 57.6			
83 51.3							

Needle No. 2. Poles reversed.

CIRCLE WEST.				CIRCLE EAST.			
Face east.		Face west.		Face east.		Face west.	
a	b	a	b	a	b	a	b
84° 48′	85° 22′	84° 09′	84° 40′	86° 20′	86° 05′	84° 27′	85° 20′
84 48	85 23	84 15	84 39	86 15	86 00	84 21	85 16
84 48.0	85 22.5	84 12.0	84 39.5	86 17.5	86 02.5	84 24.0	85 18.0
85 05.2		84 25.8		86 10.0		84 51.0	
84 45.5				85 30.5			
85 08.0							

[1] Erroneously given 67° 01′ in the Narrative, vol. II. p. 431; the date should also be changed as given above.

February 16, 1854. Needle No. 2. Poles direct. Meridian reads 69° 30′.

CIRCLE WEST.				CIRCLE EAST.			
Face west.		Face east.		Face west.		Face east.	
a	b	a	b	a	b	a	b
85° 38′	86° 02′	84° 41′	84° 30′	85° 24′	85° 38′	83° 51′	83° 44′
85 38	86 02	84 41	84 28	85 23	85 39	83 56	83 44
85 38.0	86 02.0	84 41.0	84 29.0	85 23.5	85 38.5	83 53.5	83 44.0
85 50.0		84 35.0		85 31.0		83 48.7	
85 12.5				84 39.9			
84 56.2							

Needle No. 2. Poles reversed.

CIRCLE WEST.				CIRCLE EAST.			
Face west.		Face east.		Face west.		Face east.	
a	b	a	b	a	b	a	b
84° 28′	84° 25′	84° 53′	84° 49′	84° 35′	84° 33′	85° 11′	85° 38′
84 30	84 23	84 52	84 49	84 36	84 33	85 13	85 38
84 29.0	84 24.0	84 52.5	84 49.0	84 35.5	84 33.0	85 12.0	85 38.0
84 26.5		84 50.7		84 34.2		85 25.0	
84 38.6				84 59.6			
84 49.1							

February 23, 1854. Needle No. 2. Poles reversed. Magnetic meridian 67° 35′.

CIRCLE EAST.				CIRCLE WEST.			
Face east.		Face west.		Face east.		Face west.	
a	b	a	b	a	b	a	b
85° 30′	85° 35′	85° 11′	85° 14′	85° 06′	85° 04′	84° 26′	84° 12′
85 26	85 30	85 06	85 10	85 08	85 07	84 27	84 14
85 28.0	85 32.5	85 08.5	85 12.0	85 07.0	85 05.5	84 26.5	84 13.0
85 30.2		85 10.2		85 06.2		84 19.8	
85 20.2				84 43.0			
85 01.6							

Needle No. 2. Poles direct.

CIRCLE EAST.				CIRCLE WEST.			
Face east.		Face west.		Face east.		Face west.	
a	b	a	b	a	b	a	b
84° 27′	84° 08′	85° 01′	85° 21′	84° 28′	84° 12′	85° 06′	85° 13′
84 24	84 04	84 57	85 18	84 29	84 14	85 07	85 15
84 25.5	84 06.0	84 59.0	85 19.5	84 28.5	84 13.0	85 06.5	85 14.0
84 15.7		85 09.3		84 20.7		85 10.2	
84 42.5				84 45.4			
84 44.0							

RECAPITULATION OF RESULTS FOR MAGNETIC INCLINATION.

No. of station.	Locality.	Date.	No. of needle.	DIP. Pole direct.	DIP. Pole reversed.	Difference for change of polarity.	Mean and resulting dip.	
I.	New York city	May 18, 1853	2	73° 01′.4	72° 46′.8	+14′.6	72° 54′.1	72° 55′.6
"	" "	" "	2	73 09.3	72 54.6	+14.7	72 61.9	
"	" "	May 20, "	1	73 44.1	72 15.1	+89.0	72 59.6	
"	" "	" "	1	73 22.7	72 11.2	+71.5	72 47.0	
II.	Fiskernaes	June 29, "	2	80 32.3	80 50.2	—17.9	80 41.3	
III.	Fiskernaes Harbor	July 1, "	2	81 16.6	80 29.4	+47.2	80 53.0	
IV.	Saikatle	July 9, "	Ll.	(Approximate.)		—	80 56.0	
V.	Sukkertoppen	July 9, "	2	80 37.8	81 01.6	—23.8	80 49.7	
VI.	Proven	July 19, "	2	83 05.5	83 04.5	+ 1.0	83 05.0	82 57.0
"	"	" "	2	82 39.5	82 58.4	—18.9	82 49.0	
VII.	Upernavik	July 22, "	2	83 38.1	83 45.0	— 6.9	83 41.5	
VIII.	Bedevilled Reach	Aug. 12, "	2	85 26.3	84 49.7	+86.6	85 08.0	
IX.	Marshall Bay	Sept. 3, "	Ll.	(Approximate.)		—	84 49.0	
X.	Fern Rock Observatory, Van Rensselaer Harbor	Jan. 26, 1854	2	83 51.3	85 08.0	—76.7	84 29.7	84 45.8
"	" "	Feb. 16, "	2	84 56.2	84 49.1	+ 7.1	84 52.6	
"	" "	Feb. 23, "	2	84 44.0	85 01.6	—17.6	84 52.8	
"	" "	March 2, "	2	—	—	—	84 49.0	
"	" "	June 10, "	2	—	—	—	84 47.2	
"	" "	" "	2	—	—	—	84 51.0	
"	" "	April 24, 1855	2	(12 sets.)		—	84 48.7	
"	" "	May 20, "	2	—	—	—	84 35.6	

The resulting dip at Van Rensselaer Harbor may be taken as corresponding in time to June, 1854.

SECTION III.

OBSERVATIONS OF MAGNETIC INTENSITY.

1854 AND 1855.

SECTION III.

OBSERVATIONS AND DISCUSSION OF THE MAGNETIC INTENSITY.

THE instrument used (a unifilar magnetometer) has already been described. For the determination of the intensity, the long magnet A. 67 has exclusively been used for oscillations and deflections. The effect of the torsion in the suspension was found so small that it was neglected. The vibrations have been observed in sets of two, one containing the readings of the chronometer when the magnet was moving in the direction of the scale readings, and the other when the magnet was moving in the opposite direction.[1] A mean time pocket chronometer was generally used for noting the time, and its rate was too small to affect sensibly the duration of a single vibration. In the deflections, the magnets were always kept at right angles to one another; the distance of the middle of the deflecting magnet, A. 67, from the suspended magnet, is given by a scale divided into feet and decimals of a foot.[2] The observations were made by Mr. A. Sonntag. At Van Rensselaer Harbor the observations extend over the time from January, 1854, to May, 1855. Two other stations were occupied, one in June, 1855, at Hakluyt Island, the other in July, on the coast between Parker Snow Point and Cape York, at the return of the party.

The necessary constants have been determined at Washington, D. C.

Magnet A. 67 is nearly three inches in length, the two other magnets, I. 7 and I. 10, are somewhat shorter.

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[1] The vibrations given in the Narrative, vol. II., Appendix, No. XV., pp. 431—434, are, therefore, double vibrations, and should have been noted as such.

[2] By some inadvertence, Appendix No. XV. of vol. II. of the Narrative contains the distances expressed in inches; it should have been given in feet and decimals, thus, 13 inches should be 1.3 feet, and 9 inches should read 0.9 feet.

January 17, 1854. **Fern Rock Observatory,** Van Rensselaer Harbor.

A. 67 suspended. Experiments of vibrations. (From right to left.)

No.	Time by pocket chronometer.	No.	Time by pocket chronometer.	Time of 45 double vibrations.
1	$5^h\ 58^m\ 37^s.3$	46	$6^h\ 10^m\ 10^s.8$	$11^m\ 33^s.5$
2	52.9	47	26.3	33.4
3	59 08.0	48	41.4	33.4
4	23.8	49	57.0	33.2
5	38.7	50	11 12.7	34.0
6	54.5	51	28.0	33.5
7	6 00 09.9	52	43.3	33.4
8	25.9	53	58.4	32.5
9	40.2	54	12 14.0	33.8
10	55.8	55	29.6	33.8
				Mean $11^m\ 33^s.45$

Arc at beginning 4° 40′. Temp. 50°. Time of 2 vibrations
" end 1 28 $15^s.410$.

The vibrations from left to right could not be observed.

January 18, 1854. **Fern Rock Observatory.**

Experiments of vibrations. (From right to left.)

No.	Time by pocket chronometer.	No.	Time by pocket chronometer.	Time of 50 double vibrations.
1	$5^h\ 30^m\ 43^s.0$	51	$5^h\ 43^m\ 37^s.5$	$12^m\ 54.5$
2	58.8	52	53.8	55.0
3	31 14.0	53	44 08.8	54.8
4	29.3	54	23.9	54.6
5	44.4	55	39.8	55.4
6	32 00.0	56	54.0	54.0
7	15.3	57	45 10.8	55.5
8	31.5	58	25.8	54.3
9	46.5	59	41.8	55.3
10	33 02.0	60	57.0	55.0
11	18.1	61	46 12.5	54.5
				12 54.81

Arc at beginning 4° 40′. Temp. 68. Time of 2 vibrations
" end 1 12 $15^s.496$.

January 18, 1854. **Fern Rock Observatory.**

Experiments of vibrations. (From left to right.)

No.	Time by pocket chronometer.	No.	Time by pocket chronometer.	Time of 50 double vibrations.
1	$5^h\ 30^m\ 50^s.8$	51	$5^h\ 43^m\ 46^s.7$	$12^m\ 55^s.9$
2	31 06.7	52	44 02.0	55.3
3	22.0	53	18.4	56.4
4	36.9	54	32.7	55.8
5	52.9	55	49.0	56.1
6	32 08.0	56	45 04.8	56.8
7	23.8	57	20.0	56.2
8	39.2	58	35.3	56.1
9	54.8	59	51.0	56.2
10	33 10.3	60	46 07.0	56.7
11	26.0	61	22.2	56.2
				12 56.15

Arcs and temp. as before. Time of 2 vibrations $15^s.523$.
(Dr. Hayes assisted in these observations.)

February 21, 1854. **Fern Rock Observatory.**

Experiments of vibrations. (From right to left.)

No.	Time by pocket chronometer.	No.	Time by pocket chronometer.	Time of 50 double vibrations.
1	$4^h\ 59^m\ 26^s.0$	51	$5^h\ 12^m\ 23^s.5$	$12^m\ 57.5$
2	41.8	52	39.4	57.6
3	56.4	53	55.0	58.6
4	5 00 12.6	54	13 10.2	57.6
5	28.2	55	26.2	58.0
6	43.5	56	41.5	58.0
7	58.9	57	57.3	58.4
8	01 14.6	58	14 12.8	58.2
9	30 2	59	28.3	58.1
10	45.6	60	43.5	57.9
11	02 01.3	61	59.2	57.9
				12 57.98

Arc at beginning 5° 52′. Temp. 79°. Time of 2 vibrations
" end 2 24 $15^s.560$.

Experiments of vibrations. (From left to right.)

No.	Time by pocket chronometer.	No.	Time by pocket chronometer.	Time of 50 double vibrations.
1	$4^h\ 59^m\ 33^s.5$	51	$5^h\ 12^m\ 31^s.8$	$12^m\ 58^s.3$
2	48.3	52	47.1	58.8
3	5 00 04.8	53	13 02.8	58.0
4	20.4	54	18.4	58.0
5	35.7	55	34.0	58.3
6	51.2	56	49.5	58.3
7	01 06.9	57	14 05.2	58.3
8	22.5	58	20.8	58.3
9	38.0	59	36.2	58.2
10	53.5	60	51.7	58.2
11	02 09.5	61	15 07.4	57.9
				12 58.24

Arcs and temp. as before. Time of 2 vibrations $15^s.565$.

February 21, 1854. **Fern Rock Observatory.**

Experiments of vibrations. (From right to left.)

No.	Time by pocket chronometer.	No.	Time by pocket chronometer.	Time of 50 double vibrations.
1	$6^h\ 20^m\ 47^s.5$	51	$6^h\ 33^m\ 42^s.6$	$12^m\ 55.1$
2	21 03.0	52	58.0	55.0
3	19.0	53	34 14.0	55.0
4	34.3	54	29.6	55.3
5	49.5	55	45.0	55.5
6	22 05.5	56	35 00.3	54.8
7	20.9	57	16.8	55.9
8	36.3	58	32.0	55.7
9	51.5	59	47.0	55.5
10	23 07.0	60	36 03.7[1]	56.7
				12 55.45

Arc at beginning 5° 20′. Temp. 55°. Time of 2 vibrations
" end 1 36 $15^s.509$.

[1] Corrected by 10^s.

February 21, 1854. **Fern Rock Observatory.**

Experiments of vibrations. (From left to right.)

No.	Time by pocket chronometer.	No.	Time by pocket chronometer.	Time of 50 double vibrations.
1	6^h 20^m $55^s.2$	51	6^h 33^m $51^s.0$	12^m 55.8
2	21 11.0	52	34 06.5	55.5
3	27.0	53	22.6	55.6
4	42.0	54	37.5	55.5
5	57.5	55	53.4	55.9
6	22 13.3	56	35 08.6	55.3
7	29.0	57	25.0	56.0
8	43.8	58	39.6	55.8
9	59.2	59	55.5	56.3
10	23 15.3	60	36 12.0	56.7
				12 55.84

Arcs and time as before. Time of 2 vibrations $15^s.517$.

RECAPITULATION OF RESULTS.

January 17, 1854.	Time of 2 vibrations	$15^s.410$	Temp. 50°
" 18, "	" "	15.496	" 68
" 18, "	" "	15.523	" 68
February 21, "	" "	15.560	" 79
" 21, "	" "	15.565	" 79
" 21, "	" "	15.509	" 55
" 21, "	" "	15.517	" 55
	Combination by two means	15.499	63.0
	Time of one vibration	7.749	

January 31, 1854. Experiments of deflections. Distance 1.3 feet. Deflecting magnet A 67.

Magnet.	North pole.	Circle reads.	Mean.	Diff. or 2 u.	Temp.
E.	W.	318° 40′ 41	40′.5	30° 43′.5	68°
"	E.	287 57 57	57.0		73
W.	E.	288 47 47	47.0	30 50.0	75
"	W.	319 37 37	37.0		72.5
				Means 30 46.7	72.1

February 13, 1854. Experiments of deflections. Distance 0.975 feet.

Magnet.	North pole.	Circle reads.	Mean.	2 u.	Temp.
E.	E.	162° 07′ 06	06′.5	78° 56′.5	50°
"	W.	83 10 10	10.0		61
W.	W.	86 24 24	24.0	78 23.0	65
"	E.	164 47 47	47.0		66
				Means 78 40.0	60.5

February 27, 1854. Experiments of deflections. Distance 1.3 feet.

Magnet.	North pole.	Circle reads.	Mean.	2 u.	Temp.
E.	E.	140° 54′.5 54.5	54′.5	30° 56′.0	58°
"	W.	109 58 59	58.5		58
W.	W.	110 31 32	31.5	30 43.5	58
"	E.	141 15 15	15.0		56
				30 49.7	57.5

June 7, 1854. Experiments of vibrations. (Left to right.)

No.	Time by chronometer 2721.	No.	Time by chronometer 2721.	Time of 45 double vibrations.
1	3^h 04^m $34^s.2$	46	3^h 16^m $02^s.5$	11^m $28^s.3$
2	49.4	47	17.8	28 4
3	05 05.0	48	33.0	28.0
4	20.3	49	48.3	28.0
5	35.8	50	17 03.6	27.8
6	51.1	51	19.0	27.9
7	06 06.3	52	34.2	27.9
8	21.8	53	49.4	27.6
9	36.9	54	18 04.8	27.9
10	52.1	55	20.0	27.9
				11 27.97

Arc at beginning 6° 8′. Temp. +33°. Time of 2 vibrations $15^s.288$.
" end 2 48

Rate of mean time chronometer 2721 (showing nearly Greenwich time), about $2^s.0$ losing.

June 7, 1854. Experiments of vibrations. (Right to left.)

No.	Time by chronometer 2721.	No.	Time by chronometer 2721.	Time of 45 double vibrations.
1	3^h 04^m $42^s.3$	46	3^h 16^m $10^s.2$	11^m $27^s.9$
2	57.6'	47	25.5	27.9
3	05 12.7	48	40.8	28.1
4	28.1	49	56.0	27.9
5	43.3	50	17 11.2	27.9
6	58.8	51	26.5	27.7
7	06 13.8	52	41.9	28.1
8	29.2	53	57.4	28.2
9	44.4	54	18 12.5	28.1
10	07 00.0	55	27.8	27.8
				11 27.96

Arcs and temp. as before. Time of 2 vibrations $15^s.288$.

June 7, 1854. Experiments of vibrations. (Left to right.)

No.	Time by chronometer 2721.	No.	Time by chronometer 2721.	Time of 45 double vibrations.
1	3^h 22^m $08^s.0$	46	3^h 33^m $37^s.0$	11^m $29^s.0$
2	23.3	47	52.3	29.0
3	38.5	48	34 07.6	29.1
4	53.8	49	23.0	29.2
5	23 09.2	50	38.2	29.0
6	24.5	51	53.7	29.2
7	39.7	52	35 09.0	29.3
8	55.0	53	24.5	29.5
9	24 10.3	54	39.6	29.3
10	25.7	55	54.9	29.2
				11 29.18

Arc at beginning 6° 8′. Temp. 33°. Time of 2 vibrations $15^s.315$.
" end 2 48

June 7, 1854. Experiments of vibrations. (Right to left.)

No.	Time by chronometer 2721.	No.	Time by chronometer 2721.	Time of 45 double vibrations.
1	3^h 22^m $16^s.0$	46	3^h 33^m $45^s.0$	11^m $29^s.0$
2	31.2	47	34 00.2	29.0
3	46.3	48	15.5	29.2
4	23 01.8	49	30.9	29.1
5	17.0	50	46.3	29.3
6	32.3	51	35 01.5	29.2
7	47.8	52	16.8	29.0
8	24 03.1	53	32.2	29.1
9	18.3	54	47.3	29.0
10	33.3	55	36 02.5	29.2
				11 29.11

Arcs and temp. as before. Time of 2 vibrations $15^s.313$.

June 7, 1854. Experiments of vibrations. (Left to right.)

No.	Time by chronometer 2721.	No.	Time by chronometer 2721.	Time of 54 double vibrations.
1	8^h 12^m $39^s.1$	55	8^h 26^m $30^s.7$	13^m $51^s.6$
2	54.5	56	46.0	51.5
3	13 09.8	57	27 01.5	51.7
4	25.1	58	17.0	51.9
5	40.3	59	32.2	51.9
6	56.0	60	47.8	51.8
7	14 11.3	61	28 03.2	51.9
8	26.5	62	18.8	52.3
9	42.1	63	34.0	51.9
10	57.5	64	49.3	51.8
				13 51.83

Arc at beginning 6° 40′. Temp. 35. Time of two vibrations $15^s.403$.
" end 2 56

June 7, 1854. Experiments of vibrations. (Right to left.)

No.	Time by chronometer 2721.	No.	Time by chronometer 2721.	Time of 54 double vibrations.
1	8^h 12^m $46^s.8$	55	8^h 26^m $38^s.5$	13^m $51^s.7$
2	13 02.0	56	54.0	52.0
3	17.2	57	27 09.3	52.1
4	32.6	58	24.8	52.2
5	48.1	59	40.3	52.2
6	14 03.3	60	55.7	52.4
7	18.7	61	28 11.1	52.4
8	34.0	62	26.4	52.4
9	49.5	63	41.9	52.4
10	15 05.0	64	57.4	52.4
				13 52.22

Arcs and time as before. Time of 2 vibrations $15^s.412$.

June 7, 1854. Experiments of vibrations. (Left to right.)

No.	Time by chronometer 2721.	No.	Time by chronometer 2721.	Time of 50 double vibrations.
1	8^h 35^m $17^s.1$	51	8^h 48^m $07^s.8$	12^m $50^s.7$
2	32.2	52	23.1	50.9
3	48.0	53	38.6	50.6
4	36 03.3	54	54.0	50.7
5	19.0	55	49 09.3	50.3
6	34.3	56	24.8	50.5
7	49.6	57	40.1	50.5
8	37 05.1	58	55.6	50.5
9	20.6	59	50 10.9	50.3
10	36.2	60	26.3	50.1
11	51.5	61	41.6	50.1
				12 50.47

Arc 7° 28′. Temp. 35°. Time of 2 vibrations $15^s.409$.
3 12

June 7, 1854. Experiments of vibrations. (Right to left.)

No.	Time by chronometer 2721.	No.	Time by chronometer 2721.	Time of 50 double vibrations.
1	8^h 35^m $24^s.7$	51	8^h 48^m $15^s.2$	12^m $50^s.5$
2	40.0	52	30.7	50.7
3	55.2	53	46.0	50.8
4	36 10.8	54	49 01.3	50.5
5	26.2	55	16.8	50.6
6	42.0	56	32.2	50.2
7	57.2	57	47.7	50.5
8	37 12.7	58	50 03.0	50.3
9	28.3	59	18.7	50.4
10	43.8	60	33.8	50.0
11	59.0	61	49.2	50.2
				12 50.43

Arcs and temp. as before. Time of 2 vibrations $15^s.409$.

RECAPITULATION OF RESULTS, JUNE 7, 1854.

Set No. 1.	Time of 2 vibrations	15s.288	Temp. 33°
		15.288	" 33
Set No. 2.	" "	15.315	" 33
		15.313	" 33
Set No. 3.	" "	15.403	" 35
		15.412	" 35
Set No. 4.	" "	15.409	" 35
		15.409	" 35
June 7, 1854.	Mean	15.355	+34.0
	Time of 1 vibration . . .	7.678	

June 7, 1854. Experiments of deflections.
Deflecting magnet A. 67. Deflected magnet I. 10. Distance 0.9 feet.

Magnet.	North pole.	Circle reads.	Mean.	2 u.	Temp.
W.	E.	374° 16′.3 15.0	15′.7	108° 21′.2	36°.2
"	W.	265 55.0 54.0	54 5		38.0
W.	W.	260 58.0 55.5	56.7	107 33.8	36.0
"	E.	368 31.0 30.0	30.5		34.0
				Means 107 57.5	36.0

Experiments of deflections. Distance 1.3 feet.

Magnet.	North pole.	Circle reads.	Mean.	2 u.	Temp.
E.	E.	331° 33′.0 31.0	32′.0	30° 58′.5	34°.5
"	W.	300 34.0 33.0	33.5		34.3
W.	W.	301 01.0 00.0	00.5	31 35.5	35.8
"	E.	332 37.0 35.0	36.0		35.0
				Means 31 17.0	34.9

These two sets of deflections were observed between the second and third set of the preceding vibrations.

June 8, 1854. Experiments of vibrations. (Left to right.)

No.	Time by chronometer 2721.	No.	Time by chronometer 2721.	Time of 40 double vibrations.
1	3^h 16^m $20^s.0$	41	3^h 26^m $40^s.4$	10^m $20^s.4$
2	35.5	42	56.0	20.5
3	50.9	43	27 11.5	20.6
4	17 06.5	44	27.2	20.7
5	22.2	45	42.6	20.4
6	37.8	46	58.1	20.3
7	53.3	47	28 13.5	20.2
8	18 08.8	48	29.1	20.3
9	24.3	49	44.6	20.3
10	39.8	50	29 00.5	20.7
11	55.2	51	15.5	20.3
				10 20.43

Arcs 5° 36′. Temp. 35°. Time of 2 vibrations $15^s.511$.
3 20

June 8, 1854. Experiments of vibrations. (Right to left.)

No.	Time by chronometer 2721.	No.	Time by chronometer 2721.	Time of 40 double vibrations.
1	3^h 16^m $27^s.3$	41	3^h 26^m $48^s.0$	10^m $20^s.7$
2	43.2	42	27 03.5	20.3
3	58.6	43	19.0	20.4
4	17 14.2	44	34.6	20.4
5	29.7	45	50.0	20.3
6	45.3	46	28 05.6	20.3
7	18 00.8	47	21.1	20.3
8	16.2	48	36.5	20.3
9	31.8	49	52.2	20.4
10	47.3	50	29 07.6	20.3
11	19 02.9	51	23.3	20.4
				10 20.37

Arcs and temp. as before. Time of 2 vibrations $15^s.509$.

June 8, 1854. Experiments of vibrations. (Left to right.)

No.	Time by chronometer 2721.	No.	Time by chronometer 2721.	Time of 40 double vibrations.
1	3^h 31^m $33^s.3$	41	3^h 41^m $53^s.9$	10^m $20^s.6$
2	49.0	42	42 09.2	20.2
3	32 04.5	43	24.7	20.2
4	20.0	44	40.2	20.2
5	35.6	45	55.8	20.2
6	51.2	46	43 11.2	20.0
7	33 06.7	47	26.7	20.0
8	22.1	48	42.1	20.0
9	37.6	49	57.7	20.1
10	53.1	50	44 13.0	19.9
11	34 08.3	51	28.5	20.2
				10 20.15

Arcs 6° 8′. Temp. 35°.2. Time of 2 vibrations $15^s.503$.
and 3 12

June 8, 1854. Experiments of vibrations. (Right to left.)

No.	Time by chronometer 2721.	No.	Time by chronometer 2721.	Time of 40 double vibrations.
1	$3^h\ 31^m\ 40^s.8$	41	$3^h\ 42^m\ 01^s.2$	$10^m\ 20^s.4$
2	56.4	42	16.5	20.1
3	32 11.9	43	32.2	20.3
4	27.3	44	47.5	20.2
5	43.1	45	43 03.0	19.9
6	58.6	46	18.4	19.8
7	33 14.1	47	33.9	19.8
8	29.6	48	49.4	19.8
9	45.1	49	44 04.9	19.8
10	34 00.7	50	20.3	19.6
11	16.2	51	35.8	19.6
				10 19.93

Arcs and temp. as before. Time of 2 vibrations $15^s.498$.

(4 sets of deflections were taken after the above, for which see below.)

June 8, 1854. Experiments of vibrations. (Left to right.)

No.	Time by chronometer 2721.	No.	Time by chronometer 2721.	Time of 40 double vibrations.
1	$8^h\ 31^m\ 54^s.3$	41	$8^h\ 42^m\ 09^s.5$	$10^m\ 15^s.2$
2	32 10.2	42	24.9	14.7
3	25.3	43	40.2	14.9
4	40.8	44	55.5	14.7
5	56.2	45	43 10.9	14.7
6	33 11.4	46	26.2	14.8
7	27.0	47	41.7	14.7
8	42.3	48	56.9	14.6
9	57.4	49	12.3	14.9
10	34 13.1	50	27.5	14.4
11	28.3	51	42.9	14.6
				10 14.75

Arcs 6° 48′. Temp. 35°. Time of 2 vibrations $15^s.369$.
and 2 08

June 8, 1854. Experiments of vibrations. (Right to left.)

No.	Time by chronometer 2721.	No.	Time by chronometer 2721.	Time of 40 double vibrations.
1	$8^h\ 32^m\ 02^s.3$	41	$8^h\ 42^m\ 18^s.3$	$10^m\ 16.0$
2	17.8	42	33.6	15.8
3	33.2	43	49.0	15.8
4	48.7	44	43 04.4	15.7
5	33 04.0	45	19.9	15.9
6	19.3	46	35.2	15.9
7	34.8	47	50.6	15.8
8	50.2	48	44 06.0	15.8
9	34 05.5	49	21.4	15.9
10	21.2	50	36.9	15.7
11	36.8	51	52.3	15.5
				10 15.80

Arcs and temp. as before. Time of 2 vibrations $15^s.395$.

June 8, 1854. Experiments of vibrations. (Left to right.)

No.	Time by chronometer 2721.	No.	Time by chronometer 2721.	Time of 40 double vibrations.
1	8^h 48^m $52^s.0$	41	8^h 59^m $04^s.6$	10^m $12^s.6$
2	49 07.3	42	19.7	12.4
3	23.0	43	35.3	12.3
4	38.2	44	50.5	12.3
5	53.4	45	9 00 05.8	12.4
6	50 08.9	46	21.1	12.2
7	24.3	47	36.3	12.0
8	39.6	48	51.6	12.0
9	54.7	49	1 07.0	12.3
10	51 10.1	50	22.2	12.1
11	25.3	51	37.5	12.2
				10 12.25

Arcs 6° 56′. Temp. 35°. Time of 2 vibrations $15^s.306$.
and 3 20

June 8, 1854. Experiments of vibrations. (Right to left.)

No.	Time by chronometer 2721.	No.	Time by chronometer 2721.	Time of 40 double vibrations.
1	8^h 48^m $59^s.8$	41	8^h 59^m $12^s.0$	10^m $12^s.2$
2	49 15.1	42	27.5	12.4
3	30.3	43	42.8	12.5
4	45.8	44	58.0	12.2
5	50 01.1	45	9 00 13.4	12.3
6	16.3	46	28.6	12.3
7	31.8	47	43.9	12.1
8	47.2	48	59.3	12.1
9	51 02.2	49	01 14.6	12.4
10	17.8	50	29.9	12.1
11	33.0	51	45.3	12.3
				10 12.26

Arcs and temp. as before. Time of 2 vibrations $15^s.306$.
Daily rate of chronometer 2721, losing $1^s.0$.

RECAPITULATION OF RESULTS, JUNE 8, 1854.

Set No. 1.	Time of 2 vibrations	$15^s.511$	Temp. 35°
		15.509	" 35
Set No. 2.	" "	15.503	" 35.2
		15.498	" 35.2
Set No. 3.	" "	15.369	" 35
		15.395	" 35
Set No. 4.	" "	15.306	" 35
		15.306	" 35
	Means	15.425	35.0
	Time of 1 vibration . . .	7.712	

The following deflections correspond in time to the middle of the above vibration results.

June 8, 1854. Experiments of deflections.
Deflecting magnet A. 67. Deflected magnet I. 10. Distance 1.3 feet.

Magnet.	North pole.	Circle reads.	Mean.	2 u.	Temp.
W.	E.	329° 46′ 45	45′.5	31° 10′.5	36°.7
"	W.	298 36 34	35.0		37.7
E.	W.	298 08 06	07.0	31 33.5	37.0
"	E.	329 41 40	40.5		36.2
				Means 31 22.0	36.9

Experiments of deflections. Distance 0.9 feet.

Magnet.	North pole.	Circle reads.	Mean.	2 u.	Temp.
E.	E.	365° 52′.5 51.0	51′.7	110° 58′.2	37°.2
"	W.	254 54 53	53.5		36.6
W.	W.	262 30 28	29.0	106 38.0	37.0
"	E.	369 08 06	07.0		37.0
				Means 108 48.1	36.9

Experiments of deflections. Distance 0.9 feet.

Magnet.	North pole.	Circle reads.	Mean.	2 u.	Temp.
W.	E.	369° 08′.0 06.5	07′.2	106° 48′.2	37°.2
"	W.	262 20 18	19.0		37.0
E.	W.	254 41 40	40.5	110 06.7	37.6
"	E.	364 48.0 46.5	47.2		36.6
				Means 108 27.4	37.1

Experiments of deflections. Distance 1.3 feet.

Magnet.	North pole.	Circle reads.	Mean.	2 u.	Temp.
E.	E.	328° 52′ 52	52′.0	31° 29′.5	36°.0
"	W.	297 23 22	22.5		35.2
W.	W.	298 03 02	02.5	31 10.5	36.3
"	E.	329 13 13	13.0		37.0
				Means 31 20.0	36.1

June 19, 1854. Experiments of deflections.

Deflecting magnet A. 67. Deflected magnet I. 7. Distance 0.9 feet.

Magnet.	North pole.	Circle reads.	Mean.	2 u.	Temp.
W.	W.	268° 50′ 49	49′.5	107° 33′.0	40°.6
"	E.	376 23 22	22.5		41.6
E.	E.	373 05 04	04.5	106 05.0	41.2
"	W.	267 00 266 59	59.5		41.2
				Means 106 49.0	41.1

Experiments of deflections. Distance 1.3 feet.

Magnet.	North pole.	Circle reads.	Mean.	2 u.	Temp.
E.	W.	303° 38′ 37	37′.5	30° 43′.0	40°.8
"	E.	334 21 20	20.5		41.0
W.	E.	334 46 46	46.0	30 42.5	43.5
"	W.	304 04 03	03.5		43.0
				Means 30 42.7	42.1

June 19, 1854. Experiments of vibrations. (Left to right.)

No.	Time.[1]	No.	Time.[1]	Time of 40 double vibrations.
1	4^h 33^m 20^s.1	41	4^h 43^m 38^s.6	10^m 18^s.5
2	35.3	42	54.0	18.7
3	51.0	43	44 09.5	18.5
4	34 06.5	44	25.0	18.5
5	21.9	45	40.4	18.5
6	37.3	46	55.9	18.6
7	52.8	47	45 11.2	18.4
8	35 08.3	48	26.6	18.3
9	23.8	49	42.1	18.3
10	39.3	50	57.7	18.4
11	54.9	51	46 13.0	18.1
				10 18.44

Arcs 7° 28′. Temp. 43°. Time of 2 vibrations 15^s.461.
and 3 44

[1] Number of chronometer not stated.

June 19, 1854. Experiments of vibrations. (Right to left.)

No.	Time.	No.	Time.	Time of 40 double vibrations.
1	4^h 33^m $28^s.2$	41	4^h 43^m $46^s.8$	10^m $18^s.6$
2	43.4	42	44 02.3	18.9
3	59.0	43	17.8	18.8
4	34 14.3	44	33.2	18.9
5	29.9	45	48.6	18.7
6	45.3	46	45 04.2	18.9
7	35 00.9	47	19.5	18.6
8	16.3	48	35.1	18.8
9	31.9	49	50.4	18.5
10	47.2	50	46 05.8	18.6
11	36 02.8	51	21.4	18.6
				10 18.72

Arcs and temp. as before. Time of 2 vibrations $15^s.463$.

Experiments of vibrations. (Left to right.)

No.	Time.	No.	Time.	Time of 40 double vibrations.
1	4^h 50^m $26^s.2$	41	5^h 00^m $44^s.0$	10^m $17^s.8$
2	41.8	42	59.3	17.5
3	57.3	43	01 14.8	17.5
4	51 12.9	44	30.3	17.4
5	28.2	45	45.9	17.7
6	43.5	46	02 01.3	17.8
7	59.1	47	16.7	17.6
8	52 14.5	48	32.2	17.7
9	29.9	49	47.7	17.8
10	45.4	50	03 03.2	17.8
11	53 01.0	51	18.8	17.8
				10 17.67

Arcs 6° 56′. Temp. 43°. Time of 2 vibrations $15^s.442$.
and 4 00

Experiments of vibrations. (Right to left.)

No.	Time.	No.	Time.	Time of 40 double vibrations.
1	4^h 50^m $34^s.1$	41	5^h 00^m $51^s.6$	10^m $17^s.5$
2	49.5	42	01 07.1	17.6
3	51 04.9	43	22.4	17.5
4	20.3	44	37.9	17.6
5	35.9	45	53.4	17.5
6	51.2	46	02 08.9	17.7
7	52 06.9	47	24.3	17.4
8	22.2	48	39.6	17.4
9	37.8	49	55.0	17.2
10	53.1	50	03 10.3	17.2
11	53 08.6	51	25.8	17.2
				10 17.44

Arcs and temp. as before. Time of 2 vibrations $15^s.436$.

June 19, 1854. Experiments of vibrations. (Left to right.)

No.	Time.	No.	Time.	Time of 40 double vibrations.
1	5^h 13^m $12^s.2$	41	5^h 23^m $30^s.3$	10^m $18^s.1$
2	27.9	42	45.7	17.8
3	43.3	43	24 01.2	17.9
4	58.9	44	16.8	17.9
5	14 14.2	45	32.3	18.1
6	29.5	46	47.9	18.4
7	45.1	47	25 03.4	18.3
8	15 00.3	48	18.9	18.6
9	16.1	49	34.1	18.0
10	31.3	50	49.7	18.4
11	46.9	51	26 05.1	18.2
				10 18.15

Arcs 6° 48′. Temp. 42°.4. Time of 2 vibrations $15^s.454$.
3 36

Experiments of vibrations. (Right to left.)

No.	Time.	No.	Time.	Time of 40 double vibrations.
1	5^h 13^m $20^s.2$	41	5^h 23^m $37^s.6$	10^m $17^s.4$
2	35.7	42	52.9	17.2
3	51.2	43	24 08.3	17.1
4	14 06.5	44	24.0	17.5
5	22.1	45	39.5	17.4
6	37.5	46	54.9	17.4
7	53.2	47	25 10.2	17.0
8	15 08.4	48	25.2	16.8
9	23.7	49	40.8	17.1
10	39.2	50	56.5	17.3
11	54.8	51	26 11.7	16.9
				10 17.19

Arcs and temp. as before. Time of 2 vibrations $15^s.430$.

Experiments of vibrations. (Left to right.)

No.	Time.	No.	Time.	Time of 40 double vibrations.
1	5^h 33^m $23^s.3$	41	5^h 43^m $39^s.5$	10^m $16^s.2$
2	38.9	42	54.9	16.0
3	54.2	43	44 10.3	16.1
4	34 09.5	44	25.8	16.3
5	25.2	45	41.3	16.1
6	40.4	46	56.7	16.3
7	55.9	47	45 11.9	16.0
8	35 11.2	48	27.4	16.2
9	26.8	49	42.8	16.0
10	42.2	50	58.2	16.0
11	57.6	51	46 13.6	16.0
				10 16.11

Arcs 7° 04′. Temp. 42°.4. Time of two vibrations $15^s.403$.
3 28

Experiments of vibrations. (Right to left.)

No.	Time.	No.	Time.	Time of 40 double vibrations.
1	5^h 33^m $31^s.2$	41	5^h 43^m $47^s.2$	10^m $16^s.0$
2	46.5	42	44 02.8	16.3
3	34 02.1	43	18.1	16.0
4	17.4	44	33.5	16.1
5	33.0	45	49.0	16.0
6	48.4	46	45 04.5	16.1
7	35 03.7	47	19.8	16.1
8	19.0	48	35.2	16.2
9	34.3	49	50.6	16.3
10	49.5	50	46 05.9	16.4
11	36 05.2	51	21.3	16.1
				10 16.15

Arcs and temp. as before. Time of 2 vibrations $15^s.404$.

RECAPITULATION OF RESULTS, JUNE 19, 1854.

Set No. 1.	Time of 2 vibrations	$15^s.461$	Temp. 43°
		15.463	" 43
Set No. 2.	" "	15.442	" 43
		15.436	" 43
Set No. 3.	" "	15.454	" 42.4
		15.430	" 42.4
Set No. 4.	" "	15.403	" 42.4
		15.404	" 42.4
	Means	15.437	42.7
	Time of 1 vibration . .	7.718	

June 19, 1854. Experiments of deflections.
Deflecting magnet A. 67. Deflected magnet I. 7. Distance 1.3 feet.

Magnet.	North pole.	Circle reads.	Mean.	2 u.	Temp.
W.	W.	298° 54′ 53	53′.5	30° 53′.0	42°.0
"	E.	329 47 46	46.5		42.2
E.	E.	329 20 19	19.5	30 50.0	43.2
"	W.	298 30 29	29.5		42.0
				Means 30 51.5	42.4

Experiments of deflection. Distance 0.9 feet.

Magnet.	North pole.	Circle reads.	Mean.	2 u.	Temp.
E.	W.	259° 19′ 18	18′.5	106° 11′.5	42°.2
"	E.	365 31 29	30.0		42.0
W.	E.	369 39 38	38.5	106 30.5	43.2
"	W.	263 09 07	08.0		41.8
				Means 106 21.0	42.3

June 24, 1854. Experiments of deflections.
Deflecting magnet A. 67. Deflected magnet I. 7. Distance 0.9 feet.

Magnet.	North pole.	Circle reads.	Means.	2 u.	Temp.
W.	W.	264° 10′ 09	09′.5	105° 32′.0	38°.0
"	E.	369 42 41	41.5		38.0
E.	E.	365 00 364 59	59.5	105 10.0	38.0
"	W.	259 50 49	49.5		38.0
				Means 105 21.0	38.0

Experiments of deflection. Distance 1.3 feet.

Magnet.	North pole.	Circle reads.	Means.	2 u.	Temp.
E.	W.	298° 37′ 36	36′.5	30° 44′.5	38°.5
"	E.	329 21 21	21.0		38.6
W.	E.	330 13 12	12.5	30 31.0	40.3
"	W.	299 42 41	41.5		40.0
				Means 30 37.7	39.4

June 24, 1854. Experiments of vibrations. (Left to right.)

No.	Time by chronometer 264.	No.	Time by chronometer 264.	Time of 40 double vibrations.
1	4^h 21^m $34^s.3$	41	4^h 31^m $53^s.3$	10^m $19^s.0$
2	49.6	42	32 08.8	19.2
3	22 05.2	43	24.2	19.0
4	20.7	44	39.6	18.9
5	36.3	45	55.0	18.7
6	51.8	46	33 10.4	18.6
7	23 07.3	47	26.3	19.0
8	22.8	48	41.8	19.0
9	38.4	49	57.2	18.8
10	53.8	50	34 12.5	18.7
11	24 09.1	51	28.0	18.9
				10 18.89

Arcs 6° 16′. Temp. 41°.2. Time of 2 vibrations $15^s.472$.
and 3 20

The chronometer nearly shows Greenwich mean time, and its daily rate is less than $0^s.5$ (gaining).

June 24, 1854. Experiments of vibrations. (Right to left.)

No.	Time by chronometer 264.	No.	Time by chronometer 264.	Time of 40 double vibrations.
1	4^h 21^m $41^s.8$	41	4^h 31^m $59^s.0$	10^m $17^s.2$
2	57.1	42	32 14.3	17.2
3	22 12.6	43	29.2	16.6
4	28.2	44	44.4	16.2
5	43.4	45	59.5	16.1
6	59.0	46	33 14.9	15.9
7	23 14.3	47	30.3	16.0
8	29.8	48	45.8	16.0
9	45.2	49	34 01.0	15.8
10	24 00.8	50	16.3	15.5
11	16.2	51	31.6	15.4
				10 16.17

Arcs and temp. as before. Time of 2 vibrations $15^s.404$.

June 24, 1854. Experiments of vibrations. (Left to right.)

No.	Time by chronometer 264.	No.	Time by chronometer 264.	Time of 40 double vibrations.
1	4^h 40^m $31^s.1$	41	4^h 50^m $46^s.0$	10^m $14^s.9$
2	46.5	42	51 01.3	14.8
3	41 02.0	43	16.8	14.8
4	17.4	44	32.0	14.6
5	32.8	45	47.5	14.7
6	48.2	46	52 02.8	14.6
7	42 03.5	47	18.1	14.6
8	18.9	48	33.4	14.5
9	34.3	49	48.8	14.5
10	49.8	50	53 04.1	14.3
11	43 05.1	51	19.4	14.3
				10 14.60

Arcs 5° 52′. Temp. 41°.2. Time of 2 vibrations $15^s.365$.
and 3 20

June 24, 1854. Experiments of vibrations. (Right to left.)

No.	Time by chronometer 264.	No.	Time by chronometer 264.	Time of 40 double vibrations.
1	4^h 40^m $38^s.8$	41	4^h 50^m $53^s.8$	10^m $15^s.0$
2	54.2	42	51 09.2	15.0
3	41 09.5	43	24.6	15.1
4	24.9	44	40.0	15.1
5	40.2	45	55.4	15.2
6	55.8	46	52 10.8	15.0
7	42 11.1	48	26.2	15.1
8	26.3	47	41.6	15.3
9	41.9	49	57.0	15.1
10	57.2	50	53 12.3	15.1
11	43 12.6	51	27.8	15.2
				10 15.11

Arcs and temp. as before. Time of 2 vibrations $15^s.378$.

June 24, 1854. Experiments of vibrations. (Left to right.)

No.	Time by chronometer 264.	No.	Time by chronometer 264.	Time of 40 double vibrations.
1	5^h 03^m $29^s.3$	41	5^h 15^m $44^s.5$	10^m 15.2
2	44.9	42	59.5	14.6
3	04 00.3	43	14 15.1	14.8
4	15.6	44	30.4	14.8
5	31.0	45	45.9	14.9
6	46.4	46	15 01.3	14.9
7	05 01.8	47	16.8	15.0
8	17.1	48	32.2	15.1
9	32.3	49	47.7	15.4
10	47.8	50	16 02.9	15.1
11	06 03.2	51	18.2	15.0
				10 14.982

Arcs 6° 16′. Temp. 41°.2. Time of 2 vibrations $15^s.375$.
and 3 28

June 24, 1854. Experiments of vibrations. (Right to left.)

No.	Time by chronometer 264.	No.	Time by chronometer 264.	Time of 40 double vibrations.
1	5^h 03^m $37^s.1$	41	5^h 13^m $52^s.0$	10^m 14.9
2	52.4	42	14 07.6	15.2
3	04 07.8	43	23.0	15.2
4	23.2	44	38.3	15.1
5	38.4	45	53.8	15.4
6	53.8	46	15 09.1	15.3
7	05 09.3	47	24.5	15.2
8	24.5	48	39.9	15.4
9	40.0	49	55.2	15.2
10	55.0	50	16 10.6	15.6
11	06 10.8	51	26.0	15.2
				10 15.24

Arcs and temp. as before. Time of 2 vibrations $15^s.381$.

June 24, 1854. Experiments of vibrations. (Left to right.)

No.	Time by chronometer 264.	No.	Time by chronometer 264.	Time of 40 double vibrations.
1	5^h 18^m $38^s.3$	41	5^h 28^m $54^s.8$	10^m $16^s.5$
2	54.0	42	29 10.1	16.1
3	19 09.3	43	25.3	16.0
4	24.9	44	40.8	15.9
5	40.3	45	56.2	15.9
6	55.7	46	30 11.6	15.9
7	20 11.2	47	27.0	15.8
8	26.7	48	42.4	15.7
9	42.2	49	57.8	15.6
10	57.5	50	31 13.1	15.6
11	21 12.9	51	28.7	15.8
				10 15.89

Arcs 6° 48′. Temp. 41°.2. Time of 2 vibrations $15^s.397$.
3 20

June 24, 1854. Experiments of vibrations. (Right to left.)

No.	Time by chronometer 264.	No.	Time by chronometer 264.	Time of 40 double vibrations.
1	5^h 18^m $46^s.2$	41	5^h 29^m $02^s.7$	10^m $16^s.5$
2	19 01.9	42	18.0	16.1
3	17.2	43	33.6	16.4
4	32.8	44	49.0	16.2
5	48.2	45	30 04.2	16.0
6	20 03.6	46	19.7	16.1
7	19.0	47	35.0	16.0
8	34.3	48	50.4	16.1
9	49.7	49	31 05.8	16.1
10	21 05.1	50	21.5	16.4
11	20.6	51	36.8	16.2
				10 16.19

Arcs and temp. as before. Time of 2 vibrations $15^s.405$.

RECAPITULATION OF RESULTS, JUNE 24, 1854.

Set No. 1.	Time of 2 vibrations	$15^s.472$	Temp. 41°.2
		15.404	" 41.2
Set No. 2.	" "	15.365	" 41.2
		15.378	" 41.2
Set No. 3.	" "	15.375	" 41.2
		15.381	" 41.2
Set No. 4.	" "	15.397	" 41.2
		15.405	" 41.2
	Mean	15.397	41.2
	Time of 1 vibration . . .	7.699	

June 24, 1854. Experiments of deflections.
Deflecting magnet A. 67. Deflected magnet I. 7. Distance 1.3 feet.

Magnet.	North pole.	Circle reads.	Means.	2 u.	Temp.
W.	W.	300° 17′ 15	16′.0	30° 12′.0	44°.2
"	E.	330 29 27	28.0		43.0
E.	E.	330 41 40	40.5	30 37.0	42.2
"	W.	300 04 03	03.5		42.4
				Means 30 24.5	42.9

Experiments of deflections. Distance 0.9 feet.

Magnet.	North pole.	Circle reads.	Means.	2 u.	Temp.
E.	W.	261° 24′ 22	23′.0	106° 07′.5	41.4
"	E.	367 31 30	30.5		41.0
W.	E.	373 07 05	06.0	109 04.5	42.4
"	W.	264 02 01	01.5		41.7
				Means 107 36.0	41.6

The detail record of the observations of deflections and vibrations at Van Rensselaer Harbor, in May, 1855, and of the vibrations at Hakluyt Island, and near Cape York, in June and July, 1855, could not be found; the results, however, are preserved in Appendix No. XV. of the Narrative (vol. II.), and are herewith subjoined.

SYNOPSIS OF RESULTS OF VIBRATIONS AND DEFLECTIONS, OBSERVED AT VAN RENSSELAER HARBOR DURING THE YEARS 1854 AND '55.

Date.	Temp.'s observed.	Time of 1 vibration.	Mean adopted. T.	Corresponding temp. t_i.	Angle of deflection. u.	Distance in feet. r.
1854.						
January 17	50°.0	7s.705				
" 18	68.0	7.748				
" 18	68.0	7.761				
" 31	72.1				15° 23′.3	1.3
February 13	60.5		7s.749	63°.0	39 20.0	0.975
" 21	79.0	7.780				
" 21	79.0	7.782				
" 21	55.0	7.755				
" 21	55.0	7.758				
" 27	57.5				15 24.8	1.3
June 7	33.0	7.644				
" 7	33.0	7.644				
" 7	33.0	7.657				
" 7	33.0	7.656				
" 7	36.0				53 58.7	0.9
" 7	34.9		7.678	34.0	15 38.5	1.3
" 7	35.0	7.702				
" 7	35.0	7.706				
" 7	35.0	7.705				
" 7	35.0	7.704				
June 8	35.0	7.755				
" 8	35.0	7.754				
" 8	35.2	7.752				
" 8	35.2	7.749				
" 8	36.9				15 41.0	1.3
" 8	36.9				54 24.0	0.9
" 8	37.1		7.712	35.0	54 13.7	0.9
" 8	36.1				15 40.0	1.3
" 8	35.0	7.685				
" 8	35.0	7.697				
" 8	35.0	7.653				
" 8	35.0	7.653				
June 19	41.1				53 24.5	0.9
" 19	42.1				15 21.3	1.3
" 19	43.0	7.730				
" 19	43.0	7.731				
" 19	43.0	7.721				
" 19	43.0	7.718	7.718	42.7		
" 19	42.4	7.727				
" 19	42.4	7.715				
" 19	42.4	7.702				
" 19	42.4	7.702				
" 19	42.4				15 25.7	1.3
" 19	42.3				53 10.5	0.9

Date.	Temp.'s observed.	Time of 1 vibration.	Mean adopted. T.	Corresponding temp. t_1.	Angle of deflection. n.	Distance in feet. r.
1854.						
June 24	38°.0				52° 40′.5	0.9
" 24	39.4				15 18.8	1.3
" 24	41.2	7.736				
" 24	41.2	7.702				
" 24	41.2	7.683				
" 24	41.2	7.689	7.699	41°.2		
" 24	41.2	7.688				
" 24	41.2	7.690				
" 24	41.2	7.698				
" 24	41.2	7.702				
" 24	42.9				15 12.3	1.3
" 24	41.6				53 48.0	0.9
1855.						
May 16	17.0	7.448				
" 16	19.3	7.416				
" 16	17.0		7.405	19.3	14 37.1	1.3
" 16	17.0				50 50.7	0.9
" 16	22.0	7.384				
" 16	19.0	7.371				
May 17	23.0	7.394	7.391	23.0		
" 17	23.0	7.388				
" 17	23.0				49 59.8	0.9
" 17	23.0				14 32.6	1.3
May 18	15.0	7.383	7.384	15.0		
" 18	15.0	7.385				
" 18	27.0				14 23.2	1.3
" 18	27.0				48 00.8	0.9
May 19	28.0	7.407				
" 19	28.5	7.413	7.405	28.2		
" 19	28.0	7.396				
" 19	27.0				49 00.7	0.9
" 19	27.0				14 36.7	1.3

ABSTRACT OF OBSERVATIONS OF VIBRATIONS AT HAKLUYT ISLAND.

Approx. lat. 77° 23′. Approx. long. 72° 30′ W. of Gr.

1855. June 21.	33°.3	7ˢ.020	7ˢ.026	33°.5
" 21.	33.3	7.026		
" 21.	33.8	7.033		

ABSTRACT OF OBSERVATIONS OF VIBRATIONS AT A STATION IN LAT. 76° 03′ AND LONG. 68° 00′ W. OF GR., ON THE COAST BETWEEN PARKER SNOW'S POINT AND CAPE YORK.

1855. July 19.	40°.0	6ˢ.475	6ˢ.495	46°.5
" 19.	41.5	6.489		
" 19.	41.2	6.544		
" 19.	39.5	6.474		

DETERMINATION OF THE MOMENT OF INERTIA OF MAGNET A. 67.
(With stirrup and mirror attached.)

No determination of the moment of inertia of magnet A. 67 having been made by the expedition, it became necessary to determine the same afterwards. The following observations for this purpose were made by myself at the Coast Survey Office, Washington, D. C.

After adjusting the instrument and suspending A. 67, the following experiments of vibrations were made:—

March 18, 1858. Mean time chronometer Kessels 1285.

No. of vibrations.	Mean local time by chronometer 1285.	20 vibrations.	No of vibrations.	Time by chronometer 1285.	18 vibrations.
0	$9^h\ 31^m\ 10^s.7$	$1^m\ 21^s.7$	0	$10^h\ 28^m\ 51^s.3$	$1^m\ 13^s.2$
20	32 32.4	21.6	18	30 04.5	13.5
40	33 54.0	21.1	36	31 18.0	13.0
60	35 15.1	21.4	54	32 31.0	13.8
80	36 36.5	21.5	72	33 44.8	13.1
100	37 58.0		90	34 57.9	
		Mean 1 21.47			Mean 1 13.32
Temp. 71°.8. (Rate of chronometer too small to affect the result.) 1 vibration=$4^s.073$.			Arc 234^d and 328^d 242 318	Temp. 71°.0. 1 vibration=$4^s.073$	

The mirror was below the magnet in these two sets; in the following four sets it was above.

Magnet suspended with inertia ring Z, of the following dimensions: Outer diameter 2.322 inches; inner diameter 1.837 inches; thickness 0.188 inches at 69°; weight 648.937 grains: hence $K_1 = \frac{1}{2}(r^2 + r_1^2)\,w = 4.936$ (in feet and grains), $lg\ K_1 = 0.69338$.

Vibrations with ring.

No. of vibrations.	Time by chronometer 1285.	20 vibrations.	No. of vibrations.	Time by chronometer 1285.	20 vibrations.
0	$12^h\ 34^m\ 06^s.0$	$2^m\ 26^s.2$	0	$12^h\ 48^m\ 13^s.6$	$2^m\ 25^s.9$
20	36 32.2	26.6	20	50 39.5	25.8
40	38 58.8	25.3	40	53 05.3	26.2
60	41 24.1	25.5	60	55 31.5	28.9[1]
80	43 49.6	25.8	80	58 00.4	26.2
100	46 15.4		100	13 00 26.6	
		2 25.88			2 26.02
Arc 190^d—360^d 228 —321	Temp. 75°. 1 vibration $7^s.294$.		Arc 229^d—321^d 239 —301	1 vibration=$7^s.301$	

Vibrations without ring.

No. of vibrations.	Time by chronometer 1285.	20 vibrations.	No. of vibrations.	Time by chronometer 1285.	20 vibrations.
0	$1^h\ 17^m\ 29^s.9$	$1^m\ 21^s.3$	0	$1^h\ 26^m\ 50^s.7$	$1^m\ 21^s.4$
20	18 51.2	21.3	20	28 12.1	20.9
40	20 12.5	21.5	40	29 33.0	21.5
60	21 34.0	21.1	60	30 54.5	21.4
80	22 55.1	21.9	80	32 15.9	21.1
100	24 17.0		100	33 37.0	
		1 21.42			1 21.26
Arc 298^d—230^d 1 vibration $4^s.071$.	Temp. 76°.		1 vibration=$4^s.063$.		

[1] Omitted, disturbed by a current of air.

Observations for torsion.

Torsion circle.	Scale readings.	Mean.	Diff.
74°	248—304	276	
164	361—234	297	21^d
344	11—428	220	77
74	190—370	280	60
			$31' = 39^d$ for 90°
	For torsion with ring use		42

March 19, 1858. Vibrations without ring. (Mirror above.)

No. of vibrations.	Time by chronometer 1285.	20 vibrations.	
0	$9^h\ 23^m\ 31^s.9$	$1^m\ 21^s.2$	Temp. 75°.
20	24 53.1	21.2	
40	26 14.3	21.2	
60	27 35.5	21.4	
80	28 56.9	21.1	
100	30 18.0		
		1 21.22	1 vibration $= 4^s.061$.

Vibrations with ring.

No. of vibrations.	Time by chronometer 1285.	20 vibrations.	
0	$9^h\ 50^m\ 17^s.0$	$2^m\ 26^s.3$	
20	52 43.3	26.4	
40	55 09.7	25.8	
60	57 35.5	25.6	
80	60 01.1		
		2 26.02	1 vibration $= 7^s.301$.

Recapitulation of Results.

March 18, 1858.	1 vibration, without ring . .	$4^s.073$	—	Temp. 71°.8
" "	" " " . .	4.073	—	" 71.0
" "	" with " . .	—	$7^s.294$	" 75.0
" "	" " " . .	—	7.301	" 75.0
" "	" without " . .	4.071	—	" 76.0
" "	" " " . .	4.063	—	" 76.0
March 19, 1858.	" " " . .	4.061	—	" 75.0
" "	" with " . .	—	7,301	" 75.0
	Mean by combination . .	T=4.069 at 74°.0	T_1=7.299 at 75°.0	

The moment of inertia of the magnet (with appendages) K becomes for the temp. 69° (and corrected for torsion)

$$K = K_1 \left(\frac{T^2}{T_1^2 - T^2}\right) = 2.220 \text{ and } lg\ K = 0.34631.$$

Using 0.0000068 for the coefficient of dilatation for 1° Fahr., the above $lg\ K$ for different temperatures becomes:

For 62°, $lg\ K = 0.34628$ and $lg\ \pi^2 K = 1.34058$
" 32, " 0.34609 " = 1.34039 (Chas. A. S.)

The value of the induction coefficient

$$P = -\frac{r^2 r_1^5 \sin. u_1 - r_1^2 r^5 \sin. u}{r_1^5 \sin. u_1 - r^5 \sin. u}$$

may be put in the following convenient form—

$$P = -r^2 \frac{\sigma - \varrho^3}{\sigma - \varrho^6} \text{ where } \sigma = \frac{\sin. u^1}{\sin. u} \text{ and } \varrho = \frac{r}{r_1}.$$

We find:	June 7, 1854	$P = -0.007$
"	8, "	-0.003
"	8, "	-0.006
"	19, "	$+0.009$
"	19, "	-0.003
"	24, "	-0.001
"	24, "	$+0.033$
	May 16, 1855	$+0.035$
"	17, "	$+0.039$
"	18, "	-0.011
"	19, "	-0.011

If we take the indiscriminate mean of the above values we find $P = +0.007$, and if we reject the three values marked by brackets, $P = -0.004$; the latter value is probably nearer the truth than the first one, but both are so small that they may be neglected in the computation of the intensity.

In the absence of observations, the temperature coefficient for the magnetic moment or q may be assumed $= 0.0003$, a value found for other magnets of the same magnetic moment and size; with but three exceptions, the temperature corrections are small.

After correcting for difference of temperature, the following results for magnetic moment m and horizontal intensity X have been computed by the formulæ

$$\frac{m}{X} = \tfrac{1}{2} r^3 \sin. u \text{ and } m X = \frac{\pi^2 k}{T^2}.$$

TABLE OF RESULTS OF $log. \frac{m}{X}$, $log. m X$, OF m THE MAGNETIC MOMENT OF MAGNET A. 67, AND OF THE HORIZONTAL INTENSITY X, AT VAN RENSSELAER HARBOR.

Date.	$lg. \frac{m}{X}$.	$lg. m X$.	m.	X.
1854.				
Jan. 31	9.46463	9.56091	0.326	1.117
Feb. 13	9.46795	9.56243	0.327	1.115
" 27	9.46532	9.56282	0.327	1.119
June 7	9.46954	9.56964	0.330	1.122
" 7	9.47155	9.56980	0.331	1.120
" 8	9.47268	9.56583	0.330	1.113
" 8	9.47184	9.56583	0.330	1.114
" 8	9.47091	9.56581	0.330	1.115
" 8	9.47223	9.56593	0.330	1.114
" 19	9.46636	9.56570	0.328	1.121
" 19	9.46371	9.56556	0.327	1.124
" 19	9.46574	9.56552	0.328	1.122
" 19	9.46504	9.56553	9.328	1.123
" 24	9.46218	9.56801	0.327	1.130
" 24	9.46256	9.56782	0.328	1.129
" 24	9.45956	9.56737	0.326	1.133
" 24	9.46855	9.56754	0.330	1.121
1855.				
May 16	9.44285	9.60156	0.332	1.200
" 16	9.45125	9.60156	0.336	1.189
" 17	9.44593	9.60293	0.334	1.198
" 17	9.44065	9.60293	0.332	1.206
" 18	9.43607	9.60219	0.331	1.210
" 18	9.43286	9.60219	0.329	1.215
" 19	9.43956	9.60148	0.332	1.205
" 19	9.44266	9.60148	0.332	1.200

Mean value of $m = 0.330$ at $t = 36°$.[1]

RECAPITULATION OF VALUES OF X.

January 31, 1854	$X = 1.117$
February 20, "	1.117
June 15, "	1.121
May 18, 1855	1.203
Mean corresponding to June, 1854 . . .	1.139

Taking the above value 1.139 for the mean horizontal force during the whole period, and multiplying it by sec. 84° 45′.8, the total force at Van Rensselaer Harbor during the same period becomes $\phi = 12.479$.

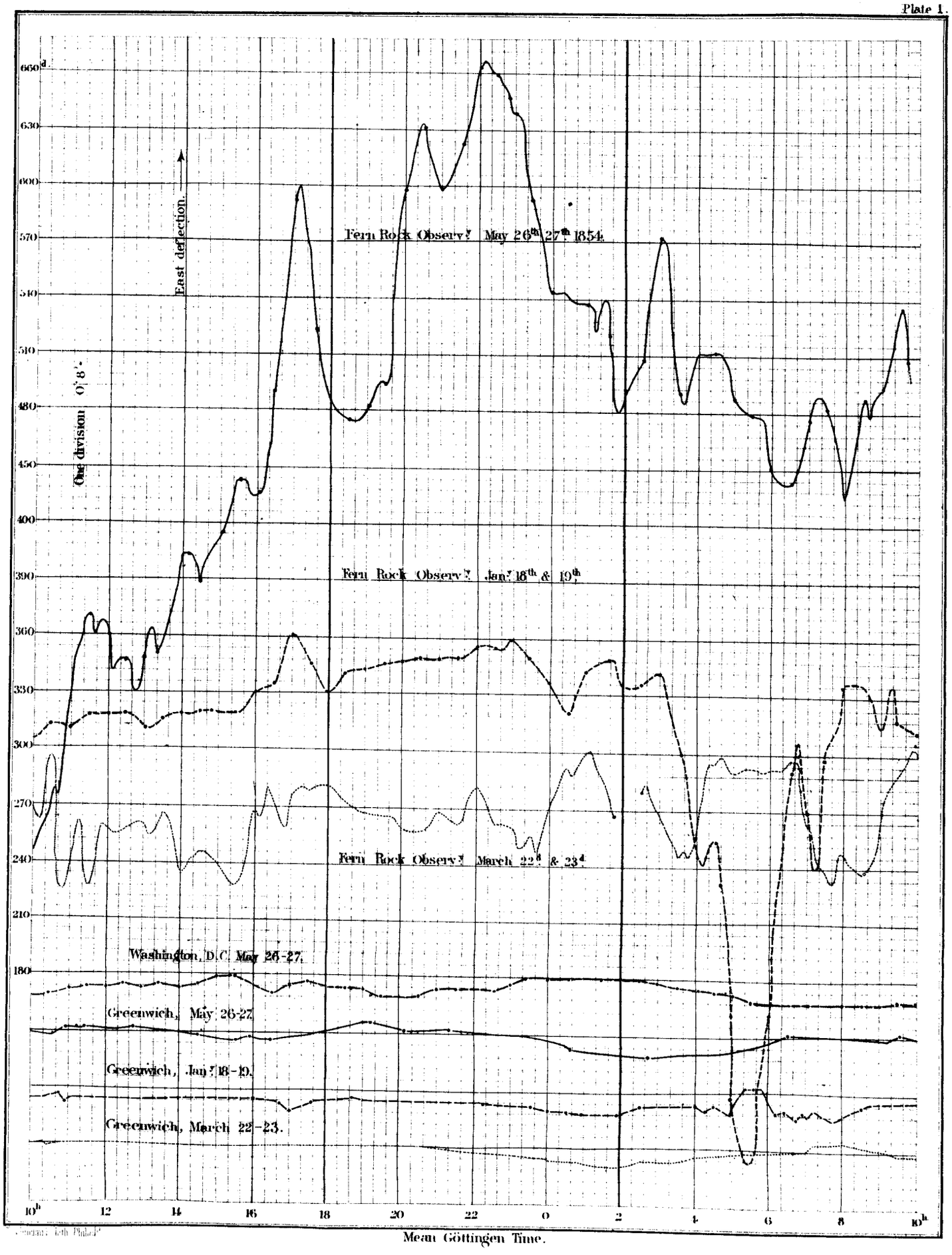
By means of the known value of m the horizontal intensity at the stations Hakluyt Island and coast near Cape York has been computed as follows:—

Hakluyt Island, June 21, 1855 . .	$X = 1.344$
Coast near Cape York, July 19, 1855 .	X 1.573

[1] I redetermined m at Washington, D. C., in March, 1858, and found it equal to 0.311, exhibiting but a small loss of magnetism during nearly four years.

DIURNAL CHANGES OF THE MAGNETIC DECLINATION ON TERM-DAYS.

Plate 1.



DIURNAL CHANGES OF THE MAGNETIC DECLINATION ON TERM-DAYS.

Plate 2

SMITHSONIAN CONTRIBUTIONS TO KNOWLEDGE.

METEOROLOGICAL OBSERVATIONS

IN THE

ARCTIC SEAS.

BY

ELISHA KENT KANE, M.D., U.S.N.

MADE DURING THE SECOND GRINNELL EXPEDITION IN SEARCH OF SIR JOHN FRANKLIN, IN 1853, 1854, AND 1855, AT VAN RENSSELAER HARBOR, AND OTHER POINTS ON THE WEST COAST OF GREENLAND.

REDUCED AND DISCUSSED.

BY

CHARLES A. SCHOTT,
ASSISTANT U. S. COAST SURVEY.

[ACCEPTED FOR PUBLICATION, MAY, 1858.]

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INTRODUCTORY LETTER.

WASHINGTON, *May* 17, 1858.

PROFESSOR JOSEPH HENRY, LL.D.,

Secretary of the Smithsonian Institution:

DEAR SIR: The records of the meteorological observations made under the direction of Dr. Kane, in the second expedition to the Arctic regions, were placed in my hands by his late lamented father, Judge Kane, in December last.

Dr. Kane had selected Assistant Charles A. Schott, of the Coast Survey, for the reduction of a considerable portion of the observations made in that expedition; and I, therefore, placed these in Mr. Schott's possession for reduction and discussion. The work has been faithfully performed, and I recommend it for publication in the "Smithsonian Contributions to Knowledge." It is proper to state that the instruments were furnished in part by the Smithsonian Institution, and that the computations have been made at its expense.

Very respectfully, yours,

A. D. BACHE.

PART I.

TEMPERATURES.

RECORD AND DISCUSSION OF TEMPERATURES.

THE vessel of the exploring expedition entered the winter quarters at Van Rensselaer Harbor, on the eastern trend of the coast of Greenland from Smith's Strait, on the 8th of September, 1853.[1] From the first of that month, she had not changed her position a mile, and the record and discussion of the observations for temperature will therefore commence, in the present paper, with September 1st, and be continued to January the 24th, 1855. This is the last day of entry in the original log-book in my possession. The temperatures after that date, and extending to the last of April, 1855, have been taken from Appendix No. XII. of the second volume of the narrative of the expedition.

The bay, surrounded by cliffs, is open towards the north and west, and the harbor is in latitude 78° 37′, and in longitude 70° 53′[2] west of Greenwich.

By the 28th of September, 1853, the erection of the meteorological observatory on the floe had been completed. It was a wooden structure, placed 140 yards from the ship, on the open ice-field, latticed and pierced with auger-holes on all sides, so as to allow the air to pass freely, and was firmly cemented to the ice at the base by freezing. To guard against the fine and almost impalpable drift which insinuates itself everywhere, and which would interfere with the observation of minute and sudden changes of temperature, a series of screens were placed at right angles to each other, so as to surround the inner chamber. The thermometers were suspended within the central chambers; a pane of glass permitted the light of the lanterns to reach them from a distance, and a lens and eyeglass were so fixed as to allow observing the instruments without going inside the screens. One of them—a three-feet spirit standard, by Tagliabue, of New York, graduated to 70° minus—was of sufficiently extended scale to be read, by rapid inspection, to tenths of a degree. It was not desired absolutely to neutralize the influence of the winds, but to make the exposure to them so uniform as to give comparable results for every quarter of the compass.[3]

The expedition was well supplied with thermometers. Thirty-six mercurial thermometers were received from the National Observatory at Washington, D. C. Their corrections near the freezing point were determined at the observatory, and

[1] See Narrative of the Expedition, Vol. II. p. 394.

[2] The result of a new reduction of the moon culminations.

[3] See Narrative, Vol. I. p. 117.

again by Mr. Sonntag, by means of Mr. Tagliabue's standard. Besides these, there were four maximum and four minimum thermometers, and two dozen spirit thermometers of various sizes, including two standards with a register 36 inches in length.[1] By one of these, and a mercurial standard of the same length, most of the temperatures of the air were noted.

Dr. Kane remarks:[2] "The temperature on the floes was always somewhat higher than at the island, the difference being due, as I suppose, to the heat conducted by the sea-water, which was at a temperature of +29°, the suspended instruments being affected by radiation."

This was on the 17th of January, 1854. On another page, he says:[3] "Upon the ice-floes, commencing with a surface temperature of —30°, I found, at two feet deep, a temperature of —8°, and at four feet +2°, and at eight feet +26°." This was in midwinter, on the largest floe in the open way off Cape Stafford. This subject will again be referred to.

Comparison of Thermometers.—The different readings of the instruments, particularly at temperatures below —40°, made their frequent comparison, in order to obtain corrective elements, a matter of great importance. Appendix No. XI. of the second volume of the narrative, contains a full exposition of the unreliable indications of the instruments at very low temperatures, and to this appendix the reader may be referred for further details.[4] Whether these anomalies be due to irregularities in the diameter of the tubes, or to unequal contraction of colored fluids of different specific gravity, it is admissible to suppose that the errors for a number of instruments, compared at the same temperature, may be as frequently in excess as in defect, provided they keep within a certain limit, beyond which the indications become useless. The mean reading of all thermometers compared at a certain temperature has, therefore, been taken for the true temperature, and, by comparing each result with this mean, a series of corrections has been obtained for each instrument. The same view was taken by Dr. Kane.

From the comparisons of February 5th, 6th, and 9th, 1854, I was led to suspect that some or all of the spirit thermometers, designated in the original log-book Nos. 1, 2, 3, 4, 5, were probably identical with those in the table of Appendix No. XI. in Vol. II. of the narrative, there named C, B, No. 4, A, No. 12, respectively. The numerous comparisons given in that appendix, and to which a few more have been added, made it unnecessary to use the observations from the above numbers in the first set of comparisons between the temperatures —68° and —20°. In the following table, arranged according to temperatures, S denotes the 36 inch spirit standard, upon which instrument the temperatures determined by the expedition mainly depend; $S_{(2)}$, a second similar standard; M, the 36 inch mercurial standard; the rest are alcoholic thermometers, from twelve to eighteen inches in length of scale. Fahrenheit's scale is used throughout.

---

[1] The expedition was also provided with one or more other thermometers, of which I could find no further account.

[2] See Narrative, Vol. I. p. 154.

[3] Narrative, Vol. I. p. 267.

[4] An extract from this appendix will be found at the end of this article.

COMPARISON OF THERMOMETER READINGS BETWEEN THE TEMPERATURES —68° AND —20°, MADE IN 1854.

Therm. No.	Feb. 5th.	Feb. 5th.	Feb. 4th.	Jan. 29th.	Feb. 5th.	March 14th.	Feb. 6th.	March 3d.	Feb. 6th.	March 12th.	Feb. 9th.	March 3d.	Feb. 9th.	March 3d.	March 3d.	March 16th.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
12	—80.0	—77.9	—78.2	—73.0	—71.0	—64.4	—57.8	—58.0	—57.3	—56.2	—58.0	—54.5	—54.0	—47.5	—46.7	—44.1
1	—75.5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4	—75.0	—72.7	—74.0	—66.5	—63.0	—58.7	—55.5	—53.5	—55.0	—53.0	—53.5	—53.5	—53.5	—46.1	—45.5	—43.2
2	—72.0	—69.0	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	—70.5	—67.5	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	—68.4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	—41.4
C	—64.6	—62.5	—63.0	—57.0	—54.0	...	—45.0	...	—44.0	...	—42.7	—43.0	—43.0	—40.5	—40.2	—38.8
S	—60.3	—58.3	—57.8	—54.8	—53.0	—50.2	—46.6	—45.5	—46.3	—43.8	—44.8	—45.0	—44.8	—41.2	—40.8	—39.1
$S_{(2)}$	...	...	...	...	...	...	...	...	...	...	—44.8	...	...	...	...	...
A	—57.0	—56.0	—56.2	—53.0	—50.0	—47.2	—44.5	—42.9	—44.0	—41.8	—43.0	—42.9	—42.5	—40.0	—39.7	—37.6
B	—56.4	—55.5	—56.0	—52.5	—51.0	—46.7	—43.6	—42.0	—43.0	—41.0	—42.0	—42.0	—42.0	—39.9	—39.0	—37.2
Means	—68.0	—64.9	—64.2	—59.5	—57.0	—53.4	—48.8	—48.4	—48.3	—47.2	—47.0	—46.8	—46.6	—42.5	—42.0	—40.2

Therm. No.	March 16th.	Feb. 25th.	Feb. 25th.	Feb. 26th.	Feb. 7th.	Feb. 14th.	Feb. 24th.	Feb. 18th.	Feb. 23d.	Feb. 20th.	Feb. 19th.	Feb 12th.	Feb. 15th.	Feb. 19th.	Feb. 18th.	Feb. 17th.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
12	—43.7	—46.2	—41.0	—37.7	—35.0	—35.8	—33.8	—33.2	—31.7	—27.9	—27.0	—25.7	—25.0	—23.8	—22.7	—21.7
4	—42.9	—43.3	—40.6	—37.0	—34.2	—35.4	—33.3	—32.6	—31.2	—27.5	—27.0	—25.0	—24.3	—23.5	—21.9	—21.7
2	...	...	...	...	—32.4	...	...	...	...	...	...	...	...	...	...	...
8	...	...	...	...	—32.9	...	...	...	...	...	...	...	...	...	...	...
9	—41.0	...	—38.9	—35.7	—33.0	...	—32.0	...	—30.2	...	—26.0	...	—24.0	—23.3	—21.2	—21.0
C	—38.2	...	—35.6	—32.8	—29.5	—29.8	—29.0	—28.8	—27.3	—24.4	—23.6	—22.2	—22.0	—21.0	—20.0	—19.6
S	—38.7	—36.6	—36.6	—34.0	—31.8	—31.7	—31.0	—30.2	—29.0	—26.9	—24.5	—22.6	—22.1	—21.2	—20.0	—19.4
$S_{(2)}$	...	...	...	...	...	—31.8	...	—30.2	...	...	...	—22.6	...	...	...	...
M	—38.4	—36.1	—36.3	—33.8	—31.3	—31.2	—30.4	—29.6	—28.6	—25.2	—23.9	—22.0	—21.5	—20.8	—19.5	—19.1
A	—37.7	—34.8	—35.2	—32.9	—30.2	—29.7	—29.5	—29.0	—28.0	—24.7	—24.2	—21.6	—21.6	—20.8	—19.7	—19.3
B	—37.2	—36.0	—34.8	—32.2	—29.8	—29.2	—29.0	—28.5	—27.5	—24.3	—23.5	—22.2	—22.0	—21.3	—20.2	—19.6
Means	—39.7	—38.8	—37.4	—34.5	—32.0	—31.8	—31.0	—30.5	—29.2	—25.8	—25.0	—23.0	—22.8	—22.0	—20.7	—20.2

From the preceding comparisons, the following corrections have been deduced:—

Readings of *S*.	Corrections.	Readings of *S*.	Corrections.	Readings of *S* and *M*.	Corrections to *S*.	Corrections to *M*.	Readings of *S* and *M*.	Corrections to *S*.	Corrections to *M*.
—60°	—7°.5	—50°	—3°.1	—40°	—1°.2	—1°.5	—30°	—0°.1	—0°.6
—59	—7.0	—49	—2.9	—39	—1.1	—1.3	—29	—0.1	—0.7
—58	—6.4	—48	—2.6	—38	—1.0	—1.2	—28	0.0	—0.6
—57	—5.9	—47	—2.4	—37	—0.9	—1.1	—27	0.0	—0.6
—56	—5.4	—46	—2.3	—36	—0.7	—1.0	—26	0.0	—0.6
—55	—4.8	—45	—2.1	—35	—0.6	—0.8	—25	—0.1	—0.7
—54	—4.4	—44	—2.0	—34	—0.5	—0.7	—24	—0.3	—1.0
—53	—4.0	—43	—1.7	—33	—0.3	—0.7	—23	—0.4	—1.0
—52	—3.7	—42	—1.4	—32	—0.2	—0.7	—22	—0.6	—1.0
—51	—3.4	—41	—1.3	—31	0.0	—0.6	—21	—0.7	—1.2
...	...	...	...	...	...	...	—20	—0.8	—1.2

The corrections between temperatures of —20° and —40° for the two standards are small, and hardly exceed 1° at the lower limit, but beyond this point, for the lower temperatures, a regular increase is observed in the correction to the spirit standard. The caliber of most of the spirit thermometers was tested before leaving New York, and the differences exhibited in the table of comparisons for the several instruments arise, perhaps, principally from the unequal contraction of colored and not chemically pure alcohol. At these extreme low temperatures, the fluid appears to change its condition, and the coloring matter, with a falling temperature, remains adhering to the sides of the tube.

In order to test his thermometers, Dr. Kane provided himself with chemically pure mercury, and noted the temperatures at which it became solid. The following notes have been extracted from the log:—

Nov. 25, 1853. The mercury was exposed upon the floe at the meteorological observatory, and remained liquid with the spirit standard at —42°.0.

Dec. 8, 1853. At two o'clock, the mercury exposed was found frozen at —40°.5 of the spirit standard, the mercurial standard being at —39°.8.

Dec. 14, 1853. The mercury froze around the edges of the saucer containing it; *S* at —41°.0, and *M* at —40°.0.

Jan. 16, 1854. Mercury in bulb ceased to record at —43°.5; observed frozen at —38°.0.

Jan. 29, 1854. The mercury in the standard instrument, after registering —43°.0, descended in the bulb; at another time it registered, after being frozen, —44°.0, and then became stationary.

Nov. 29, 1854. Mercury congealed at —43°.0 of spirit standard, and resumed its fluidity at —38°.0.

If we refer the readings of the spirit standard to those of the mercurial standard by adding +0°.3, we obtain the following observed temperatures for the freezing point of mercury:—

—40°.2 —39°.8 —40°.7 —40°.0 —38°.0 and —42°.7 Mean, —40°.2

Similar differences in the freezing point of mercury have been noticed by other observers; Parry, for instance, saw the mercury liquid at —43°. The above mean being so near to what is generally assumed (—40°) as the point of congelation, I thought it best to apply no correction to the readings of the mercurial standard, and to diminish that of the spirit standard, for temperatures lower than —40°, by the apparent difference, at that temperature, between the indications of the mercurial and all other thermometers compared with it, or by the constant 1°.5; thus the maximum correction to the spirit standard becomes —6°.0 at —60°.

Thus applying the proper corrections to the spirit standard *S*, according to observations of February 4, 1854, spirit of naphtha became solid at —57°, oil of sassafras at —46°, bisulphuret of carbon at —26°; oil of wintergreen clouded at —40°, and remained liquid at the maximum temperature of that day, viz: —63°; the ethers likewise remained unchanged. On the following day, aqua ammonia F. F. froze solid from two hours exposure at a temperature of —52°, chloric ether became solid, and, after four hours of exposure, chloroform was covered with a granular follicle at —66°.

TABLE OF CORRECTIONS TO SPIRIT STANDARD *S*, OF TEMPERATURES BETWEEN —60° AND —40°.

Scale.	Corrections.	Scale.	Corrections.	Scale.	Corrections.	Scale.	Corrections.
—60°	—6°.0	—54°	—2°.9	—49°	—1°.4	—44°	—0°.5
—59	—5.5	—53	—2.5	—48	—1.1	—43	—0.2
—58	—4.9	—52	—2.2	—47	—0.9	—42	+0.1
—57	—4.4	—51	—1.9	—46	—0.8	—41	+0.2
—56	—3.9	—50	—1.6	—45	—0.6	—40	+0.3
—55	—3.3						

CORRECTIONS TO *S*, FOR TEMPERATURES BETWEEN —40° AND —20°.

Scale.	Corrections.	Scale.	Corrections.	Scale.	Corrections.	Scale.	Corrections.
—40°	+0°.3	—34°	+0°.2	—29°	+0°.6	—24°	+0°.7
—39	+0.2	—33	+0.4	—28	+0.6	—23	+0.6
—38	+0.2	—32	+0.5	—27	+0.6	—22	+0.4
—37	+0.2	—31	+0.6	—26	+0.6	—21	+0.5
—36	+0.3	—30	+0.5	—25	+0.6	—20	+0.5
—35	+0.2						

For temperatures between —20° and +15°, the following table of corrections has been constructed. The third column contains the number of comparisons.

Scale.	Corrections.	Comparisons.	Scale.	Corrections.	Comparisons.	Scale.	Corrections.	Comparisons.
—20°	+0°.5	24	+1°	+0°.5	...	+ 7°	+0.2°	...
—15	+0.5	24	+2	+0.4	...	+10	+0.3	19
—10	+0.6	25	+3	+0.3	...	+12	+0.2	...
— 5	+0.5	17	+4	+0.2	...	+14	+0.1	...
0	+0.5	24	+5	+0.1	57	+15	0.0	6

In the absence of direct comparisons for temperatures of +16° and upwards, I have adopted Mr. Sonntag's corrections, as found by comparing the daily means for May, June, and July, in the log-book, with the corresponding means in Appendix XII. of Vol. II. of the narrative. They have, however, all been diminished by 0°.7, the correction, according to his table, applicable at +15°.0, for which temperature I have found that no correction was required. The last set of corrections to the spirit standard becomes then—

Scale.	Corrections.	Scale.	Corrections.
+15°.0	0°.0	+30°.0	—0°.7
+18.0	—0.1	+35.0	—0.5
+20.0	—0.3	+40.0	—0.4
+15.0	—0.5	+45.0	—0.4

In the following abstract of the hourly record of the atmospheric temperatures from September 1st, 1853, to January 24th, 1855, observed at Van Rensselaer Harbor, the *corrected* figures have been inserted in accordance with the previous investigation; foot notes contain any additional information that may be required.

These temperatures refer to the level of the sea. The observations were made by the officers and men on duty, and are referred to mean local time. Occasional short interpolations were effected by means of the known diurnal variation, and the gradual change in the absolute temperature; in all cases, accordingly, the means given are *corrected* for any such omission in the record. The hourly series in my possession terminates with January 24th, 1855; the daily means up to April 30th, 1855, have been extracted from the second volume of the narrative. Before these numbers were set down, the difference in the system of corrections, as adopted by Mr. Sonntag, and in the present paper was applied.

That the temperature was lower in winter in exposed positions at the astronomical observatory, and in the outer bay or channel, than at the meteorological observatory on the floe in the harbor, there can be no doubt; but, owing to non-

compared instruments, the exact amount cannot be ascertained. November 23d, 1853, on the floe outside, the temperature was 10° lower, and again, December 20th, 1853, it was 6½° lower than inside. On the 19th of January, 1854, the spirit standard on the floe inside indicated —50°, and at the astronomical observatory the temperature was —58°.

To the local difference, in winter, of the temperature of the air incumbent on land, and on ice-floes resting on a sea with a temperature not far from its freezing-point, I have already alluded. During the first winter, the temperatures were observed on the floe, but, during the second, on board the brig; the mean difference, for the five coldest months in the two years, amounts to 1°.5, and for the absolute minima it is but 0°.9—the first being the colder in either case. This result, together with the statement (p. 405, Vol. II. of the Narrative) that *local* radiations were guarded against as far as possible, leaves no doubt that the recorded temperatures during the coldest months of the first season are not sensibly affected by any local radiation; at the same time, it must be admitted that, in winter, the ice-covered sea is, nevertheless, a source of heat which, propagated through this cover, is expended by radiation into the colder atmosphere.

Occasional omissions in the hourly record have been supplied by interpolation; these values are always indicated by being inclosed between brackets. The process of interpolation will be found illustrated by an example at the end of the record.

TEMPERATURE OF THE AIR IN SHADE OBSERVED AT VAN RENSSELAER HARBOR,

In September, 1853, in Lat. 78° 37′, Long. 70° 53′ W. of Greenwich.

Expressed in degrees of Fahrenheit's scale. On deck the brig Advance and at meteorological observatory on floe.[1]

Hour.	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.	16th.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1h.	+28.6	+28.6	+28.1	+28.1	+28.3	+27.6	+30.6	+20.6	+18.9	+15.6	+15.1	+13.7	+17.6	+11.8	+12.0	+ 8.5
2	30.1	28.6	27.6	28.1	28.1	27.1	31.1	19.6	19.1	15.1	15.1	13.0	15.8	11.8	13.2	9.1
3	30.1	28.6	27.6	28.1	28.1	27.1	31.1	19.6	18.9	14.6	15.1	12.3	14.6	12.3	13.7	9.4
4	29.6	28.6	28.9	28.1	27.8	27.1	31.6	19.3	18.6	14.3	14.6	12.3	13.9	12.3	13.4	9.9
5	29.6	28.6	28.6	28.3	27.6	27.6	31.1	18.1	18.6	14.1	15.1	12.3	13.7	12.3	13.2	10.4
6	29.6	28.6	28.6	28.3	27.8	27.8	30.6	18.6	19.6	19.1	15.6	14.6	14.2	12.4	13.2	10.9
7	29.6	28.3	28.6	28.3	27.6	28.1	30.8	20.1	21.1	17.1	16.1	16.6	17.8	13.2	13.0	11.8
8	29.6	28.6	28.6	28.6	27.8	28.1	31.6	19.6	22.1	21.6	16.6	20.6*	21.6	13.2	13.7	13.2
9	30.3	28.6	28.6	28.6	28.1	28.1	31.6	19.8	19.9	17.6	17.6	26.1	23.6	14.7	14.2	13.9
10	30.3	29.6	28.6	28.6	28.1	28.6	31.6	19.6	19.4	18.4	19.4	25.1	21.6	15.3	14.2	14.6
11	30.3	29.6	28.6	29.6	27.6	29.1	31.6	19.6	19.4	19.2	17.3	20.1	17.6	15.8	14.6	16.1
Noon	28.6	30.1	28.6	29.6	28.1	29.6	31.6	20.6	19.3	18.7	17.2	20.1	16.6	14.9	14.6	15.1
13	30.6	30.6	28.6	28.6	28.1	30.6	29.3	21.1	19.6	18.6	17.6	20.1	14.8	14.6	17.3	18.1
14	30.6	30.3	28.1	28.1	28.1	30.6	26.6	21.1	19.6	18.6	17.6	20.6	13.9	14.3	16.1	20.8*
15	30.6	30.3	28.1	28.6	28.1	30.6	24.6	21.1	19.1	17.6	18.1	20.6	15.6	15.1	16.4	19.6
16	30.6	30.1	27.6	28.6	28.1	29.3	25.1	21.6	19.1	17.1	17.1	19.6	14.6	15.3	16.6	15.6
17	30.1	28.1	27.6	28.6	28.1	29.8	24.3	21.6	19.6	16.6	17.1	20.6	14.2	16.1	14.6	15.1
18	29.6	27.6	28.1	28.1	27.6	28.6	23.6	21.1	18.6	16.6	17.6	19.6	14.6	16.1	13.0	15.1
19	30.1	27.6	28.6	28.3	27.6	(28.1)	23.1	21.1	19.1	16.1	17.6	19.8	13.2	14.2	12.3	15.6
20	29.6	27.6	28.6	28.3	27.6	27.6	22.1	21.1	18.6	15.6	16.6	19.9	12.2	14.2	11.5	15.6
21	29.6	27.6	28.6	28.1	27.6	28.6	21.8	20.8	18.8	15.9	16.2	19.5	12.2	13.2	10.7	15.6
22	29.1	27.6	28.6	28.1	27.1	28.6	21.6	20.4	18.5	15.8	15.1	19.3	13.7	12.6	11.1	14.6
23	29.1	27.6	27.6	28.6	27.1	29.1	21.3	19.4	17.6	15.5	13.9	18.8	12.7	12.0	10.9	13.7
Midn't	+29.1	+27.6	+27.6	+28.6	+27.1	+29.6	+20.8	+18.8	+16.3	+15.0	+13.9	+18.3	+12.7	+11.3	+10.2	+13.7
Means	+29.79	+28.71	+28.28	+28.45	+27.80	+28.62	+27.46	+20.18	+19.14	+16.85	+16.38	+18.48	+15.54	+13.71	+13.49	+14.00

Hour.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th.	27th.	28th.	29th.	30th.		Means.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°		°
1h.	+14.6	+ 8.0	+ 6.7	+ 5.0	+ 5.2	+ 4.5	+19.6	+18.6	+18.6	+17.1	+11.8	+ 8.9	+ 9.3	+ 9.8	...	+16.38
2	14.6	8.2	6.0	4.0	5.2	4.0	17.6	17.1	17.6	15.6	11.8	9.4	9.2	9.7	...	16.08
3	12.7	7.5	6.0	3.7	5.0	4.0	17.6	17.1	17.6	13.7	11.6	9.3	9.0	9.8	...	15.86
4	11.8	6.2	5.0	3.7	4.0	4.2	18.1	16.6	16.1	12.7	11.3	8.4	8.6	9.3	...	15.54
5	11.2	6.2	4.5	4.0	3.7	5.0	18.1	18.3	17.1	8.9	10.4	9.0	7.7	4.7	...	15.27
6	11.2	6.2	5.5	5.5	6.0	5.2	18.6	19.3	19.1	9.4	11.3	8.6	8.0	5.0	...	15.95
7	11.8	8.0	7.0	7.5	8.2	11.8	18.6	19.8	19.1	9.6	11.3	8.6	7.6	4.0	...	16.70
8	15.6	12.3	7.0	11.4	10.6	13.7	18.9	19.8	19.1	16.6	11.3	8.9	7.8	3.7	...	18.06
9	(15.2)	15.6	9.0	10.9	10.1	16.6	19.6	19.6	20.6	16.6	11.8	8.6	8.2	5.1	...	18.63
10	(14.8)	17.6	10.0	11.4	14.2	19.1	19.6	18.6	21.6	19.6	13.2	9.3	8.9	6.1	...	19.23
11	(14.4)	18.6	11.0	10.9	14.6	18.6	23.1	18.6	21.6	15.6	13.2	9.8	9.1	9.3	...	19.15
Noon	(14.0)	12.7	11.0	14.1	13.7	17.3	23.6	18.8	23.6	13.2	12.7	10.3	9.3	9.5	...	18.90
13	13.7	12.7	10.5	11.1	13.7	17.8	23.1	17.1	23.3	12.2	12.3	10.5	9.8	9.3	...	18.84
14	12.7	12.3	11.7	11.1	14.6	18.1	23.1	19.6	23.3	10.0	11.8	10.5	10.0	9.0	...	18.76
15	11.8	11.3	11.1	14.8	11.8	19.1	23.8	14.9	23.3	9.6	11.2	10.6	11.0	10.7	...	18.64
16	12.7	11.3	12.0	14.6	11.6	19.1	23.1	14.6	21.8	9.6	10.4	10.4	10.0	10.3	...	18.25
17	13.0	9.9	11.1	13.7	11.4	18.6	21.6	14.1	21.6	9.4	8.5	10.3	10.1	7.2	...	17.75
18	13.2	8.0	10.4	12.7	10.9	17.6	20.6	12.7	21.6	11.8	7.5	10.2	10.1	3.3	...	17.20
19	10.4	7.2	9.9	11.4	8.9	17.6	20.6	10.9	20.8	12.3	7.0	10.2	10.2	0.8	...	16.85
20	9.9	7.0	8.4	9.4	8.0	17.4	22.6	10.9	20.6	12.3	7.0	10.0	10.0	+ 0.3	...	16.35
21	9.0	(7.0)	7.0	8.4	6.7	17.1	19.8	12.5	20.6	12.3	6.5	9.8	10.1	— 0.3	...	16.04
22	9.0	7.0	7.0	9.9	6.7	18.6	19.3	14.6	21.1	8.7	6.2	9.8	10.1	— 0.3	...	15.98
23	9.9	6.0	6.0	9.7	6.5	18.6	18.8	16.6	20.1	8.7	9.4	9.7	10.1	— 0.7	...	15.81
Midn't	+ 9.9	+ 5.5	+ 6.0	+ 5.0	+ 4.7	+19.6	+18.8	+18.3	+19.3	+12.5	+ 8.9	+ 9.0	+ 9.7	— 0.7	...	+15.57
Means	+12.38	+ 9.68	+ 8.33	+ 9.33	+ 9.00	+14.30	+20.34	+16.63	+20.38	+12.42	+10.35	+ 9.59	+ 9.33	+ 5.62	...	+17.16

[1] The observations upon the floe commence Sept. 28th. From Aug. 18th to Sept. 27th, inclusive, mercurial thermometer No. 6 was used; its scale correction, determined by two standards, is, —0°.2 and —0°.7 (at +39°), mean —0°.4. On and after Sept. 27th, the spirit standard *S* was used. A second correction has been applied, to refer the temperatures on deck to the temperatures on floe, viz: at +30° and +15° none, at +10°, +0°.3, and at +5° and 0°, +0°.4; deduced from 27 comparisons.

* Value deduced from temperature 80 feet above deck.

NOTE.—The mean temperature of the air given in Appendix No. XII. of the narrative, refers to days of nautical reckoning, commencing and ending with noon; on and after September 11, 1853, civil reckoning was adopted.

TEMPERATURE OF THE AIR IN SHADE OBSERVED AT VAN RENSSELAER HARBOR,

In October, 1853, in Lat. 78° 37′, Long. 70° 53′ W. of Greenwich.

Expressed in degrees of Fahrenheit's scale. At meteorological observatory on floe.[1]

Hour.	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.	16th.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1h.	−0.8	+1.0	+ 0.5	+14.0	+12.7	+13.9	+13.1	+12.2	+ 4.6	+3.0	−5.3	+ 5.2	+12.7	+12.2	+13.2*	+6.1
2	−1.0	+0.5	+ 1.5	+13.5	+11.8	+14.7	+13.4	+11.9	+ 6.3	+1.7	−5.5	+ 8.2	+12.4	+13.3	+12.6*	+4.9
3	+0.3	+0.3	+ 1.8	+13.2	+13.5	+14.0	+13.6	+11.6	+ 7.6	+1.5	−5.5	+10.5	+12.3	+13.3	+11.8*	+3.7
4	+2.0	0.0	+ 2.1	+13.1	+15.2	+13.4	+14.0	+11.2	+10.5	+0.3	−5.5	+12.2	+12.2	+13.2	+11.6*	+2.4
5	+2.1	+2.4	+ 1.5*	+14.8	+14.9	+13.6	+13.2	+10.3	+10.3	−0.5	−6.5	+12.2	+12.6	+13.6	+10.3	+2.2
6	+2.6	+3.2	+ 3.0	+15.5	+14.5	+13.6	+10.4	+10.3	+ 9.3	−1.5	−6.5	+12.0	+12.8	+13.7	+10.5	+2.2
7	+2.9	+5.1	+ 3.3	+15.5	+14.8	+14.3	+ 9.1	+ 9.8	+ 7.7	−0.5	−7.3	+12.0	+13.3	+14.1	+10.8	+2.0
8	+3.5	+5.1	+ 3.3	+15.5	+14.3	+14.6	+ 9.8	+10.3	+ 7.1	−0.5	−7.3	+12.4	+13.1	+14.6	+11.7	+1.5
9	+5.1	+5.0	+ 4.3	+15.9	+15.2	+15.8	+10.1	+ 9.5	+ 7.1	−0.5	−7.0	+13.8	+13.3	+14.8	+13.0*	+1.9
10	+5.1	+4.9	+ 5.2	+16.2	+15.3	+16.2	+10.3	+ 9.8	+ 6.2	−1.1	−5.5	+13.1	+13.3	+14.8	+13.2*	+1.7
11	+6.1	+4.7	+ 6.3	+16.2	+16.2	+16.8	+ 9.4	+10.2	+ 6.1	−1.5	−5.0	+12.7	+14.1	+14.8	+14.6*	+2.3
Noon	+6.1	+4.7	+ 7.7	+16.0	+17.5	+17.0	+ 8.3	+ 9.5	+ 6.2	0.0	−4.5	+12.2	+14.1	+14.6	+16.6*	+2.8
13	(+4.7)	+4.7	+ 8.9	+14.5	+15.5	+14.7	+ 7.2	+ 8.5	+ 6.2	−0.5	−2.5	+12.6	+13.6	+14.5	+14.2	+2.8
14	+3.3*	+3.8	+ 8.3	+15.3	+16.0	+14.7	+ 7.2	+ 8.6	+ 6.2	−2.5	−2.5	+(12.3)	+10.8	+14.7	+14.2	+1.5
15	+3.3*	+1.3	+ 9.1	+16.6	+12.5	+14.1	+ 8.4	+ 8.7	+ 4.7	−1.5	−2.7	+12.0	+11.3	+14.8	+13.7	+3.3
16	+3.2*	+1.5	+10.1	+18.6	+12.8	+14.1	+ 8.5	+ 8.7	+ 3.3	−3.3	−3.2	+10.3	+11.2	+14.4	+13.4	+2.9
17	+2.5*	+0.7	+10.3	+18.2	+12.1	+13.2	+10.3	+ 8.7	+ 3.3	−3.6	−2.6	+10.8	+11.9	+14.2	+14.8*	+2.4
18	+1.8	−0.5	+10.3	+17.8	+13.8	+12.4	+10.7	+ 8.2	+ 3.3	−4.5	−2.2	+11.3	+11.3	+14.1	+14.6*	+1.8
19	−0.3	−1.5	+11.7	+17.0	+13.6	+13.0	+10.7	+ 7.9	+ 2.8	−5.4	−1.1	+12.2	+11.1	+14.3	+14.6*	+1.0
20	−1.5	−1.5	+13.1	+16.0	+13.4	+13.0	+10.8	+ 7.3	+ 2.4	−5.6	−0.6	+12.4	+10.6	+14.6	+13.6*	+0.5
21	−1.7	−1.0	+11.9	+14.8	+13.4	+12.9	+10.0	+ 7.2	+ 1.8	−5.5	0.0	+13.2	+ 9.6	+14.0	+11.2	+1.0
22	−1.0	−0.4	+12.4	+15.3	+12.4	+14.2	+ 9.3	+ 7.2	+ 1.9	−5.3	0.0	+12.7	+ 9.8	+13.8	+ 9.8	+3.8
23	−0.2	−0.4	+13.3	+14.8	+13.6	+14.4	+ 8.5	+ 6.2	+ 2.1	−5.5	−1.2	+12.7	+10.8	+13.6	+ 8.7	+4.9
Midn't	+1.2	0.0	+15.3	+14.7	+13.9	+14.1	+12.0	+ 4.8	+ 3.0	−4.4	−1.1	+12.7	+11.7	+13.4	(+7.4)	+5.8
Means	+2.05	+1.82	+ 7.26	+15.54	+14.12	+14.28	+10.35	+ 9.11	+ 5.42	−1.97	−3.80	+11.74	+12.08	+14.06	+12.50	+2.73

Hour.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th.	27th.	28th.	29th.	30th.	31st.	Means.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1h.	+5.8	− 2.4	+14.1	−0.9	− 4.7	−14.8	−20.0	−1.5	+ 8.2	+8.3	− 1.5	−16.7	−15.5	−15.5	−10.4	+1.96
2	+5.1	− 1.5	+15.8	−1.3	− 5.5	−16.5	−20.5	−1.5	+ 8.2	+7.2	− 1.5	−16.0	−16.5	−16.0	−10.9	+1.57
3	+5.1	− 0.9	+17.1	−1.4	− 6.5	−16.6	−21.6	+0.5	+ 8.3	+6.2	+ 0.5	−13.7	−17.5	−16.7	−10.9	+1.79
4	+5.1	− 0.4	+17.5	−3.1	− 6.8	−17.1	−22.4	+0.1	+ 9.3	+7.0	+ 0.5	−13.5	−17.8	−17.5	− 9.4	+1.92
5	+3.8	− 1.1	+16.3	−2.5	− 7.5	−11.0	−20.0	+0.4	+ 9.5	+6.7	− 2.0	−16.5	−18.5	−17.3	−10.8	+1.82
6	+4.2	− 2.0	+16.2	−2.5	−10.4	−18.8	−20.4	+1.8	+ 9.6	+5.3	− 2.3	−16.9	−18.3	−16.8	−11.5	+1.38
7	+4.7	− 0.1	+17.5	−3.0	−11.4	−18.7	−18.5	+1.6	+11.1	+5.6	− 5.0	−16.9	−17.5	−16.6	−12.5	+1.52
8	+4.7	− 0.5	+17.2	−3.4	− 9.4	−19.9	−18.7	+1.5	+ 9.8	+5.1	− 7.4	−16.5	−17.8	−16.4	−13.5	+1.41
9	+4.0	+ 2.7	+16.8	−3.8	− 8.7	−19.1	−12.5	+2.6	+ 9.5	+2.5	− 8.8	−16.5	−18.0	−16.2	−13.8	+1.87
10	+2.7	(+3.7)	+16.5	−5.2	− 6.0	−18.0	−15.9	+2.9	+ 9.3	+2.0	− 8.1	−15.6	−18.5	−17.0	−15.5	+1.81
11	+2.0	(+4.7)	+15.0	−6.1	− 5.5	−17.6	−14.2	+4.7	+ 9.3	+2.2	−10.6	−15.5	−18.0	−16.1	−16.0	+2.01
Noon	+1.0	(+5.7)	+15.0	−6.4	− 5.5	−18.9	−13.5	+6.6	+ 9.5	+2.4	−12.0	−16.1	−16.2	−15.6	−15.7	+2.23
13	−0.5	(+6.7)	+15.0	−7.4	− 9.2	−19.3	−12.5	+7.4	+ 8.8	+3.3	−12.0	−10.7	−17.5	−14.8	−15.0	+2.00
14	(−0.8)	+ 7.7	+16.2	−7.9	− 8.0	−19.3	−11.4	+7.7	+ 8.8	+3.3	−13.5	− 9.4	−18.1	−13.7	−14.6	+1.90
15	−1.1	+11.3	+15.0	−7.9	− 7.0	−20.0	− 8.4	+9.8	+ 8.0	+3.3	−14.5	− 9.4	−18.2	−12.5	−14.7	+2.04
16	−1.0	+11.7	+14.8	−5.0	− 9.8	−19.9	− 4.0	+8.7	+ 5.6	+0.5	−14.5	−12.8	−18.2	−11.9	−15.5	+1.78
17	0.0	+10.3	+12.4	−5.5	−10.6	−18.9	− 5.3	+9.2	+ 4.2	−0.5	−13.5	−12.8	−18.4	−11.4	−15.0	+1.66
18	−2.5	+11.2	+12.4	−4.8	−13.0	−18.2	− 5.0	+9.6	+ 4.3	−1.5	−14.5	−12.7	−18.7	−11.2	−15.7	+1.38
19	−2.0	+11.5	+11.8	−4.0	−13.0	−19.9	− 4.1	+9.4	+ 5.3	−2.5	−15.3	−14.5	−18.7	−10.5	−15.9	+1.26
20	−2.1	+12.3	+10.5	−3.8	−11.2	−19.9	− 2.7	+9.2	+ 5.3	−3.5	−16.7	−14.7	−17.8	−10.9	−15.9	+1.18
21	−0.9	+12.2	+ 8.5	−2.2	−10.0	−18.5	− 0.5	+8.7	+ 7.2	−4.9	−16.5	−15.7	−17.5	−10.9	−14.5	+1.20
22	−0.5	+12.8	+ 0.5	−1.0	−13.0	−20.6	− 0.5	+7.7	+ 7.6	−5.5	−15.6	−15.0	−17.0	−10.4	−14.0	+1.01
23	−0.5	+13.3	+ 0.2	−0.5	−11.0	−21.2	− 1.5	+7.7	+ 8.3	−6.6	−16.1	−14.7	−17.5	−10.4	−14.0	+1.02
Midn't	−1.0	+13.2	0.0	−0.5	−11.0	−20.5	− 1.5	+7.4	+ 8.5	−7.1	−16.3	−16.5	−16.0	−10.4	−14.3	+1.21
Means	+1.47	+ 5.92	+13.01	−3.75	− 8.95	−18.47	−11.48	+5.09	+ 8.06	+1.62	− 9.88	−14.55	−17.65	−14.03	−13.33	+1.62

[1] Observations by spirit standard *S*.

* Supplied from observations on deck, and referred to floe.

Oct. 25th. Astronomically, the upper limb of the sun would, by calculation, graze the horizon at noon. The sun was last seen on the 15th, on account of hills and clouds obstructing the view.

TEMPERATURE OF THE AIR IN SHADE OBSERVED AT VAN RENSSELAER HARBOR,

In November, 1853, in Lat. 78° 37′, Long. 70° 53′ W. of Greenwich.

Expressed in degrees of Fahrenheit's scale. At meteorological observatory on floe.[1]

Hour.	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.	16th.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1h.	—12.7	—20.3	—21.2	—14.8	—10.9	—23.5	—20.9	—10.3	—26.2	—25.0	— 8.7	—15.6	—16.0	—22.5	—26.5	—29.0
2	13.3	20.5	21.3	14.0	9.4	22.5	20.5	10.1	24.8	27.0	8.7	16.7	16.0	22.5	27.2	29.0
3	11.5	21.0	22.0	14.3	10.5	18.0	20.7	10.8	22.0	27.0	10.0	16.7	16.5	23.5	25.0	29.4
4	11.7	21.5	21.5	14.5	10.5	18.1	20.8	10.7	23.1	21.0	9.6	16.7	17.5	24.0	26.6	28.5
5	8.7	20.0	20.4	15.2	10.3	24.0	22.4	10.3	25.0	19.8	8.4	14.7	18.2	24.7	27.2	29.0
6	8.6	20.1	20.4	17.0	10.0	23.5	21.8	10.2	26.2	26.9	7.2	10.7	19.0	25.0	27.5	29.0
7	8.7	20.2	21.0	18.2	9.8	21.5	21.0	10.4	28.0	26.5	7.0	6.5	18.0	21.6	28.1	28.6
8	9.4	20.0	19.8	17.7	10.0	20.5	21.3	12.8	27.0	26.8	7.5	5.5	18.3	21.3	27.4	28.9
9	9.2	20.2	19.5	17.2	10.1	21.4	19.0	14.6	28.7	25.5	8.6	4.2	18.2	24.2	26.6	28.0
10	9.2	20.0	20.0	18.0	10.2	19.3	16.4	17.0	27.5	28.8	10.2	4.3	18.6	24.3	26.8	27.5
11	9.2	21.0	19.8	18.2	10.5	18.5	16.0	17.0	27.0	25.5	17.0	2.0	18.8	24.4	26.9	27.9
Noon	9.3	20.3	19.8	17.6	11.1	16.0	10.0	20.6	26.8	22.0	17.4	1.8	19.5	24.8	26.5	27.6
13	9.4	19.5	19.0	17.7	11.5	14.4	10.0	21.8	26.7	22.2	19.6	4.5	18.2	24.5	27.5	29.8
14	9.9	19.5	19.3	17.5	11.9	14.0	9.7	24.0	26.0	16.5	22.5	8.7	19.1	25.0	27.0	27.2
15	10.4	20.0	19.8	16.3	13.7	14.0	9.7	19.0	27.0	16.5	23.0	11.0	19.8	24.7	27.2	25.5
16	13.0	20.6	19.4	13.7	13.9	15.8	9.7	17.0	22.5	18.3	19.0	11.5	19.5	25.8	28.0	25.6
17	15.5	20.2	18.7	13.5	13.0	15.8	9.8	18.0	21.6	7.5*	16.5	11.0	20.0	27.5	28.2	26.0
18	16.3	20.0	17.5	13.2	11.5	16.7	9.5	19.5	22.8	9.2	16.8	11.6	20.5	27.4	28.0	27.5
19	18.0	20.2	17.5	14.8	12.1	16.7	9.5	19.4	23.7	8.6	17.4	13.3	21.1	26.8	28.0	27.0
20	18.7	20.5	17.5	16.2	11.9	16.0	9.8	19.5	24.2	9.2	17.6	14.7	21.7	25.8	28.4	26.0
21	19.2	21.4	19.5	15.5	16.5	14.8	10.1	17.1	25.6	7.8	19.1	12.8	22.4	25.6	27.5	25.6
22	20.0	21.4	19.3	13.4	18.4	14.0	10.4	17.6	25.2	7.8	18.4	15.2	21.8	26.8	27.8	27.9
23	19.0	21.3	18.2	11.8	20.8	18.0	10.4	21.0	25.6	7.8	18.0	16.1	22.9	26.2	28.0	26.4
Midn't	—20.0	—21.5	—16.2	—11.2	—20.8	—20.5	—10.7	—24.2	—23.2	— 6.5	—17.2	—16.6	—23.8	—26.5	—27.9	—26.4
Means	—12.95	—20.47	—19.53	—15.48	—12.47	—18.23	—14.63	—16.37	—25.27	—18.32	—14.39	—10.93	—19.39	—24.80	—27.32	—27.64

Hour.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th.	27th.	28th.	29th.	30th.	31st.	Means.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	
1h.	—28.5	—27.6	—33.0	—35.0	—26.5	—36.8	—36.5	—39.5	—38.1	—22.0	—25.0	—16.3	— 1.5	—9.0	...	—22.65
2	28.0	28.7	33.0	35.0	27.0	36.1	36.0	39.7	38.0	20.5	28.3	16.2	— 2.0	7.7	...	—22.66
3	27.6	27.6	31.5	35.0	28.5	35.2	36.2	39.5	37.5	20.0	28.5	17.1	+ 0.5	5.0	...	—22.27
4	28.0	30.5	31.0	35.0	28.5	34.9	35.0	40.0	35.7	16.8	25.5	18.2	+ 0.5	4.5	...	—21.98
5	27.5	30.5	33.2	34.0	29.6	35.5	37.5	40.6	37.1	24.1	24,0	20.0	0.0	4.8	...	—22.56
6	27.1	30.4	33.7	34.0	28.0	37.5	37.8	41.8	37.7	25.4	23.6	21.0	0.0	4.2	...	—22.84
7	27.3	31.2	33.2	34.9	29.6	36.7	37.5	40.0	37.2	26.9	23.1	20.8	+ 0.5	6.2	...	—22.65
8	28.0	31.3	32.8	34.0	29.3	37.0	36.8	40.0	34.8	26.9	20.4	19.1	+ 0.5	5.8	...	—22.33
9	27.0	32.1	32.2	33.8	30.4	36.5	36.5	38.5	32.5	27.5	21.0	17.0	+ 1.0	3.5	...	—22.09
10	26.4	32.6	33.0	31.6	30.6	36.5	36.5	39.0	32.0	29.5	21.0	16.0	+ 0.6	5.8	...	—22.27
11	27.9	32.1	33.0	31.0	31.5	36.5	37.0	38.0	30.5	29.4	21.5	14.8	— 3.0	5.0	...	—22.36
Noon	29.0	32.6	33.1	33.0	31.8	36.5	36.0	38.0	31.5	29.6	21.0	14.5	— 5.5	5.0	...	—22.27
13	30.0	31.0	34.2	33.2	33.0	36.5	37.0	39.2	31.7	28.2	20.0	14.0	— 6.3	5.0	...	—22.52
14	29.5	31.5	32.5	32.5	33.0	37.5	38.0	38.3	28.0	26.4	21.7	12.5	—10.2	3.5	...	—22.43
15	29.5	31.0	35.0	33.0	33.5	35.5	38.2	37.5	27.6	27.4	21.7	12.0	—12.5	4.0	...	—22.53
16	26.8	31.0	35.1	33.8	35.7	32.7	38.0	36.5	27.5	28.0	22.5	9.5	—14.2	4.8	...	—22.31
17	24.5	33.1	35.8	33.0	35.0	31.5	38.5	36.2	28.5	26.2	20.9	5.7	—13.5	5.0	...	—21.67
18	26.6	33.6	35.5	30.8	34.8	31.5	38.0	37.8	25.7	27.2	21.8	5.4	—13.5	5.8	...	—21.87
19	25.5	33.0	35.2	29.6	33.5	31.0	37.0	37.9	25.1	27.6	22.2	8.1	—14.5	6.0	...	—22.01
20	25.8	33.2	34.0	29.7	34.0	31.5	38.0	37.2	24.1	25.2	23.0	7.0	—17.0	7.6	...	—22.17
21	22.4	32.2	35.1	28.4	36.2	35.5	39.0	38.0	23.5	26.3	22.5	6.5	—21.5	8.5	...	—22.54
22	22.5	32.1	35.2	28.1	36.0	34.5	37.7	38.0	20.0	29.4	22.5	5.2	—23.0	8.2	...	—22.59
23	22.9	32.2	35.2	28.0	36.1	36.0	40.0	38.0	20.0	29.5	23.0	5.2	—24.0	10.5	...	—23.07
Midn't	—23.2	—32.9	—35.3	—27.0	—36.3	—36.0	—39.0	—37.5	—21.5	—29.6	—19.8	— 2.0	—17.0	—11.0	...	—22.71
Means	—26.73	—31.42	—33.78	—32.22	—32.02	—35.23	—37.40	—38.61	—30.24	—26.23	—22.69	—12.67	— 8.15	— 6.10	...	—22.39

[1] Temperatures noted by spirit standard *S*, till Nov. 2d, 4h.; after this hour, and throughout the month, the indications of the mercurial standard (*M*) are given.

* Corrected by 20°.

NOTES.—Nov. 5th. Thermometers were read at 2 o'clock P. M. without a light. Nov. 10th. At noon, the thermometers could no more be read without the use of a lantern; on the 14th inst., they were again read at 11 and 12 A. M., during bright moonlight. Nov. 22d. The darkness is now complete, being barely able to read at noonday; upper limb of sun below the horizon 7° 53′. Nov. 23d. The thermometer was 10° lower outside (or at —48°) than in the harbor; at this temperature, whiskey froze in the tent.

TEMPERATURE OF THE AIR IN SHADE OBSERVED AT VAN RENSSELAER HARBOR,

In December, 1853, in Lat. 78° 37′, Long. 70° 53′ W. of Greenwich.

Expressed in degrees of Fahrenheit's scale. At meteorological observatory on floe.[1]

Hour.	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.	16th.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1h.	—16.5	—29.5	—33.5	—25.0	— 8.5	—30.5	—26.4	—39.5	—35.0	—26.0	—13.5	—30.0	—27.5	—39.0	—42.5	—39.5
2	20.5	33.4	31.5	26.5	9.5	29.5	26.0	39.5	34.0	25.5	13.5	28.5	28.7	39.5	42.5	40.4
3	23.5	35.0	31.5	26.4	13.5	27.0	26.0	39.5	34.0	24.5	15.5	29.5	29.5	39.4	43.5	42.5
4	26.6	34.6	29.7	27.3	14.0	27.0	24.0	41.0	34.5	23.5	18.5	29.6	29.5	39.5	43.5	41.5
5	29.5	28.2	29.0	26.4	15.5	23.8	32.5	41.5	34.8	22.1	21.2	26.6	27.0	38.2	41.0	40.2
6	31.0	27.3	26.5	25.0	21.0	23.4	31.0	43.2	36.0	19.6	23.1	23.9	27.5	39.0	42.5	40.5
7	32.5*	24.7	26.5	23.0	17.0	26.1	31.6	41.9	33.0	19.0	23.0	24.9	29.0	37.4	41.0	40.4
8	31.7	25.2	24.5	22.2	20.5	29.2	32.0	42.5	31.5	17.8	20.5	25.4	30.5	39.4	41.5	42.0
9	28.0	24.5	25.5	26.4	24.0	31.5	37.0	41.5	34.6	15.0	20.0	26.0	30.0	40.0	42.5	42.5
10	32.0	26.0	25.5	23.6	26.5	32.0	38.3	42.5	34.0	15.0	23.8	25.8	31.5	39.8	42.9	42.7
11	30.5	24.5	26.0	23.0	28.4	32.7	37.8	42.0	34.5	12.5	24.6	26.5	34.8	40.5	43.0	41.5
Noon	24.5	22.5	26.0	20.8	28.5	33.2	38.5	43.5	31.5	10.5	26.0	26.5	34.5	40.5	42.5	41.5
13	20.9	21.0	27.1	12.0	27.4	33.7	36.9	43.5	28.8	10.3	26.4	26.5	35.0	39.5	41.6	42.0
14	23.0	22.5	26.1	12.0	27.2	33.7	37.8	43.9	25.4	10.5	27.4	27.5	35.4	38.5	41.6	39.5
15	23.1	24.5	26.2	12.5	28.2	33.5	40.8	43.9	26.8	10.0	27.9	27.0	34.0	37.5	41.4	40.5
16	22.2	26.0	27.7	14.5	27.2	33.0	42.0	44.0	26.3	9.5	27.9	25.5	35.2	40.0	39.4	40.5
17	23.0†	25.5	29.5	18.0	32.5	33.0	38.5	44.0	24.5	10.5	30.5	25.3	37.0	42.6	39.5	34.5
18	23.0	26.0	30.5	18.5	33.5	33.5	37.1	44.0	26.5	12.2	31.0	26.3	38.0	42.0	39.5	37.5
19	20.5	25.5	31.0	19.0	33.5	33.0	39.5	44.0	24.5	12.4	29.5	28.3	39.5	41.5	40.5	41.5
20	29.5	28.5	32.5	16.5	31.5	32.5	41.0	44.0	24.0	11.0	28.5	28.6	38.5	41.8	39.0	41.0
21	23.0	26.8	31.0	10.9	32.5	32.8	39.5	39.4	20.5	10.8	31.0	29.2	36.5	40.4	39.8	40.2
22	23.5	26.8	28.5	12.1	31.0	31.5	38.0	35.8	21.5	11.2	31.0	29.5	35.5	41.3	37.5	40.9
23	27.0	26.8	27.5	11.0	30.8	30.0	38.5	36.1	21.8	13.0	29.5	28.2	37.0	41.0	37.5	41.0
Midn't	—31.0	—30.4	—26.0	— 9.5	—29.5	—26.4	—40.0	—35.0	—23.5	—13.2	—28.5	—27.8	—37.5	—41.5	—38.0	—42.2
Means	—25.69	—26.90	—28.30	—19.25	—24.65	—30.52	—35.45	—41.49	—29.23	—15.23	—24.68	—27.20	—33.30	—39.99	—41.01	—40.69

Hour.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th.	27th.	28th.	29th.	30th.	31st.	Means.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1h.	—41.5	—39.5	—21.5	—30.0	—35.0	—34.8	—28.7	—13.5	—19.0	—26.5	—14.5	+13.0	— 0.8	—19.5	—11.5	—25.35
2	42.3	38.0	21.0	30.5	33.5	35.6	27.5	13.5	19.7	23.0	14.0	+13.0	— 0.8	19.5	10.0	—25.32
3	43.5	36.0	20.5	29.5	33.8	36.0	21.5	14.8	19.5	27.5	13.5	+13.5	— 0.8	20.5	10.0	—25.64
4	42.3	37.8	19.5	29.5	33.0	36.8	18.0	15.5	20.0	25.6	13.0	+15.8	— 0.8	21.7	9.5	—25.53
5	43.4	36.6	18.8	27.7	34.8	36.8	11.5	11.2	18.0	23.2	12.2	+16.5	+ 1.4	21.6	8.5	—24.64
6	42.5	32.8	19.8	31.6	31.0	37.5	11.9	11.4	19.4	23.2	13.9	+16.0	— 0.5	21.5	8.2	—24.83
7	42.0	31.9	17.5	34.2	31.1	38.0	11.1	10.8	20.8	22.5	14.4	+ 8.7	— 1.5	20.3	8.2	—24.73
8	37.5	29.5	17.9	35.0	32.0	37.2	16.0	11.5	22.5	22.5	13.3	+ 7.0	— 2.4	21.0	6.9	—24.99
9	39.0	28.5	16.4	31.0	32.0	37.3	14.0	11.6	23.3	21.6	12.5	+ 8.5	— 6.6	22.0	7.5	—25.28
10	39.2	27.5	16.7	32.4	31.6	37.5	12.3	12.2	22.2	21.0	12.5	+ 8.5	— 8.0	21.3	8.0	—25.67
11	39.5	25.8	16.8	33.5	31.0	37.2	12.4	12.0	23.4	21.3	12.6	+ 9.8	—12.5	20.3	8.1	—25.79
Noon	41.0	25.0	16.5	30.0	32.3	33.9	11.5	12.3	23.6	21.5	12.0	+ 9.0	—14.5	19.5	8.5	—25.29
13	40.5	25.5	18.0	35.3	34.5	33.2	9.7	12.3	28.5	20.3	12.0	+ 9.5	—16.3	17.1	6.5	—24.93
14	41.0	24.5	21.7	34.3	37.8	32.0	10.3	12.2	28.7	20.4	11.8	+11.0	—16.8	16.7	7.3	—25.05
15	42.0	26.5	23.3	36.6	37.5	35.0	12.0	12.0	29.0	20.5	11.2	+ 7.7	—16.9	15.8	7.5	—25.67
16	38.4	27.5	26.5	36.5	39.5	35.5	15.0	12.0	30.1	19.5	10.2	+ 6.5	—17.2	16.5	7.6	—26.01
17	41.0	25.5	23.6	36.2	39.9	39.0	14.8	10.2	29.0	19.2	9.1	+ 4.9	—13.6	14.2	7.5	—26.01
18	41.5	25.2	24.6	38.2	40.0	32.8	14.0	10.1	29.5	19.0	8.4	+ 4.2	—12.4	13.6	8.0	—26.20
19	41.5	25.4	28.2	40.0	39.4	36.5	12.1	10.1	29.1	19.0	7.5	+ 2.5	—15.1	13.5	8.0	—26.73
20	41.5	25.0	30.1	40.2	37.0	34.6	12.2	11.0	27.4	18.5	5.2	+ 2.0	—16.4	12.5	7.8	—26.64
21	38.7	22.8	34.0	33.6	28.6	31.0	13.0	13.0	26.0	18.5	4.6	+ 1.1	—18.0	12.6	11.0	—25.44
22	38.7	22.0	34.9	30.8	28.5	31.0	12.6	13.0	27.5	17.8	3.5	+ 1.8	—20.2	12.8	10.8	—25.09
23	38.5	23.0	35.0	32.5	35.0	30.2	12.2	13.0	26.8	16.8	5.8	+ 2.2	—18.2	10.8	9.3	—25.18
Midn't	—37.5	—22.6	—30.5	—32.8	—31.6	—29.0	—12.0	—13.0	—26.5	—16.5	— 6.4	+ 1.8	—18.8	—12.5	— 5.5	—24.95
Means	—40.60	—28.52	—23.05	—33.41	—34.18	—34.93	—14.43	—12.18	—24.56	—21.06	—10.59	+ 8.10	—10.32	—17.39	— 8.40	—25.46

[1] Temperatures noted by the mercurial standard (*M*); readings between —40°.0 and —44°.0 checked by spirit standard (*S*), or noted by the latter instrument.

* Temperature falling 21°.8 in eight hours. † Corrected by 10°.

Dec. 20th. At 3½ P. M., the temperature at the floe was —36°.5; the party at skirts of bay obtained, for the same hour, —43°.0.

Dec. 22d. Maximum depression of the sun below the horizon, at noon and for the upper limb, 11° 7′.

Dec. 28th. First heavy gale experienced since the closure of the winter harbor; wind from the S. E. (magnetic). Rise of temperature, between 0h. and 1h., 19°.4—the most sudden change yet noted.

TEMPERATURE OF THE AIR IN SHADE OBSERVED AT VAN RENSSELAER HARBOR,
In January, 1854, in Lat. 78° 37′, Long. 70° 53′ W. of Greenwich.
Expressed in degrees of Fahrenheit's scale. At meteorological observatory on floe.[1]

Hour.	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.	16th.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1h.	—4.5	+ 2.0	+7.0	—11.6	— 8.0	—4.5	—4.8	—12.6	—23.0	—30.0	—29.6	—36.0	—21.8	—25.0	—43.2	—38.0
2	—4.5	+ 2.0	+4.0	11.8	10.5	4.7	4.8	16.7	23.5	30.0	34.1	36.5	25.5	25.0	44.5	39.5
3	—3.5	+ 2.0	+3.8	12.5	13.5	5.5	6.0	16.6	24.5	29.2	36.2	36.5	25.7	25.1	43 8	43.2
4	—3.5	— 1.0	+3.0	13.0	14.5	6.5	7.2	17.6	26.0	30.2	37.0	36.0	23.6	24.0	44.5	44.5
5	—3.5	— 2.4	+4.1	11.1	15.7	8.8	6.4	15.5	27.0	31.9	36.0	35.2	23.5	25.0	41.9	44.5
6	—2.1	+ 3.0	+3.6	10.4	14.0	9.2	6.8	17.0	26.8	32.8	36.2	35.3	23.7	26.5	43.2	45.0
7	—2.0	+ 0.9	+3.6	10.6	13.6	9.0	8.0	16.8	29.0	33.5	37.5	33.7	23.6	29.0	41.9	45.0
8	—2.0	+ 0.9	+3.5	10.8	13.0	11.1	8.0	19.5	29.2	32.8	37.4	32.5	23.0	29.0	42.3	45.8
9	—1.5	+ 0.4	+4.7	11.7	9.5	11.0	9.0	20.6	29.7	32.2	39.5	35.7	23.4	28.8	41.9	47.3
10	—2.1	+ 1.0	+4.7	11.5	10.2	9.0	7.5	24.5	29.2	31.9	39.5	30.0	23.0	29.0	45.2	47.3
11	—1.4	+ 5.0	+4.4	11.5	10.0	8.8	9.5	23.0	28.3	33.1	38.7	28.0	23.5	30.5	45.2	48.5
Noon	—1.3	+ 9.0	+3.2	12.0	8.2	7.5	4.9	18.5	28.5	29.4	38.0	32.8	22.9	31.0	45.8	46.8
13	—0.5	+11.5	+3.2	11.0	10.5	9.7	9.8	17.8	30.2	34.5	38.5	28.6	23.0	32.8	47.3	47.9
14	0.0	+ 9.7	+2.8	11.7	7.0	9.7	8.2	17.0	29.5	34.0	38.3	28.0	25.0	34.5	45.1	48.1
15	+1.6	+ 8.0	+1.2	14.0	9.0	12.0	8.5	23.8	28.1	35.0	35.5	26.1	27.0	34.7	43.2	48.5
16	+1.2	+ 8.5	+1.8	12.0	10.5	10.5	9.8	23.5	28.8	36.0	35.4	24.8	26.8	34.5	42.4	50.4
17	+1.8	+10.1	+1.5	10.8	10.8	7 0	7.6	24.9	31.0	36.0	35.2	25.0*	29.5	36.8	39.0	50.4
18	+1.5	+ 9.5	+0.4	10.2	13.5	6.0	7.6	25.6	31.0	38.5	35.8	23.0*	27.5	36.8	35.5	51.1
19	+1.0	+ 7.2	—0.2	9.8	13.4	2.2	9.0	25.2	32.0	38.5	32.8	24.1	29.0	38.4	34.5	50.4
20	+2.0	+ 7.2	—0.2	9.6	12.8	2.6	9.0	25.5	32.0	37.5	32.4	23.1	28.5	36.4	35.5	50.4
21	+1.5	+ 7.0	0.0	9.5	13.0	4.0	7.0	26.5	28.5	36.5	36.0	22.0	25.0	41.1	34.3	45.6
22	+0.5	+ 6.8	0.0	9.5	9.0	3.8	8.2	23.5	30.0	35.0	37.0	21 5	26.5	41.1	35.5	47.9
23	+0.5	+ 6.5	0.0	9.0	8.8	5.6	8.2	23.5	34.2	34.0	37.8	21.5	26.5	41.0	36.3	49.7
Midn't	+2.0	+ 5.0	—4.5	— 9.0	— 5.5	—6.0	—8.8	—23.5	—30.5	—28.0	—37.6	—21.0	—25.5	—41.0	—36.4	—48.5
Means	—0.78	+ 4.99	+2.32	—11.03	—11.02	—7.28	—7.69	—20.80	—28.77	—33.35	—36.33	—29.04	—25.12	—32.38	—41.18	—46.85

Hour.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th.	27th.	28th.	29th.	30th.	31st.	Means.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1h.	—48.9	—39.5	—48.1	—52.5	—44.5	—26.5	—31.9	—29.5	—38.5	—21.5	—35.5	—28.5	—45.6	—47.3	—40.5	—27.82
2	49.3	42.1	47.1	52.9	39.0	27.9	38.6	29.5	36.3	21.0	32.5	28.5	45.6	49.3	43.2	—28.66
3	49.1	44.5	48.5	53.6	39.0	25.0	35.5	32.5	33.2	21.0	32.0	27.0	43.2	50.4	44.5	—28.87
4	49.1	47.1	47.9	54.2	37.0	22 9	34.5	33.5	30.0	19.5	29.6	29.0	46.8	47.9	41.9	—28.94
5	48.1	49.8	47.9	56.2	37.5	23.5	37.5	32.0	28.0	19.0	30.0	28.5	47.3	44.5	43.9	—28.97
6	47.9	48.7	47.9	56.9	37.5	23.5	37.5	33.0	27.5	19.0	30.8	26.4	42.4	47.2	44.7	—28.82
7	43.8	49.1	51.6	58.3	37.0	24.5	40.5	30.8	32.0	19.0	31.0	29.5	43.2	47.0	40.2	—29.23
8	44.2	46.2	51.6	55.5	35.2	22.5	38.5	31.5	28.5	19.2	31.0	30.0	43.4	46.3	41.0	—28.92
9	42.5	48.5	51.2	56.6	34.5	24.5	37.2	33.7	32.0	19.5	33.8	29.2	42.0	51.6	37.2	—29.38
10	40.3	46.8	52.9	58.0	36.2	25.5	31.2	32.3	32.8	20.1	35.0	37.0	43.5	46.8	33.7	—29.24
11	38.7	46.8	54.2	54.9	38.0	31.4	31.0	28.5	33.2	20.5	36.0	38.3	43.4	39.7	31.0	—28.91
Noon	35.3	49.1	52.9	53.4	36.0	36.0	30.5	34.5	29.0	22.5	37.5	38.0	44.5	41.9	28.7	—28.55
13	34.5	46.2	51.0	50.4	37.5	38.4	36.5	36.5	26.9	24.7	35.5	40.5	45.0	46.1	31.5	—29.31
14	30.7	43.8	52.2	51.6	37.5	40.5	36.5	36.5	23.0	26.5	35.5	41.8	46.4	47.3	32.5	—29.22
15	40.5	46.2	51.8	51.6	37.7	40.6	32.0	37.5	23.0	28.5	34.0	44.5	44.5	47.4	37.0	—30.05
16	43.2	45.6	53.5	50.4	39.5	39.7	36.0	37.0	23.0	32.5	31.0	45.6	43.2	46.0	39.6	—30.31
17	45.6	44.5	51.6	45.0	39.0	40.5	30.5	36.0	23.5	33.5	29.7	46.3	46.8	36.0	40.2	—29.65
18	41.3	41.9	49.1	45.6	35.5	39.5	30.6	38.0	24.2	32.5	28.6	43.8	48.5	37.5	40.2	—29.27
19	41.9	44.5	50.4	45.3	40.3	41.0	28.0	38.7	23.0	32.5	28.0	47.3	48.5	37.0	39.9	—29.60
20	41.3	44.7	52.9	50.0	41.5	41.0	30.5	39.0	22.0	33.5	26.0	45.6	47.3	39.0	40.0	—29.70
21	39.8	45.9	52.5	45.6	35.0	41.0	28.5	37.8	21.5	33.2	28.5	45.8	45.8	43.2	40.0	—29.18
22	39.0	47.9	53.2	48.5	37.0	39.0	26.8	38.9	22.0	34.1	28.0	45.3	45.0	40.2	40 0	—29.23
23	36.8	48.5	53.5	48.5	31.0	44.6	29.5	39.4	22.0	32.6	28.2	46.5	46.8	40.5	43.2	—29.70
Midn't	—40.7	—48.4	—52.2	—47.9	—29.0	—40.0	—30.4	—39.3	—22.5	—33.6	—29.3	—46.3	—47.0	—41.2	—44.7	—29.40
Means	—42.19	—46.10	—51.07	—51.81	—37.16	—33.31	—33.34	—34.83	—27.40	—25.81	—31.54	—37.88	—45.24	—44.22	—39.14	—29.21

[1] Temperatures above —40°, noted by (*M*); lower temperatures, by (*S*). * Readings changed by 10°.

Jan. 4th. To-day at noon a distinct zone of illumination was seen to the south, clearly defining the highest hills. Upper limb of sun still 10° 25′ below the horizon. The largest print is illegible at noon.

Jan. 7th. The increased illumination of the southern horizon is distinctly visible; we cannot yet read large print. (K.) Same remark on Jan. 18th.

Jan. 19th. To-day I read the title-page of my prayer-book, by turning the type towards the illuminated sky to the southward. Upper limb depressed below the horizon at noon 7° 55′.

Jan. 22d. Spirit standard read at 12 o'clock without artificial light. At 2 P. M. dark, with a faint streak of light to the south.

TEMPERATURE OF THE AIR IN SHADE OBSERVED AT VAN RENSSELAER HARBOR,

In February, 1854, in Lat. 78° 37′, Long. 70° 53′ W. of Greenwich.

Expressed in degrees of Fahrenheit's scale. At meteorological observatory on floe.[1]

Hour.	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1h.	—46.8	—41.0	—56.0	—46.2	—52.9	—51.3	—55.5	—24.5	—49.1	—48.5	—30.0	—34.3	—28.7	—24.5	—31.7
2	47.9	41.0	56.2	46.8	56.9	51.6	54.2	27.2	45.1	43.2	29.7	33.5	30.5	20.7	31.5
3	44.5	43.7	56.9	49.1	58.0	53.2	41.9	29.2	43.2	43.2	29.2	32.7	30.6	21.0	29.2
4	44.5	39.0	52.2	52.2	60.2	54.2	31.7	23.5	45.6	44.5	31.0	32.3	32.5	22.0	29.7
5	44.5	42.0	53.4	56.0	62.1	56.9	26.5	31.5	45.8	45.6	31.5	30.8	34.5	26.2	30.0
6	39.5	42.8	51.2	60.4	65.0	49.1	27.0	31.7	46.5	43.4	31.2	23.5	34.6	28.3	30.0
7	38.5	42.9	47.4	61.9	66.0	46.8	23.2	31.7	45.8	37.8	31.5	22.5	34.5	30.4	29.5
8	38.8	45.1	44.3	62.9	65.0	46.1	22.0	31.1	44.8	34.0	31.5	21.0	35.0	31.6	28.5
9	47.1	42.5	50.4	62.9	66.4*	44.5	25.0	30.2	45.0	22.0	31.7	22.5	33.7	32.0	22.0
10	47.1	44.7	46.8	51.6	64.5	45.8	21.3	31.7	45.6	21.0	32.2	22.5	36.0	34.2	22.0
11	43.7	45.7	45.6	61.4	64.5	45.6	21.4	31.7	46.2	21.3	33.7	22.5	36.2	34.2	21.0
Noon	39.5	46.2	47.9	61.4	55.5	47.4	20.5	33.0	46.3	21.0	33.5	22.5	35.3	31.5	20.2
13	39.3	43.5	45.4	62.9	54.2	48.5	21.2	33.0	44.5	19.3	33.2	21.9	35.0	29.7	13.5
14	39.0	45.0	44.5	59.9	52.9	49.1	22.0	33.1	42.5	20.0	33.2	20.5	34.8	29.0	13.7
15	39.5	44.1	44.5	56.9	52.2	48.7	22.5	34.5	41.7	20.0	33.0	21.2	34.0	28.5	13.5
16	40.5	48.3	45.1	54.2	49.1	45.6	22.5	36.0	41.3	22.0	32.7	20.1	34.1	29.7	13.5
17	39.5	49.1	46.3	51.6	51.7	47.8	24.0	43.5	45.8	21.5	31.5	20.7	33.5	28.5	10.0
18	39.2	44.5	46.8	48.7	53.9	49.8	21.7	44.1	47.0	21.5	29.0	22.2	32.5	27.5	10.0
19	38.4	46.8	45.6	49.4	51.6	52.9	22.0	40.3	46.5	21.6	30.8	23.3	32.5	28.0	10.0
20	35.2	46.8	47.1	45.6	50.7	54.9	25.0	42.0	45.6	22.3	29.0	25.0	33.0	29.0	10.0
21	37.0	50.7	36.8	49.1	50.8	52.9	20.8	45.6	44.7	23.8	29.6	26.5	33.0	30.5	11.0
22	42.0	49.1	37.8	51.6	50.4	51.6	21.4	50.0	46.1	26.6	32.0	27.4	29.0	32.5	11.5
23	38.7	51.6	38.8	54.2	51.2	57.7	21.9	42.4	46.8	29.5	33.5	25.9	26.0	33.6	11.5
Midn't	—38.0	—55.5	—40.8	—56.2	—51.6	—58.3	—22.4	—43.4	—47.0	—30.0	—30.8	—24.8	—25.5	—33.6	—11.0
Means	—41.20	—45.48	—46.99	—54.59	—56.36	—50.55	—26.57	—35.20	—45.35	—29.32	—31.46	—25.00	—32.71	—29.03	—19.35

Hour.	16th.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th.	27th.	28th.		Means.
	°	°	°	°	°	°	°	°	°	°	°	°	°		°
1h.	—13.2	—11.0	—22.0	—20.0	—26.8	—31.5	—22.0	—27.7	—33.8	—25.6	—37.2	—38.0	—30.6	...	—34.30
2	13.7	12.2	23.5	19.6	27.6	31.6	20.8	29.5	33.5	24.1	38.7	38.0	30.6	...	—34.26
3	14.2	13.0	25.8	19.0	25.9	30.7	21.0	30.5	33.8	25.0	39.0	38.5	32.5	...	—34.09
4	14.5	12.5	25.8	16.2	27.8	30.0	22.5	29.6	33.3	25.0	31.3	38.5	35.5	...	—33.49
5	14.5	12.5	25.8	16.0	27.5	29.2	23.0	29.5	32.4	26.0	30.1	38.2	34.6	...	—34.16
6	14.0	12.5	25.8	13.6	27.5	26.9	23.0	31.5	32.4	24.5	32.5	37.0	35.0	...	—33.59
7	13.4	15.0	24.6	17.4	23.5	26.7	23.5	32.5	32.5	23.0	32.8	35.3	38.0	...	—33.16
8	14.0	17.0	23.8	17.0	24.0	27.2	22.5	32.0	34.0	25.0	30.0	35.8	35.7	...	—32.85
9	14.8	14.4	22.0	18.6	24.0	24.5	22.0	32.0	33.5	29.4	30.5	35.2	34.7	...	—32.62
10	15.5	15.3	21.0	18.9	20.8	23.0	22.0	32.9	32.3	29.4	31.0	33.0	36.5	...	—32.09
11	14.5	14.7	18.8	20.0	24.0	25.0	22.8	34.0	32.3	29.3	33.0	31.0	33.6	...	—32.42
Noon	15.0	14.5	18.8	21.0	20.8	25.2	22.5	32.4	33.5	30.5	31.5	29.3	33.3	...	—31.79
13	15.7	15.0	18.7	16.5	22.8	25.2	22.5	33.0	36.5	29.2	32.7	31.0	32.6	...	—31.30
14	16.2	17.0	17.0	16.5	25.2	25.4	24.0	34.0	31.4	33.0	32.0	31.4	34.0	...	—31.30
15	16.2	16.7	17.3	18.5	25.3	24.0	24.6	36.0	29.6	34.7	35.2	32.1	35.7	...	—31.45
16	15.0	16.5	16.0	19.8	24.0	24.5	25.7	34.5	31.2	36.3	34.6	33.4	36.8	...	—31.54
17	15.7	15.9	17.0	20.0	25.1	24.6	25.8	32.5	28.2	35.8	34.0	34.9	36.0	...	—31.80
18	14.0	15.9	18.5	20.7	26.8	25.5	26.2	33.2	27.6	38.0	34.3	32.0	35.6	...	—31.67
19	11.7	13.6	17.6	20.8	29.5	25.6	26.4	33.0	27.0	38.8	33.0	32.6	36.2	...	—31.62
20	10.3	13.5	17.0	21.0	28.6	23.0	27.4	36.9	27.5	39.2	36.0	31.5	36.5	...	—31.77
21	11.1	14.0	19.0	24.1	28.5	21.5	27.4	37.5	29.0	40.8	37.4	31.6	37.0	...	—32.20
22	11.3	16.3	20.5	25.5	29.5	24.9	28.0	38.0	29.0	40.8	39.0	31.9	37.9	...	—33.27
23	11.5	18.0	21.4	26.3	29.5	23.7	28.0	35.0	29.5	40.5	38.0	31.5	36.5	...	—33.31
Midn't	—11.3	—20.4	—21.6	—26.9	—30.0	—24.0	—27.0	—35.2	—30.0	—38.9	—37.5	—33.5	—35.2	...	—33.59
Means	—13.80	—14.89	—20.80	—19.75	—26.04	—25.98	—24.19	—33.04	—31.41	—31.78	—34.22	—33.97	—35.03	...	—32.65

[1] Temperatures noted by *M*, down to —40°; lower temperatures by *S*.

* Minimum temperature observed this winter.

Feb. 3d. Thermometers read at 9 o'clock without the use of a lantern.

Feb. 7th. Between the hours of 2 and 4 A. M., the temperature was elevated 22°.5. Wind from the south, and blowing a gale.

Feb. 16th. By calculation, the upper limb of the sun would graze the horizon at noon. Two days later, a mist prevented its visibility. On the 20th, at noon, his rays shine on the cliffs, on the eastern side of the bay.

TEMPERATURE OF THE AIR IN SHADE OBSERVED AT VAN RENSSELAER HARBOR,

In March, 1854, in Lat. 78° 37′, Long. 70° 53′ W. of Greenwich.

Expressed in degrees of Fahrenheit's scale. At meteorological observatory on floe.[1]

Hour.	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.	16th.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1h.	—37.4	—35.2	—38.6	—41.2	—42.4	—44.7	—47.0	—48.5	—40.5	—48.1	—47.1	—45.6	—47.6	—51.0	—50.4	—27.8
2	36.0	35.2	34.8	42.3	41.9	41.3	47.5	48.2	27.0	48.8	46.8	48.3	49.8	49.9	51.6	34.0
3	37.5	35.8	33.0	42.3	42.4	40.0	46.7	47.6	26.0	49.4	48.5	48.7	51.8	51.0	51.6	34.0
4	37.5	35.5	33.4	42.0	44.6	44.5	45.6	45.6	26.5	50.6	47.9	49.1	50.4	53.3	48.3	33.5
5	38.5	36.5	33.5	45.0	44.5	44.5	45.6	46.8	28.0	50.4	47.9	49.8	49.1	54.2	41.3	33.0
6	37.0	37.5	32.5	44.5	45.6	44.5	48.5	48.5	31.1	49.4	46.9	49.1	49.8	51.8	40.5	32.5
7	36.2	38.5	32.5	46.1	46.8	45.0	49.1	46.8	32.5	49.0	46.8	48.4	49.8	51.0	38.9	31.5
8	39.5	38.5	33.0	45.6	46.8	44.5	49.1	46.8	30.5	47.9	46.8	48.4	50.4	49.1	38.4	30.5
9	41.0	36.5	34.7	45.4	45.4	41.0	46.9	39.3	30.0	47.6	46.3	47.9	51.2	47.9	32.0	30.0
10	40.7	37.1	32.7	45.6	45.8	40.6	46.2	39.5	30.5	45.6	45.9	49.1	46.0	47.4	30.5	30.0
11	36.0	35.0	33.0	43.8	44.0	41.7	45.0	42.3	32.0	44.7	43.4	46.8	43.4	43.5	30.0	30.0
Noon	36.5	36.7	34.0	45.6	43.8	44.5	45.6	43.0	28.0	42.0	44.5	43.2	42.4	44.0	30.0	30.3
13	33.0	36.3	36.5	46.2	43.2	41.5	45.2	44.3	27.3	42.5	45.6	45.0	43.7	40.8	29.8	29.2
14	31.5	37.0	37.5	45.2	44.4	45.6	39.9	45.6	29.3	41.9	44.8	39.7	42.6	41.0	28.7	28.5
15	32.2	37.4	38.2	46.8	40.5	45.8	45.6	42.5	38.3	44.5	43.5	45.6	39.7	39.3	36.3	28.0
16	30.5	37.4	37.0	44.4	45.4	46.8	47.2	42.3	41.5	46.3	45.9	48.5	43.8	46.1	39.7	30.5
17	30.5	36.5	37.5	43.8	45.6	46.2	47.2	42.5	41.5	46.2	45.8	48.7	45.6	45.6	37.5	31.0
18	30.5	37.5	38.0	45.1	46.8	46.8	47.9	42.5	42.5	46.2	46.5	48.1	46.8	47.2	37.0	32.5
19	31.5	38.0	38.5	45.6	47.9	46.8	47.3	42.0	42.6	46.8	46.8	47.4	47.9	46.8	35.5	33.5
20	33.5	38.0	39.0	46.1	48.5	46.8	45.6	42.0	44.5	46.8	47.3	46.8	48.2	47.9	34.0	35.0
21	33.5	36.0	41.6	45.0	46.2	46.2	43.8	41.8	45.8	46.2	47.3	46.8	49.5	48.5	30.5	40.0
22	33.2	37.7	42.4	44.6	46.8	45.6	43.9	41.8	47.4	47.0	46.8	48.7	50.0	49.0	30.0	42.0
23	34.7	37.4	44.1	43.8	49.1	45.8	46.2	41.0	47.6	47.3	45.3	48.7	49.8	49.1	30.0	42.0
Midn't	—35.7	—38.0	—42.4	—42.6	—48.5	—45.6	—47.9	—41.4	—47.9	—47.9	—45.7	—48.6	—49.9	—50.0	—31.6	—44.1
Means	—35.17	—36.88	—36.60	—44.53	—45.29	—44.43	—46.27	—43.86	—35.78	—46.80	—46.25	—47.38	—47.47	—47.72	—36.84	—33.06

Hour.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th.	27th.	28th.	29th.	30th.	31st.	Means.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1h.	—45.0	—47.0	—39.7	—39.5	—22.5	—17.0	—7.0	—14.5	—28.5	—40.5	—40.3	—36.8	—43.4	—45.1	—41.5	—38.76
2	45.0	47.3	42.8	39.0	22.0	—13.0	7.8	13.3	31.0	44.5	39.5	35.5	44.5	45.6	41.9	—38.58
3	43.2	46.8	43.0	41.9	21.0	—14.0	5.5	14.3	31.5	43.9	39.5	36.6	44.5	46.3	43.4	—38.77
4	46.1	47.9	45.0	42.0	20.5	—14.5	5.3	14.6	32.2	45.1	40.8	34.2	44.6	45.8	42.1	—39.00
5	46.8	47.9	43.2	41.9	20.0	—16.1	5.3	14.4	32.7	46.2	38.0	34.0	45.1	44.8	41.9	—38.93
6	45.6	46.8	44.6	40.8	19.8	—17.1	4.9	14.6	33.2	46.0	37.2	33.5	43.9	41.0	41.0	—38.70
7	44.5	44.5	47.2	42.0	19.2	— 6.0	5.8	14.5	33.6	44.5	36.8	32.0	42.5	41.0	34.6	—37.99
8	43.2	41.9	47.0	37.3	18.0	— 6.0	7.0	14.5	34.0	43.2	34.5	31.0	42.5	40.0	39.2	—37.58
9	40.0	39.7	44.5	41.8	17.2	— 2.5	9.0	13.0	31.5	41.0	33.0	29.5	42.5	39.0	37.0	—36.27
10	41.5	39.7	44.5	39.3	19.2	— 2.0	8.0	15.8	30.0	40.5	32.0	31.0	39.0	37.0	34.0	—35.70
11	40.5	40.9	43.2	34.8	16.2	— 0.5	8.4	15.6	30.0	39.0	28.7	30.2	37.0	37.0	33.4	—34.52
Noon	40.0	38.0	40.5	33.0	16.2	— 0.7	6.5	13.5	30.5	36.4	29.5	31.5	33.0	36.5	33.2	—33.97
13	38.5	36.8	40.8	30.5	15.0	+ 2.5	7.2	14.1	32.0	37.5	28.2	31.2	33.4	35.0	33.5	—33.59
14	38.5	34.8	39.9	30.5	15.0	+ 1.5	7.0	14.5	32.5	37.5	28.0	31.5	30.8	34.3	32.0	—33.18
15	38.7	38.3	37.2	34.0	14.5	— 2.2	5.0	16.0	28.3	37.0	28.0	31.2	28.3	34.5	31.0	—33.82
16	39.5	37.7	36.0	33.5	15.0	— 2.5	5.7	16.5	31.5	37.5	28.2	31.2	31.5	32.5	30.2	—34.91
17	39.5	41.0	37.8	31.5	15.5	— 2.9	8.4	18.0	33.5	41.2	28.5	32.5	35.5	35.5	30.3	—35.59
18	39.7	41.1	37.8	29.5	17.0	— 3.4	5.8	18.8	37.8	41.5	29.6	35.0	35.3	38.1	30.5	—36.22
19	39.7	41.8	37.9	29.5	18.2	— 3.9	6.9	20.6	38.4	44.5	29.2	38.0	34.5	39.9	30.9	—36.74
20	41.9	43.4	38.4	29.5	18.4	— 4.4	9.5	22.0	38.8	44.5	31.0	40.5	39.5	43.2	31.3	—37.62
21	45.1	43.3	38.6	25.0	19.5	— 2.2	10.7	22.1	39.0	43.2	34.0	43.2	41.0	43.2	31.5	—37.75
22	45.8	42.8	39.0	25.0	19.2	— 2.0	11.8	22.6	40.0	41.9	34.5	44.1	39.5	43.2	29.8	—38.00
23	47.9	35.7	39.0	24.5	19.0	— 6.0	12.0	25.0	41.8	43.2	36.0	44.5	40.3	41.5	27.2	—38.24
Midn't	—48.6	—37.0	—39.4	—21.0	—19.0	— 7.8	—12.4	—29.0	—41.0	—41.9	—35.4	—44.5	—41.0	—41.0	—24.0	—38.41
Means	—42.70	—41.75	—41.13	—34.06	—18.21	— 5.95	— 7.62	—17.16	—33.89	—41.76	—33.35	—35.13	—38.88	—40.04	—34.39	—36.79

[1] Temperatures above —40° noted by *M*: below —40°, by *S*.

March 5th. The sun shows upon our observatory on the floe at 10 o'clock A. M. Noticed an effect on the exposed thermometers during sunshine.

March 8th. Sun sunk below the hills at half-past two P. M.

March 9th. Between the hours of one and two A. M., the temperature rose from —40°.5 to —27°.0. At close of the watch, a fresh breeze from the eastward.

March 22d. Temperature rises between six and seven A. M. 11°.1; wind S. E.

TEMPERATURE OF THE AIR IN SHADE OBSERVED AT VAN RENSSELAER HARBOR,

In April, 1854, in Lat. 78° 37′, Long. 70° 53′ W. of Greenwich.

Expressed in degrees of Fahrenheit's scale. At meteorological observatory on floe.[1]

Hour.	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.	16th.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1h.	—20.0	—19.5	(—35.5)	—39.9	—12.6	—13.2	—26.0	—34.0	—20.0	—11.3	—17.4	—25.4	—11.0	+3.4	—4.6	+8.5
2	20.0	19.8	(35.8)	36.4	12.0	12.0	25.8	33.8	19.5	12.0	20.0	23.5	—12.1	+4.0	—4.3	+8.0
3	19.6	20.5	(36.4)	37.2	11.6	11.6	25.0	33.0	20.0	12.8	19.0	24.0	—12.4	+3.7	—7.2	+7.5
4	19.0	21.0	(36.3)	35.7	11.8	11.0	25.0	33.5	20.0	13.3	18.0	23.0	—12.5	+3.4	—6.5	+6.3
5	18.8	21.6	(35.6)	26.7	11.0	10.3	23.7	30.5	17.5	12.0	20.0	20.5	—12.0	+3.9	—6.0	+6.5
6	18.5	18.5	(35.2)	25.5	12.3	11.0	22.0	28.0	17.3	11.0	18.0	19.5	— 9.0	+4.0	—5.5	+6.2
7	18.0	20.2	(33.9)	19.8	11.5	9.5	22.0	23.8	16.2	10.0	17.6	18.0	— 7.5	+3.8	—5.5	+7.9
8	17.8	21.2	(32.6)	17.5	13.5	10.5	21.5	24.2	13.8	7.5	14.5	18.0	— 4.0	+3.0	—3.0	+8.5
9	17.2	21.0	(30.3)	13.5	9.0	9.0	23.8	21.0	10.3	3.8	17.0	12.0	+ 2.8	+2.8	—1.8	+7.5
10	16.5	21.0	(29.1)	13.1	8.7	10.8	25.0	20.0	8.3	5.0	14.5	10.5	+ 2.2	+3.5	—1.6	+7.5
11	15.9	20.5	(27.6)	12.5	10.0	10.0	23.0	18.0	5.0	4.3	13.0	11.0	+ 3.5	+4.5	+1.2	+7.5
Noon	15.5	20.5	(26.7)	11.5	11.6	11.0	23.0	18.0	2.3	3.2	12.5	11.5	+ 4.0	+4.8	+1.5	+7.5
13	15.2	21.5	26.9	12.0	12.0	10.5	23.0	18.0	3.0	3.0	11.5	9.7	+ 4.6	+4.2	+2.0	+7.0
14	15.0	21.0	26.5	8.6	12.6	11.0	25.0	16.8	2.5	3.2	11.5	9.0	+ 4.0	+3.7	+5.5	+7.2
15	14.7	21.2	24.0	9.0	12.5	12.2	27.0	14.0	2.8	4.0	12.0	8.7	+ 3.7	+4.0	+4.0	+8.2
16	15.5	22.3	25.8	9.8	12.5	14.3	28.0	16.5	3.0	4.5	16.0	7.0	+ 3.0	+4.1	+2.5	+8.0
17	17.5	23.0	29.0	11.0	10.7	14.5	24.8	16.5	3.5	4.5	18.0	1.5	+ 2.5	+4.0	+3.6	+6.4
18	17.5	25.0	30.4	12.6	10.5	18.0	26.0	16.6	4.6	7.5	17.0	3.0	+ 3.0	+4.2	+3.0	+6.0
19	18.8	28.0	33.0	13.7	11.2	19.5	31.2	16.5	4.8	10.0	20.0	3.4	+ 2.7	+4.0	+3.6	+1.5
20	18.5	27.0	35.3	13.2	11.0	22.2	31.9	16.2	5.5	10.0	21.5	4.3	+ 2.3	+3.0	+8.0	+0.5
21	18.8	(29.9)	38.0	13.2	10.4	24.0	33.5	18.5	9.0	12.0	22.3	5.8	+ 2.0	—0.5	+7.0	0.0
22	18.8	(31.7)	39.2	13.5	13.0	27.7	36.5	18.5	9.0	13.0	23.3	6.9	+ 1.0	—3.5	+6.9	—5.5
23	18.8	(32.8)	40.0	12.5	13.0	27.0	34.0	18.5	10.0	14.5	23.0	8.8	— 0.5	—5.8	+6.8	—5.5
Midn't	—19.0	(—34.2)	—41.7	—12.5	—13.0	—27.0	—34.2	—20.0	—11.0	—15.8	—25.3	—13.0	+ 1.0	—4.5	+6.8	—6.8
Means	—17.70	—23.45	—32.70	—17.95	—11.58	—14.91	—26.70	—21.85	— 9.95	— 8.67	—17.62	—12.33	—1.61	+2.57	+0.68	+4.85

Hour.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th.	27th.	28th.	29th.	30th.		Means.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°		°
1h.	— 7.0	—14.3	—15.0	—16.6	— 9.0	— 4.0	—3.2	—10.0	—5.5	—4.0	—1.0	0.0	—2.3	+ 4.8	...	—12.19
2	— 7.2	—13.7	—14.3	—15.5	—13.3	— 3.2	—2.5	—10.3	—6.4	—3.8	—5.0	0.0	—2.5	+ 6.8	...	—12.20
3	— 7.1	—12.0	—13.0	—14.4	—13.0	—11.0	—3.7	—10.0	—6.3	—3.5	—8.0	—0.7	—3.0	+ 6.5	...	—12.61
4	— 6.8	—12.0	—12.7	—13.5	—11.0	—10.0	—2.3	— 8.0	—6.0	—3.3	—2.0	—1.0	—2.3	+ 5.5	...	—12.08
5	— 5.0	—11.5	—15.5	—14.1	—11.0	— 7.0	—0.5	— 9.5	—4.0	+3.3	—1.5	—7.3	—4.2	+ 6.4	...	—11.24
6	— 4.0	—10.8	—12.7	—13.4	—11.0	— 6.5	+2.4	— 8.5	—8.0	+3.2	—1.5	—5.6	—4.0	+ 4.4	...	—10.57
7	— 6.3	— 8.0	—10.2	—12.4	— 8.5	— 4.5	0.0	— 7.5	—4.0	+3.7	—1.0	—5.6	—4.2	+ 4.6	...	— 9.52
8	— 7.5	— 8.0	—10.0	— 6.6	— 9.2	— 3.0	+4.5	— 7.8	—4.0	+4.0	—1.2	—5.0	+1.8	+ 4.9	...	— 8.44
9	— 6.5	— 5.8	— 7.8	— 6.0	— 7.0	+ 3.0	+4.8	— 3.2	—4.5	+4.0	—1.5	—4.0	+3.0	+ 5.3	...	— 6.76
10	— 6.5	— 5.0	— 5.0	— 2.6	— 3.5	+ 4.8	+6.0	— 1.2	—5.0	+4.2	—1.0	—4.2	+1.0	+ 6.5	...	— 6.08
11	— 6.0	— 3.8	— 4.0	0.0	— 5.0	+ 6.0	+7.2	— 1.0	—3.0	+5.3	—0.5	—3.8	+3.0	+ 6.3	...	— 5.11
Noon	— 5.0	— 3.5	— 3.0	+ 1.7	— 3.4	+ 5.8	+4.5	— 0.2	—2.5	+7.7	0.0	+4.5	+3.0	+ 6.0	...	— 4.46
13	— 3.0	— 3.5	— 2.0	+ 1.0	— 2.0	+ 7.2	+4.5	+ 2.5	—2.5	+8.1	+0.5	+5.2	+5.0	+ 7.0	...	— 4.02
14	— 1.0	— 2.0	0.0	+ 2.5	+ 0.5	+ 7.5	+4.5	+ 2.0	0.0	+8.1	+4.4	+5.0	+4.0	+10.9	...	— 3.20
15	— 2.3	— 3.0	+ 3.0	+ 2.5	— 1.0	+ 8.4	+4.5	+ 2.4	+1.0	+8.5	+5.6	+4.2	+5.2	+11.0	...	— 3.07
16	— 2.8	— 3.5	+ 2.5	+ 4.0	— 3.0	+15.0	+4.5	+ 2.3	+1.5	+9.2	+6.0	+5.0	+5.5	+10.2	...	— 3.37
17	— 1.5	— 4.5	+ 2.0	+ 3.0	+ 0.5	+11.2	+4.0	+ 3.4	+2.0	+8.3	+7.2	+5.5	+3.5	+ 8.8	...	— 3.49
18	— 3.5	— 4.8	+ 0.1	+ 0.5	+ 3.8	+ 8.5	+3.5	+ 3.2	+2.0	+8.0	+7.0	+4.0	+2.5	+ 7.0	...	— 4.36
19	— 4.0	— 7.0	— 2.0	+ 2.5	+ 0.8	+ 7.0	+2.0	+ 1.2	+1.0	+7.7	+6.4	+4.0	+2.0	+ 4.0	...	— 5.76
20	— 5.8	— 8.7	— 5.3	— 3.0	— 1.4	+ 4.4	+0.5	0.0	—1.0	+7.1	+5.2	+3.5	+2.4	+ 3.0	...	— 6.73
21	— 8.5	— 8.5	— 5.5	— 5.0	— 2.0	+ 6.5	—2.5	— 2.3	—1.5	+6.0	+2.3	+1.0	+2.3	+ 3.0	...	— 8.05
22	—12.0	— 9.5	— 6.8	— 6.0	— 3.5	+ 5.0	—5.0	— 2.2	—1.9	+5.2	0.0	—3.0*	+2.1	+ 2.1	...	— 9.59
23	—13.5	—12.2	— 6.7	— 6.5	— 5.0	+ 4.0	—7.0	— 4.0	—2.1	0.0	—0.5	—3.0*	+2.0	+ 2.5	...	—10.33
Midn't	—14.2	—13.8	—16.7	— 8.0	— 5.8	— 0.1	—9.3	— 4.5	—2.7	0.0	—1.3	—2.3*	+2.3	+ 3.0	...	—11.45
Means	— 6.12	— 7.89	— 6.69	— 5.25	— 5.12	+ 2.29	+0.89	— 3.05	—2.64	+4.04	+0.77	—0.15	+1.17	+ 5.85	...	— 7.69

[1] Temperatures noted by mercurial standard.

* Sign — supplied.

For the interpolation on the 2d and 3d, the parameter of the diurnal variation was found 1.6 and 1.9 of the mean value from six observations before and six observations after the interval. The change in the mean temperature during the same time amounted to 5°.3.

April 12th. Sun rises at half-past 3 o'clock. On the 17th inst., the sun was up at 1 A. M.

April 19th. The sun was refracted above the horizon at midnight.

TEMPERATURE OF THE AIR IN SHADE OBSERVED AT VAN RENSSELAER HARBOR,

In May, 1854, in Lat. 78° 37′, Long. 70° 53′ W. of Greenwich.

Expressed in degrees of Fahrenheit's scale. At meteorological observatory on floe.[1]

Hour.	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.	16th.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1h.	+ 2.5	+ 6.8	—5.8	—6.0	—5.0	—4.5	+ 5.6	+6.4	+ 5.1	+ 5.9	+ 5.1	+ 1.5	—7.3	+0.5	+4.2	+ 5.1
2	4.6	+ 6.0	—6.5	—6.0	—7.5	—4.0	6.4	8.0	5.3	6.4	5.7	1.8	—7.1	0.5	4.2	4.2
3	6.4	+ 5.3	—5.8	—5.5	—4.8	—3.5	7.0	10.0	5.5	6.9	7.6	0.5	—5.3	2.4	4.2	4.5
4	8.5	+ 2.4	—4.5	—5.2	—4.0	—3.4	7.6	10.6	5.7	7.2	6.4	2.4	—3.1	3.3	4.2	6.4
5	13.5	+ 3.1	—3.8	—5.1	0.0	—3.3	8.2	10.8	6.2	7.2	4.4	2.9	+3.3	3.3	6.1	8.5
6	12.8	+ 5.2	—2.4	—2.5	+1.5	—4.6	9.3	11.2	6.8	7.8	5.1	3.3	+2.9	3.5	7.0	9.8
7	14.8	+ 7.0	—2.2	—2.2	+1.5	—3.6	9.8	11.7	6.5	9.3	6.1	4.7	+2.4	3.8	8.2	10.3
8	18.4	+10.0	—1.4	—1.5	+2.3	—2.0	11.7	12.2	5.5	12.7	9.3	6.1	+1.5	3.8	10.3	10.8
9	17.1	+ 9.4	—0.5	—1.0	+2.5	+0.5	12.4	12.6	6.5	14.6	12.6	7.2	+1.5	3.8	3.3	11.7
10	19.5	+ 7.6	—0.2	0.0	+2.3	+1.2	12.2	12.9	7.3	13.3	13.2	7.8	+3.1	4.0	5.1	11.4
11	16.2	+ 6.7	+0.8	+0.2	+2.1	+1.6	12.2	14.0	7.7	11.6	14.1	7.6	+4.2	5.2	7.4	11.9
Noon	14.2	+ 6.4	+1.0	+0.7	+2.2	+2.0	10.3	15.5	8.6	9.6	14.8	8.0	+5.1	7.4	8.4	12.5
13	16.0	+ 7.2	+2.3	+2.0	+2.7	+3.1	9.8	16.2	9.8	10.8	14.1	8.4	+5.3	8.1	9.0	13.5
14	18.2	+ 7.3	+2.7	+4.5	+4.0	+2.8	10.3	16.0	10.3	10.3	13.6	9.2	+5.4	8.6	10.7	14.1
15	16.3	+ 7.0	+3.3	+4.0	+4.7	+4.1	12.5	16.5	11.7	10.9	11.5	9.7	+6.7	8.2	12.5	14.6
16	15.5	+ 6.6	+3.2	+5.2	+4.5	+3.9	14.3	17.5	11.5	10.3	11.0	10.3	+7.2	8.5	14.4	15.2
17	13.2	+ 5.3	+2.0	+5.0	+4.3	+3.7	14.1	17.1	11.3	9.9	9.3	10.5	+7.4	10.3	13.7	15.0
18	10.2	+ 4.5	0.0	+4.1	+4.5	+3.5	12.2	16.3	11.5	9.7	8.5	10.3	+7.2	11.4	13.1	14.5
19	10.0	+ 3.4	—1.2	0.0	+3.0	+3.3	12.0	15.4	11.7	9.2	7.2	7.5	+7.0	10.3	11.9	14.1
20	10.4	+ 2.1	—3.0	—1.0	+1.3	+3.3	11.7	14.1	11.3	9.0	6.5	5.1	+6.7	9.8	10.3	11.2
21	10.5	0.0	—5.5	—1.5	+0.2	+2.8	11.4	12.5	10.8	8.4	5.1	3.3	+5.4	8.9	9.4	10.3
22	10.0	— 1.0	—5.8	—3.0	0.0	+2.9	11.2	10.5	10.3	8.0	4.2	2.4	+4.3	10.1	7.6	9.7
23	10.0	— 1.5	—6.0	—3.4	—0.5	+1.9	10.5	5.6	8.2	5.7	3.8	1.7	+1.9	8.1	5.4	9.2
Midn't	+10.1	— 3.0	—6.4	—3.0	—1.0	+5.1	+ 9.6	+5.1	+ 7.2	+5.4	+3.3	+0.5	+0.5	+5.1	+4.7	+ 8.9
Means	+12.45	+ 4.74	—1.90	—0.88	—0.87	+0.70	+10.51	+12.45	+ 8.43	+9.17	+8.44	+5.53	+2.76	+6.20	+8.14	+10.72

Hour.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th.	27th.	28th.	29th.	30th.	31st.	Means.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1h.	+13.3	+11.4	+ 5.3	+ 6.3	+ 9.8	+ 8.3	+13.6	+13.2	+19.0	+23.5	+30.4	+31.4	+24.5	+28.8	+20.2	+ 9.00
2	11.6	16.3	5.8	7.5	10.3	9.0	13.8	12.8	18.6	24.5	30.4	31.9	26.4	28.8	19.8	+ 9.34
3	9.5	17.6	7.4	8.6	10.7	10.6	13.8	15.4	18.3	24.5	30.9	31.4	26.4	31.5	17.9	+10.00
4	10.0	17.9	8.1	10.4	11.8	12.6	14.4	16.2	17.9	25.5	31.4	31.9	26 9	29.5	17.9	+10.55
5	9.8	19.3	9.6	9.8	12.2	13.9	15.5	19.0	21.0	26.0	33.0	33.2	29.3	31.9	18.6	+11.85
6	10.3	20.0	10.3	10.3	14.0	17.4	17.1	18.4	19.7	28.6	34.6	36.0	31.4	30.5	19.7	+12.74
7	10.1	19.8	10.8	13.3	14.3	17.9	18.1	17.9	21.2	27.7	35.3	38.0	34.5	30.7	20.7	+13.50
8	9.3	20.7	13.5	15.3	16.4	14.5	19.1	19.7	19.7	28.1	37.0	34.4	37.5	31.4	21.2	+14.44
9	8.9	18.4	13.2	12.6	18.1	15.8	17.1	14.4	21.9	28.3	37.6	34.5	36.6	30.9	22.6	+14.36
10	9.6	19.0	15.5	16.0	18.2	17.2	14.4	15.0	22.7	30.5	38.6	34.2	37.6	31.7	25.5	+15.05
11	9.8	13.4	18.7	13.4	17.9	18.4	15.4	17.6	23.8	32.6	36.5	34.5	37.6	34.5	29.3	+15.35
Noon	10.5	12.6	19.1	12.9	18.6	22.1	18.6	17.3	24.5	31.4	35.5	40.1	39.0	34.5	29.3	+15.89
13	9.8	11.6	20.3	13.7	19.0	22.1	20.2	17.1	24.9	32.9	35.7	34.2	35.6	36.0	28.3	+16.12
14	9.8	12.2	20.8	14.3	18.5	22.1	20.7	18.2	25.5	32.4	35.1	34.9	33.4	32.4	28.8	+16.36
15	11.5	12.4	19.7	15.0	19.4	22.7	17.4	17.9	26.4	32.6	34.5	34.8	32.4	31.7	27.6	+16.46
16	14.1	13.1	19.3	16.0	18.5	23.1	17.0	19.7	24.7	31.9	34.7	33.8	33.4	32.6	28.3	+16.75
17	12.2	12.8	17.4	16.4	17.9	22.6	18.2	20.1	24.5	30.9	32.4	34.1	32.9	29.3	27.4	+16.17
18	9.7	12.5	12.8	16.2	17.8	19.7	17.9	19.3	25.1	30.9	32.0	32.6	31.8	28.3	27.4	+15.34
19	8.2	11.8	12.2	15.5	16.9	17.4	17.4	20.2	24.7	29.9	31.8	30.9	31.4	28.3	27.9	+14.49
20	7.8	11.5	11.5	13.8	15.5	16.0	16.7	20.7	24.0	31.3	31.4	29.3	30.8	26.4	26.9	+13.63
21	7.4	9.9	10.9	13.2	14.2	15.0	16.0	20.5	23.5	32.6	32.4	29.0	29.4	24.5	26.4	+12.80
22	7.6	7.7	10.0	10.8	10.5	14.5	15.3	19.0	22.9	29.8	30.4	28.9	29.4	21.7	22.6	+11.69
23	9.9	4.7	6.6	10.3	10.3	13.4	15.5	18.6	23.3	29.7	29.3	28.1	28.4	20.7	20.7	+10.65
Midn't	+10.6	+ 4.2	+ 5.1	+ 9.8	+ 8.6	+13.4	+15.4	+18.2	+23.8	+30.9	+28.3	+27.4	+28.4	+20.7	+19.7	+10.21
Means	+10.05	+13.78	+12.66	+12.56	+14.97	+16.65	+16.61	+17.77	+22.57	+29.46	+33.30	+32.90	+31.88	+29.47	+23.94	+13.45

[1] Up to the 5th, inclusive, the temperatures noted by *M*; after the 5th, by *S*.

May 20th. The sun is now acquiring power in the middle of the day sufficient to soften the snow on the surface, and black objects lying upon it sink quite fast—a tarpaulin sinking about two inches in a day.

May 26th. The thermometer indicates a temperature above the freezing point of water, for the first time in the season.

TEMPERATURE OF THE AIR IN SHADE OBSERVED AT VAN RENSSELAER HARBOR,

In June, 1854, in Lat. 78° 37′, Long. 70° 53′ W. of Greenwich.

Expressed in degrees of Fahrenheit's scale. At meteorological observatory on floe.[1]

Hour.	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.	16th.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1h.	+23.5	+22.8	+26.2	+25.5	+21.1	+19.5	+21.1	+21.2	+24.5	+22.9	+27.7	+22.6	+22.1	+25.0	+22.6	+25.6
2	23.0	23.9	25.9	25.5	22.1	19.2	21.2	20.7	24.6	26.4	25.5	22.6	22.1	23.9	22.6	25.6
3	23.5	25.0	26.7	24.5	19.7	18.4	22.1	26.4	24.7	26.6	25.5	22.1	21.6	24.0	23.6	25.0
4	23.5	25.5	27.4	24.5	21.8	18.8	24.0	25.5	24.8	26.6	28.3	22.1	20.7	22.8	25.5	25.0
5	23.5	28.3	(28.1)	(24.7)	22.2	24.1	24.5	25.5	25.4	25.5	26.9	22.7	24.5	26.0	26.0	28.5
6	19.9	29.3	(28.8)	(24.9)	22.4	24.3	24.7	26.0	25.6	26.3	28.7	24.7	21.6	27.4	28.0	28.3
7	19.7	31.4	(29.5)	(25.1)	22.6	24.5	24.7	26.4	26.3	27.7	26.5	26.5	24.5	30.8	29.8	28.1
8	21.6	33.0	(30.2)	(25.3)	23.2	25.5	25.0	27.3	26.5	27.4	28.7	27.5	24.5	34.7	29.5	27.4
9	24.5	34.5	30.9	25.5	22.9	26.1	24.0	27.9	27.4	31.4	27.4	23.5	25.5	28.4	27.4	29.3
10	25.1	32.6	29.3	26.4	23.0	26.4	24.0	28.3	27.9	26.0	28.4	25.5	26.4	28.6	28.3	31.4
11	25.3	31.9	27.4	26.4	23.5	25.5	24.0	29.8	30.3	31.9	28.8	25.7	27.4	28.7	27.8	31.9
Noon	25.8	30.8	28.3	26.4	23.7	25.5	25.0	34.5	29.3	35.5	28.3	25.7	28.4	29.3	27.6	35.5
13	26.4	31.0	28.8	25.9	23.8	25.5	25.0	34.5	29.4	35.4	28.3	26.0	28.8	29.4	28.8	35.5
14	26.7	30.7	29.8	26.3	25.0	25.9	28.0	32.4	32.4	33.5	27.4	26.4	28.7	30.5	29.3	34.5
15	26.9	31.0	30.3	26.6	27.1	26.4	28.4	29.3	31.4	28.3	28.4	26.4	30.2	32.5	29.3	33.4
16	27.3	31.3	30.3	26.1	27.4	27.1	27.4	27.9	27.6	28.3	26.1	27.4	28.3	31.4	30.3	34.5
17	27.3	31.3	29.3	25.5	27.5	26.4	26.9	27.9	26.9	28.3	29.6	27.4	28.4	29.3	30.9	34.5
18	27.3	30.3	27.4	25.5	26.5	25.9	26.9	28.0	26.3	28.3	28.3	28.3	28.3	29.3	30.9	35.0
19	26.9	30.8	26.9	25.5	25.5	25.5	28.3	26.4	27.4	29.3	27.4	25.5	28.3	30.3	29.3	32.4
20	26.4	30.3	27.4	24.5	25.5	28.3	26.4	25.5	25.9	28.3	27.4	24.5	26.4	29.3	30.3	33.4
21	25.8	29.8	26.9	24.5	22.6	27.4	24.5	25.5	25.9	27.4	26.4	26.4	25.4	27.4	30.3	32.9
22	25.5	29.3	26.4	24.5	22.6	27.4	22.6	24.5	24.5	27.0	25.4	23.6	25.4	29.3	30.3	31.4
23	23.5	28.3	26.4	21.6	22.6	23.5	22.6	24.5	23.6	26.5	24.5	23.6	19.7	28.4	29.3	30.3
Midn't	+21.6	+27.4	+26.0	+21.6	+21.6	+22.6	+22.6	+24.5	+23.6	+26.0	+24.5	+23.6	+22.6	+28.4	+24.5	+29.3
Means	+24.60	+29.60	+28.11	+25.12	+23.58	+24.57	+24.75	+27.10	+26.76	+28.37	+27.27	+25.01	+25.41	+28.55	+28.55	+30.78

Hour.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th.	27th.	28th.	29th.	30th.		Means.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°		°
1h.	+31.9	+30.9	+30.3	+29.3	+29.0	+29.3	+29.3	+29.1	+31.9	+32.4	+29.1	+32.9	+34.0	+37.1	...	+27.01
2	32.1	27.9	30.8	28.9	29.8	29.3	29.3	30.8	31.4	33.4	28.3	32.8	34.2	37.4	...	+27.06
3	32.0	27.9	30.8	27.9	32.3	29.8	30.3	30.8	31.4	33.4	26.9	32.8	33.8	37.5	...	+27.23
4	35.0	30.9	30.8	26.1	29.8	28.8	30.3	30.8	31.9	33.4	28.4	32.2	34.5	37.1	...	+27.56
5	35.0	32.4	33.8	27.5	29.8	31.4	27.9	33.5	36.3	34.5	31.4	31.7	37.2	36.6	...	+28.85
6	34.9	36.0	33.6	27.5	31.1	34.2	28.6	33.6	36.5	34.6	32.9	32.9	38.0	39.6	...	+29.50
7	35.0	38.3	36.2	27.9	31.5	35.1	28.5	33.7	36.5	34.6	35.7	33.6	38.6	41.6	...	+30.36
8	34.5	40.1	37.8	31.9	32.9	35.7	29.3	34.2	38.6	40.7	39.4	34.1	39.1	42.6	...	+31.61
9	35.0	32.1	38.6	28.3	28.4	34.8	29.7	37.5	36.6	35.5	39.1	34.5	37.6	40.6	...	+30.83
10	35.0	34.4	39.6	29.3	29.3	33.4	30.3	36.5	37.0	36.6	39.4	35.0	37.6	40.1	...	+31.04
11	35.5	34.9	37.1	30.3	30.3	35.3	30.3	37.3	36.6	36.6	39.4	35.5	37.2	39.6	...	+31.41
Noon	34.5	34.4	35.5	30.3	38.1	35.3	31.9	39.6	36.6	38.6	39.1	36.3	37.1	38.6	...	+32.18
13	34.5	34.5	35.0	30.9	37.6	36.0	32.4	39.1	35.5	38.6	39.1	37.0	37.1	40.1	...	+32.33
14	33.7	35.5	35.5	30.3	35.5	32.4	32.9	38.6	35.0	38.1	(37.5)	36.0	38.1	40.1	...	+32.21
15	34.5	35.0	35.5	28.3	35.0	31.9	32.9	38.1	35.0	38.1	36.0	34.5	37.1	39.6	...	+31.91
16	35.0	34.5	35.5	28.3	34.5	32.4	34.0	37.6	34.7	36.6	35.5	34.0	37.6	39.1	...	+31.60
17	34.8	34.5	35.0	28.8	35.0	30.9	34.1	37.6	33.4	37.1	34.5	34.0	37.6	37.6	...	+31.41
18	34.5	34.8	35.0	29.8	34.5	31.4	34.0	37.0	32.9	36.6	35.5	33.6	38.1	35.5	...	+31.19
19	34.5	34.5	35.0	29.5	33.5	31.4	34.5	34.5	32.4	35.0	35.5	34.5	38.1	35.2	...	+30.79
20	35.5	34.5	33.4	29.4	33.7	31.4	34.0	34.5	32.4	35.0	35.5	34.5	38.1	35.2	...	+30.56
21	34.5	34.0	33.4	29.6	33.2	30.9	29.3	34.5	32.4	34.9	35.5	33.4	38.1	34.5	...	+29.91
22	33.4	33.4	32.4	29.7	32.4	29.3	30.3	34.3	32.2	34.7	35.5	33.4	38.3	35.5	...	+29.48
23	32.4	32.4	31.4	28.8	31.6	29.5	31.3	33.5	32.4	34.5	34.5	32.9	38.1	35.0	...	+28.57
Midn't	+32.4	+31.3	+30.3	+30.0	+31.2	+29.5	+30.3	+33.5	+32.4	+34.5	+34.0	+32.9	+37.9	+34.8	...	+28.18
Means	+34.17	+33.71	+34.26	+29.11	+32.50	+32.06	+31.09	+35.01	+34.25	+35.75	+34.90	+33.96	+37.21	+37.94	...	+30.12

[1] Temperatures noted by spirit standard *S*.

TEMPERATURE OF THE AIR IN SHADE OBSERVED AT VAN RENSSELAER HARBOR,

In July, 1854, in Lat. 78° 37′, Long. 70° 53′ W. of Greenwich.

Expressed in degrees of Fahrenheit's scale. At magnetical observatory on Fern Rock Island.[1]

Hour.	1st.	2d.	3d.	4th.	5th.	6th.	7th	8th.	9th	10th.	11th.	12th.	13th.	14th.	15th.	16th.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1h.	+35.0	+39.1	+36.0	+42.6	+39.5	+43.0	+34.0	+36.0	+32.0	+34.0	+34.0	+34.0	+35.0	+34.0	+39.0	+(33.9)
2	35.3	40.1	35.9	42.6	40.0	42.0	34.0	36.5	31.0	32.0	34.0	35.0	37.0	37.5	38.0	(34.3)
3	34.5	41.6	37.0	43.6	40.3	40.5	34.0	36.5	31.5	35.0	34.0	35.0	37.0	35.0	37.0	(34.5)
4	34.5	41.1	36.5	44.6	40.0	40.5	34.0	35.0	34.0	36.0	34.5	38.0	37.5	35.0	37.0	(34.7)
5	36.5	45.6	36.5	46.6	39.5	40.0	35.0	36.0	34.5	33.0	34.0	36.0	36.0	35.0	38.5	+34.0
6	36.0	46.1	37.5	47.6	39.5	40.0	35.0	36.5	35.0	33.0	35.0	37.0	36.0	36.0	38.0	36.2
7	36.0	45.6	39.5	43.6	40.0	42.0	35.5	36.0	35.0	34.0	35.5	37.0	36.5	36.8	37.0	36.0
8	36.5	45.1	39.0	44.6	40.0	42.0	36.0	36.0	36.0	35.0	37.0	37.0	37.0	38.0	36.6	35.5
9	36.5	49.6	39.0	48.6	41.0	41.0	38.0	37.0	37.0	36.0	37.0	38.0	38.0	39.8	37.0	36.0
10	37.2	49.6	38.5	48.6*	41.0	43.0	39.0	37.0	37.0	37.0	37.0	38.0	38.0	44.0	36.5	36.2
11	37.6	48.4	38.5	48.1	42.0	40.0	39.0	38.0	39.0	39.0	37.5	39.0	38.0	45.0	36.0	36.7
Noon	38.3	48.4	38.0	46.6	42.0	42.0	37.0	40.0	39.0	39.0	37.5	40.0	38.0	47.0*	35.0	37.0
13	38.6	48.6	36.5	48.6	39.0	41.0	37.0	39.0	39.0	39.0	38.0	41.0	40.0	48.0*	37.0	37.0
14	40.6	38.1	39.5	44.6†	38.0	38.0	37.0	36.0	39.0	43.0	38.5	41.0	41.0	49.0*	38.0	37.0
15	41.6	39.6	37.5	42.6	39.0	41.0	36.0	38.0	40.0	40.0	37.0	41.0	42.0	48.0	37.0	36.0
16	41.6	36.0†	36.5	46.6	42.0	40.0	35.0	37.0	37.0	40.0	38.0	41.0	43.0	45.0	37.0	36.5
17	39.6	39.6	36.5	44.6	41.0	35.0	35.5	36.0	36.0	39.0	39.0	38.0	41.0	45.0	38.0	37.0
18	39.6	39.9	35.5	45.6	39.0	35.0	36.0	37.0	36.0	38.0	37.0	37.0	38.0	44.0	39.0	34.8
19	42.6	37.5	35.5	43.9	42.0	34.5	36.0	36.0	35.0	37.0	36.0	37.0	37.5	43.0	39.5	33.9
20	42.6	38.5	36.5	40.1	41.0	35.0	35.5	35.0	36.0	37.0	37.0	36.0	37.0	40.0	38.0	36.2
21	39.6	39.5‡	42.5	39.1	41.0	33.0	35.0	35.0	37.0	33.0	34.0	35.0	36.0	38.7	36.0	36.4
22	39.6	35.0	37.6§	37.6	41.0	35.0	34.0	35.0	35.0	34.0	33.0	34.0	36.0	37.5	34.2	35.8
23	41.6	35.9	38.6	39.6	42.0	34.0	33.0	34.0	34.0	34.0	32.0	34.0	35.5	37.0	33.5	36.0
Midn't	+40.6	+36.5	+39.6	+40.1	+41.0	+35.0	+34.0	+33.0	+32.0	+35.0	+32.0	+34.0	+35.0	+36.0	+33.0	+36.5
Means	+38.42	+41.87	+37.68	+44.19	+40.45	+38.86	+35.60	+36.31	+35.71	+36.33	+35.77	+37.21	+37.75	+40.59	+36.91	+35.75

Hour.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th.	27th.	28th.	29th.	30th.	31st.	Means.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	
1h.	(+37.1)	(+35.7)	(+35.9)	+34.0	+35.0	+41.0	+39.0	+43.0	+38.0	+38.0	+38.5	+35.0	+39.0	+33.0	+31.0	+36.65
2	(37.4)	(35.6)	(35.6)	35.2	36.0	40.0	40.0	43.0	39.0	37.0	38.0	36.5	37.3	33.0	30.0	+36.74
3	(37.9)	(35.4)	(35.1)	36.0	35.5	39.5	40.0	44.5	39.0	36.0	36.8	38.0	36.0	34.0	29.3	+36.77
4	(38.2)	(35.3)	(34.7)	36.7	35.5	38.3	39.5	41.0	39.0	35.0	37.0	39.0	35.0	34.9	28.0	+36.77
5	+39.0	+35.2	+33.5	40.5	35.0	38.5	40.0	41.0	37.0	35.0	38.0	40.5	35.0	35.0	29.0	+36.93
6	40.0	33.0	34.0	48.0	35.0	38.5	40.5	41.5	35.5	35.0	38.0	41.0	37.0	34.0	30.0	+37.59
7	41.0	37.0	34.0	41.0	36.0	39.5	41.0	41.0	37.0	36.0	38.0	41.5	36.0	35.5	30.0	+37.76
8	38.0	36.5	35.0	40.0	37.0	40.0	43.0	43.0	38.0	37.0	38.0	43.5	44.0	37.0	30.0	+38.43
9	38.2	37.0	35.0	40.0	36.2	40.0	47.0	46.0	39.0	39.0	39.0	45.0	44.0	37.0	30.0	+39.42
10	37.7	37.0	36.5	39.2	36.0	40.0	51.0	47.0	40.0	40.5	38.0	45.0	44.0	38.0	31.0	+39.63
11	38.0	36.5	37.0	38.7	35.5	41.0	51.0	46.0	41.0	41.5	38.0	45.0	37.0	38.0	34.0	+40.00
Noon	37.0	38.0	37.0	39.0	36.5	41.0	50.0	42.0	41.0	45.0	38.0	46.0	33.0	36.0	37.0	+40.04
13	36.0	36.0	37.0	38.5	37.0	40.0	48.0	39.0	42.0	44.0	37.0	47.0	34.0	36.0	36.0	+39.83
14	37.0	38.0	37.5	39.0	37.0	40.0	48.0	40.2	43.0	40.0	37.5	48.0	35.0	35.0	37.0	+39.69
15	35.0	39.0	40.0	40.0	37.0	39.0	49.0	41.0	41.0	39.0	38.0	46.0	34.0	38.0	37.0	+39.65
16	36.0	39.0	45.0	41.0	38.5	41.0	47.0	43.0	39.0	39.0	36.5	45.0	34.0	36.0	37.0	+39.65
17	36.0	39.0	42.0	41.0	39.0	38.0	46.0	39.0	38.0	40.0	36.5	41.0	34.2	38.0	36.0	+38.85
18	37.0	38.0	40.0	40.0	40.0	38.5	46.0	38.0	38.0	39.0	36.7	41.5	34.5	39.0	36.1	+38.51
19	37.0	38.8	39.0	39.0	39.5	38.0	44.0	39.0	38.0	38.0	36.0	40.8	34.8	41.0	35.5	+38.24
20	+36.5	37.5	37.5	39.0	40.0	37.0	42.0	39.0	37.0	38.0	35.5	40.5	34.0	38.0	35.0	+37.67
21	(36.2)	37.4	38.0	39.0	40.0	37.0	41.0	39.0	41.0	36.0	35.0	41.0	34.0	35.0	34.0	+37.24
22	(36.2)	37.5	37.0	37.0	39.0	38.2	42.0	40.0	40.5	36.0	35.7	41.5	33.0	35.0	34.0	+36.67
23	(36.1)	37.0	35.0	36.0	39.5	36.5	44.0	40.0	41.0	36.1	35.8	42.0	39.0	36.0	33.0	+36.83
Midn't	(+36.0)	+36.2	+35.0	+36.0	+39.0	+37.0	+45.0	+39.8	+40.0	+35.8	+36.0	+41.0	+37.0	+36.0	+32.0	+36.94
Means	+37.28	+36.90	+36.93	+38.91	+37.28	+39.06	+44.33	+41.58	+39.25	+38.16	+37.15	+42.14	+36.45	+36.18	+33.00	+38.19

[1] The instruments were removed from the floe to Fern Rock Island magnetic observatory on the first of the month.

* The readings of the sun and shade thermometers have evidently been exchanged in the log; the above abstract contains the correct figure.

† Original record corrected by 10°.

‡ Observations from 21 hours to the same hour (inclusive) on the following day, made on board the brig. Correction to brig thermometer from comparison with two standards at +37°, —0°.7, and —0°.4; mean adopted (for mercurial thermometer No. 9), —0°.5.

§ From 22h. July 3d to Aug. 15th, mercurial thermometer No. 15 was used, according to Mr. Sonntag's notes. Comparisons with the two standards at +36°, —0°.8, and —1°.4; adopted —1°.0. On July 4th, the column in the log is still headed spirit st. I have, therefore, applied the correction on that day accordingly. The scale of No. 15 is divided from 2 to 2 degrees; the readings are generally to the nearest half degree.

July 16th. Some thermometers were broken, the tent being blown down. July 22d. First six hours supplied from dry bulb readings. July 23d. At 10 and 11 o'clock, highest temperature of the season, +51°.0.

TEMPERATURE OF THE AIR IN SHADE OBSERVED AT VAN RENSSELAER HARBOR,

In August, 1854, in Lat. 78° 37′, Long. 70° 53′ W. of Greenwich.

Expressed in degrees of Fahrenheit's scale.[1]

Hour.	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.	16th.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1h.	+33.0	+29.0	+35.5	+34.0	+34.3	+35.0	+32.5	+31.5	+33.0	+33.0	+32.0	+29.0	+31.0	+29.0	+32.2	+24.7
2	33.0	29.0	36.0	34.0	33.0	36.2	32.0	31.5	36.0	34.0	33.0	31.0	31.0	28.0	32.2	25.2
3	32.0	29.1	36.0	33.0	32.0	37.0	31.0	32.0	38.0	33.5	34.5	32.0	31.0	28.0	31.2	24.7
4	33.0	29.0	37.0	34.0	33.1	35.0	30.0	32.0	41.0	33.0	35.0	31.0	31.0	28.0	32.2	26.2
5	33.5	31.0	35.0	36.0	34.0	33.0	33.0	32.0	35.0	33.0	34.0	29.0	30.5	28.0	30.7	28.2
6	34.0	34.0	33.0	37.0	37.0	34.1	35.0	33.0	36.0	34.0	33.0	29.0	30.0	29.0	31.2	30.2
7	37.0	35.0	32.0	38.0	35.0	34.8	37.0	33.0	36.0	35.0	33.0	29.0	31.0	30.0	31.2	32.2
8	41.0	36.0	32.0	39.0	35.0	34.7	43.0	39.0	37.0	35.0	32.0	30.0	31.0	31.0	31.7	36.2
9	45.0	38.0	34.0	40.0	37.0	34.7	41.0	40.0	38.0	36.0	33.0	32.0	31.0	30.0	31.7	35.2
10	49.0	39.0	35.0	39.5	36.0	35.5	44.0	41.0	39.0	37.0	37.0	33.0	31.0	34.0	32.2	36.2
11	42.0	41.0	35.0	39.0	37.0	36.1	36.0	41.0	40.0	37.5	42.0	32.0	31.0	34.0	33.2	37.2
Noon	41.0	43.0	35.2	39.0	37.0	36.5	33.0	40.0	41.0	39.0	38.0	31.0	31.0	33.0	34.2	38·2
13	37.0	40.0	37.0	38.5	39.0	37.0	35.0	41.0	39.0	40.0	38.0	31.0	31.0	34.0	33.2	37.2
14	36.0	39.0	35.0	38.5	40.0	37.0	35.0	42.0	38.0	41.0	37.0	33.0	31.0	36.0	35.2	37.2
15	37.0	40.0	31.0	39.0	39.0	39.0	36.0	41.0	37.0	40.0	37.0	33.0	31.0	33.0	35.2	37.7
16	37.5	37.0	33.0	39.0	39.5	35.0	35.0	41.0	37.0	39.0	36.0	33.0	31.0	32.0	33.2	37.2
17	36.0	35.0	35.0	39.0	37.0	35.0	33.0	40.0	37.0	38.3	37.0	32.0	31.0	31.0	34.2	37.2
18	35.0	34.0	35.0	38.5	37.0	34.8	34.0	39.0	36.0	38.0	38.0	32.0	31.0	31.5	34.2	38.2
19	37.0	38.0	34.7	38.0	36.5	35.0	35.0	36.0	35.5	37.0	38.0	32.0	31.0	32.0	33.2	33.2
20	35.0	37.0	34.5	35.0	36.0	35.0	35.0	33.0	34.0	36.0	39.0	32.0	31.0	32.0	33.2	41.2
21	35.0	36.5	32.0	33.0	36.0	35.0	35.0	34.0	35.0	38.0	37.0	32.0	31.0	32.5	32.2	35.2
22	31.7	34.8	33.0	34.0	36.0	34.0	35.0	34.0	34.0	38.0	36.0	31.0	31.0	32.0	31.2	28.2
23	30.5	33.0	34.0	34.5	37.0	34.0	32.0	34.0	33.0	39.0	35.0	30.5	31.0	31.5	30.2	28.2
Midn't	+28.2	+32.5	+35.0	+34.0	+39.0	+33.0	+33.0	+34.0	+33.0	+36.0	+34.0	+30.5	+31.0	+32.0	+29.2	+28.2
Means	+36.22	+35.41	+34.37	+36.81	+36.35	+35.27	+35.02	+36.46	+36.60	+36.68	+35.77	+31.25	+30.94	+31.31	+32.43	+33.05

Hour.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th.	27th.	28th.	29th.	30th.	31st.	Means.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1h.	+29.7	+28.2	+27.2	+33.7	+28.2	+25.2	+19.2	+19.2	+23.7	+26.2	(+28.2)	(+23.8)	+23.2	+31.2	+30.2	+29.22
2	30.2	28.2	28.2	31.7	28.2	25.2	19.2	19.2	24.2	26.2	(28.1)	(24.2)	27.2	31.2	29.2	+29.53
3	30.8	29.2	28.2	31.7	28.2	21.2	20.2	19.2	24.2	26.2	(27.9)	(23.9)	27.2	31.7	28.2	+29.45
4	31.2	32.2	29.2	32.2	28.2	22.7	20.2	19.2	25.2	26.2	(27.6)	(24.1)	27.2	31.2	27.7	+29.83
5	27.2	30.2	28.2	33.2	29.2	21.2	22.2	19.2	27.2	27.2	+27.2	(23.6)	29.2	31.2	28.2	+29.69
6	29.2	29.2	26.2	34.2	29.2	23.2	23.2	20.2	28.2	26.2	26.7	(24.8)	30.2	30.2	29.2	+30.31
7	29.2	30.2	29.2	33.2	30.2	25.2	23.2	22.2	28.7	27.2	26.2	(25.9)	30.2	29.2	30.2	+30.95
8	30.2	30.2	28.2	32.2	31.2	27.2	23.2	25.2	29.7	27.2	26.2	(26.3)	30.2	28.2	29.2	+31.94
9	30.2	31.2	28.2	32.2	31.2	30.2	23.2	33.2	30.7	27.2	28.2	+31.2	30.2	29.2	31.2	+33.04
10	30.2	32.2	29.2	31.7	30.7	31.2	23.2	32.2	31.2	26.7	29.2	33.2	30.7	29.4	31.2	+33.89
11	30.5	33.2	30.2	32.2	30.7	32.2	25.2	31.2	31.2	26.2	30.2	34.2	31.7	30.2	32.2	+34.04
Noon	33.2	33.7	33.2	34.2	29.2	32.2	28.2	31.2	31.2	26.2	31.2	31.2	31.7	31.2	32.2	+34.20
13	32.2	35.2	34.2	33.2	28.2	31.2	28.2	32.2	31.7	30.4	32.7	29.2	32.2	(30.0)	32.7	+34.24
14	32.2	35.2	33.2	33.2	29.2	30.2	27.2	32.2	31.7	31.2	30.2	28.2	34.2	(29.9)	32.7	+34.25
15	34.2	35.2	33.7	32.2	26.2	29.2	26.2	30.2	31.2	30.7	29.2	29.2	33.2	(29.8)	32.7	+33.84
16	33.2	35.2	33.7	31.2	27.2	28.2	26.2	28.2	30.7	31.2	29.2	30.2	33.2	(29.3)	30.0*	+33.30
17	32.2	35.2	34.2	30.7	28.2	26.2	(24.1)	31.2	29.2	31.7	30.2	29.2	34.2	(29.2)	30.0*	+33.01
18	31.2	34.2	33.2	30.2	29.2	25.2	23.2	31.2	29.2	30.2	29.2	29.7	32.2	(28.9)	(24.4)	+32.50
19	30.2	34.0	33.2	29.2	28.2	25.2	22.7	31.2	28.2	30.2	29.2	29.2	31.2	(28.9)	(22.5)	+32.11
20	30.2	33.2	33.2	28.2	29.2	24.2	23.2	30.2	27.2	(29.9)	27.2	29.2	30.7	(28.9)	(20.8)	+31.75
21	29.7	32.2	33.7	27.7	29.2	25.2	22.2	30.2	28.2	(29.6)	26.2	31.2	29.2	29.0*	22.2	+31.45
22	29.7	32.2	32.2	27.7	29.2	24.2	22.2	30.2	28.2	(29.2)	25.2	31.2	29.2	29.0*	21.2	+30.80
23	30.2	31.7	33.2	28.2	28.2	23.2	21.7	27.2	27.2	(29.0)	25.2	31.2	29.2	29.0*	21.2	+30.42
Midn't	+30.2	+29.2	+32.2	+27.4	+27.2	+23.2	+20.2	+24.2	+26.2	(+28.6)	+25.2	+30.2	+29.2	+29.0*	+20.2	+29.84
Means	+30.72	+32.11	+31.05	+31.31	+28.91	+26.35	+23.24	+27.08	+28.51	+28.37	+28.16	+28.60	+30.28	+29.79	+27.90	+31.82

[1] According to entries by Mr. Sonntag on Aug. 15th, and by Dr. Kane on Oct. 11th, mercurial thermometer No. 12 seems to have been used as shade thermometer between these dates. *Its scale is divided from 2 to 2 degrees. Correction by two standards,* —1°.1 and 0°.4; mean adopted, —0°.8. Mr. Sonntag applied the same correction in the tables, p. 420 of the narrative, vol. ii., after Sept. 1st.

* Supplied from the dry bulb readings.

TEMPERATURE OF THE AIR IN SHADE OBSERVED AT VAN RENSSELAER HARBOR,

In September, 1854, in Lat. 78° 37′, Long. 70° 53′ W. of Greenwich.

Expressed in degrees of Fahrenheit's scale. On deck of the brig Advance.

Hour	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.	16th.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1h.	+21.2	(+18.0)	+16.2	+ 7.2	+ 3.2	+ 7.7	+10.2	+ 8.2	+ 7.2	+ 9.2	+ 9.2	+ 1.5	−3.8	+ 0.2	+11.2	+ 3.2
2	19.2	(16.5)	15.7	8.8	6.2	8.2	8.2	7.7	6.2	9.7	8.2	+ 0.7	−2.8	2.2	+11.2	3.7
3	18.2	+15.2	15.2	8.2	4.2	8.2	7.2	8.7	9.2	9.7	7.2	+ 0.2	−2.8	3.2	+11.2	3.2
4	17.2	17.2	15.2	8.2	4.2	8.2	7.2	8.7	9.2	9.7	4.2	− 0.8	−1.8	3.7	+11.2	5.2
5	17.2	19.2	15.2	10.2	6.2	9.2	8.2	9.2	11.2	10.2	5.2	+ 2.2	−2.8	4.2	+12.2	7.2
6	17.7	19.2	15.2	13.2	8.2	10.2	8.2	9.2	12.2	10.2	5.2	+ 3.2	−4.8	6.2	+11.2	7.2
7	17.2	20.2	16.2	13.2	8.5	14.2	9.2	12.2	14.7	12.2	8.2	+ 5.2	+1.2	8.2	(+11.5)	7.2
8	21.2	20.2	18.2	16.2	8.7	17.2	8.7	13.2	13.7	15.2	15.2	+ 9.2	+6.2	8.2	(+11.8)	9.2
9	21.2	21.2	17.2	17.2	10.2	18.2	9.2	15.2	14.2	21.2	17.2	+10.2	+9.2	9.2	+12.2	12.2
10	23.2	21.2	17.2	17.2	11.2	19.2	9.2	16.2	15.2	21.2	17.2	+12.2	+9.7	11.2	+12.2	13.2
11	27.2	22.2	17.2	18.2	15.2	21.2	12.2	17.2	16.2	22.2	18.2	+12.2	+8.7	14.2	+14.2	12.2
Noon	22.2	24.2	19.2	24.2	16.2	22.2	15.2	15.2	19.2	22.2	19.2	+12.2	+9.2	13.2	+15.2	11.2
13	27.2	24.2	17.2	26.2	17.2	21.2	17.2	13.2	18.2	21.2	19.2	+11.2	+9.2	12.2	+16.2	11.2
14	26.2	23.2	18.2	27.2	15.2	20.2	16.2	13.2	19.2	21.2	16.2	+11.2	+6.2	13.2	+16.2	12.2
15	26.2	22.2	17.7	25.2	12.2	19.7	14.2	13.7	18.2	20.2	14.7	+ 9.2	+6.2	13.2	+16.2	12.2
16	25.2	22.2	17.2	24.2	11.2	17.2	13.2	12.2	17.2	18.2	15.2	+ 8.2	+7.2	12.2	+15.2	11.2
17	25.2	21.2	17.2	23.2	10.2	17.2	(12.6)	12.2	17.2	17.2	11.2	+ 7.2	+9.2	11.2	+12.2	12.2
18	25.2	21.2	17.2	20.2	10.2	15.2	(12.0)	11.2	17.2	13.2	7.7	+ 4.2	+8.2	11.2	+ 9.2	11.2
19	21.2	20.2	16.2	19.2	10.2	14.2	(11.4)	11.2	17.2	11.2	6.7	+ 3.2	+7.2	11.2	+ 7.2	10.2
20	21.2	19.2	13.2	17.2	9.7	11.2	(10.8)	11.2	16.2	9.2	5.2	+ 3.7	+8.2	11.2	+ 5.2	9.2
21	20.2	20.2	13.2	9.2	9.2	11.2	10.2	11.4	15.2	8.2	5.2	− 0.3	+8.7	12.2	− 0.8	8.2
22	19.2	17.2	9.2	6.2	8.7	11.2	9.2	10.2	15.2	6.2	3.2	− 0.8	+8.2	12.2	− 2.8	7.2
23	19.2	17.2	8.2	4.2	8.2	10.2	7.2	8.2	10.7	7.2	2.2	− 1.8	+7.7	12.2	+ 1.2	4.7
Midn't	+19.2	+16.2	+ 8.2	+ 5.2	+ 5.2	+10.2	+ 8.2	+ 8.2	+10.7	+ 7.7	+ 2.2	− 2.8	+3.2	+11.7	+ 2.2	+ 4.7
Means	+21.60	+19.95	+15.45	+15.39	+ 9.57	+14.28	+10.64	+11.54	+14.20	+13.91	+10.14	+ 5.02	+4.78	+ 9.49	+10.11	+ 8.72

Hour.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th.	27th.	28th.	29th.	30th.		Means.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°		°
1h.	+ 2.2	+1.2	+1.2	−6.8	+4.7	+ 2.2	−3.3	− 0.8	+15.2	+12.2	+13.2	+ 4.2	+ 7.2	− 0.3	...	+ 6.07
2	+ 4.2	+2.2	+2.2	−6.8	4.2	+ 4.2	−2.3	− 2.8	14.2	15.2	12.2	10.2	6.2	+ 0.2	...	+ 6.3
3	+ 4.2	+8.2	+2.2	−5.8	3.2	+ 3.2	−1.8	+ 0.2	14.2	17.2	11.2	10.2	6.2	17.2	...	+ 7.20
4	+ 3.2	+9.2	+1.2	−5.8	3.2	+ 3.2	−2.8	+ 4.2	14.2	15.2	12.2	11.2	7.2	17.2	...	+ 7.32
5	+ 3.2	+8.2	+0.7	−7.3	2.2	+ 1.2	−0.8	+ 1.2	13.2	15.2	11.2	11.2	7.2	16.2	...	+ 7.57
6	+ 5.2	+7.2	+1.2	−8.8	3.2	+ 3.0	+1.2	+ 3.2	15.2	13.2	11.2	13.2	7.2	15.2	...	+ 8.08
7	+11.2	+6.2	−0.8	−4.8	2.2	+ 3.0	+1.2	+ 7.2	15.2	13.2	11.2	11.2	8.7	15.2	...	+ 9.31
8	+13.2	+9.2	+3.2	−1.8	1.7	+ 7.0	+0.2	+ 7.2	14.2	14.2	9.2	10.2	9.2	14.2	...	+10.78
9	+11.2	+6.2	+5.2	−1.8	2.2	+ 9.2	− 0.8	+ 7.2	11.2	15.2	12.2	11.2	11.2	15.2	...	+11.67
10	+13.2	+3.2	+7.2	−0.8	3.2	+11.2	−2.8	+ 9.2	13.2	15.2	13.2	11.2	11.2	17.2	...	+12.38
11	+13.2	(+3.8)	+7.2	+0.2	1.2	+13.2	−2.8	+ 9.7	13.2	16.2	12.2	12.2	11.2	16.2	...	+13.19
Noon	+13.2	(+4.4)	+9.2	(+1.2)	9.2	+11.2	−1.8	+11.2	13.2	16.2	10.2	13.2	10.2	16.2	...	+13.91
13	+14.2	(+5.0)	+7.2	(+2.2)	5.2	+12.2	+0.2	+11.2	14.2	16.2	9.2	13.2	13.2	16.2	...	+14.06
14	+11.2	(+5.6)	+6.2	(+3.2)	7.2	+10.2	−4.8	+11.2	13.2	15.2	8.2	11.2	12.2	16.2	...	+13.38
15	+ 7.2	+6.2	+2.2	+4.2	4.2	+ 7.2	−3.8	+12.2	13.2	15.2	7.2	10.2	12.7	16.2	...	+12.52
16	+ 7.2	+4.2	+1.2	+3.7	5.2	+ 4.2	−4.8	+11.2	12.2	15.2	6.2	11.2	13.2	16.2	...	+11.78
17	+ 6.2	−2.3	−0.8	+3.2	7.2	+ 2.2	−3.8	+11.2	11.2	12.2	6.2	11.2	13.2	17.2	...	+11.03
18	+ 6.2	+1.2	+3.7	+3.2	6.2	+ 3.2	−2.8	+12.2	11.2	13.2	5.2	12.2	12.2	17.2	...	+10.63
19	+ 0.2	−1.8	−1.3	+3.2	7.2	− 2.8	−1.8	+13.2	10.2	13.2	5.2	10.2	11.2	17.2	...	+ 9.37
20	− 3.8	+1.2	−0.8	+3.2	6.2	− 2.8	−1.8	+13.2	11.2	13.2	4.2	11.2	11.2	17.2	...	+ 8.82
21	− 5.8	+7.2	−0.8	+3.2	6.2	− 2.8	(−1.6)	+15.2	13.2	14.2	7.2	10.2	11.2	15.2	...	+ 8.45
22	− 2.8	+8.2	−3.8	+4.2	5.7	− 2.8	(−1.4)	+15.2	13.2	13.2	6.2	11.2	9.2	14.2	...	+ 7.65
23	− 6.8	+7.7	−7.8	+3.2	5.2	− 2.8	(−1.2)	+13.2	12.2	12.2	3.2	6.2	6.2	13.2	...	+ 6.35
Midn't	− 7.8	+8.2	−8.8	+3.2	+4.2	− 2.8	(−1.0)	+11.2	+12.2	+12.2	+ 2.2	+ 5.2	+ 6.2	+13.2	...	+ 5.93
Means	+ 5.12	+4.99	+1.51	−0.38	+4.60	+ 3.92	−1.88	+ 8.64	+13.08	+14.33	+ 8.74	+10.53	+ 9.78	+14.55	...	+ 9.74

Sept. 30th. First part of the day, wind blowing in heavy squalls.

TEMPERATURE OF THE AIR IN SHADE OBSERVED AT VAN RENSSELAER HARBOR,

In October, 1854, in Lat. 78° 37′, Long. 70° 53′ W. of Greenwich.

Expressed in degrees of Fahrenheit's scale. On deck of the brig Advance.

Hour.	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.	16th.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1h.	+14.2	+ 4.2	+17.2	+21.2	+17.2	+13.2	—1.8	+6.2	— 7.8	—24.8	—28.2	—4.5	— 1.5	— 6.0	+13.5	—10.5
2	14.2	4.2	16.7	21.2	18.2	+13.2	—0.8	+7.2	8.8	23.8	27.5	—3.5	— 0.5	— 6.0	+ 8.5	11.5
3	15.2	9.2	16.2	22.2	17.2	+13.2	—1.8	+3.2	7.8	22.8	26.5	—4.5	— 0.5	— 5.5	+ 4.5	10.5
4	13.2	9.2	16.2	22.2	18.2	+14.7	—2.8	+3.2	7.8	24.8	27.5	—2.5	+ 0.5	— 6.8	+ 4.9	11.5
5	14.2	9.2	18.2	21.2	19.2	+11.2	—4.8	+3.2	7.8	25.8	26.5	—2.5	+ 0.5	— 6.5	+ 4.5	11.5
6	12.2	9.2	19.2	20.2	21.2	+10.2	—3.8	+3.2	8.8	24.8	25.5	—1.5	— 1.0	— 7.5	+ 5.5	7.5
7	13.2	9.2	17.2	20.2	21.2	+ 9.2	—3.8	+3.2	10.8	25.3	22.5	—2.0	— 1.5	— 1.5	+ 7.5	7.5
8	13.2	10.2	19.2	22.2	19.2	+10.2	—3.8	+4.7	14.8	24.8	18.5	—1.0	— 1.5	— 1.5	+ 5.5	9.5
9	13.2	11.2	21.2	23.2	19.2	+10.2	—4.8	+2.2	11.8	25.8	16.5	+1.5	— 3.5	— 1.5	+ 3.5	8.5
10	15.2	10.7	21.2	23.2	19.2	+10.2	—6.8	+3.2	11.8	24.8	14.5	+3.5	— 4.5	+ 1.5	+ 2.5	9.5
11	14.2	9.2	21.2	23.2	20.2	+13.2	—7.3	+4.2	13.8	22.8	13.5	+3.3	— 4.5	— 1.5	— 2.5	9.5
Noon	15.2	10.2	21.7	23.2	19.2	+ 2.2	—5.8	—0.8	12.8	23.8	12.5	+3.3	— 7.0	— 1.5	— 3.5	12.5
13	15.2	11.7	21.2	23.2	19.2	+ 4.2	—4.8	+1.2	13.8	23.8	12.5	+4.5	— 7.0	— 1.8	— 3.7	14.5
14	13.2	12.2	23.2	23.2	20.2	+ 3.2	—2.8	—0.8	14.8	22.8	13.5	+4.5	— 9.0	— 1.5	— 4.3	15.5
15	10.2	13.2	23.2	21.2	20.7	+ 3.2	—3.3	—1.8	15.8	22.8	12.5	+1.7	—11.0	+ 0.1	— 4.5	18.0
16	10.2	14.7	23.2	20.2	19.7	+ 4.2	+0.2	—2.8	17.8	22.8	14.5	+1.7	—11.0	+ 0.1	— 5.5	15.5
17	9.2	17.2	21.2	17.2	19.2	+ 4.2	—1.8	—3.8	17.8	22.8	14.0	+0.5	—12.5	+ 1.5	— 7.5	17.5
18	8.2	16.2	19.2	16.2	19.2	+ 4.2	+0.2	—3.8	18.8	25.8	12.0	—2.0	—13.5	+ 2.5	— 7.5	17.5
19	9.2	17.2	18.2	15.2	19.2	+ 2.2	+1.2	—4.8	20.8	26.8	11.5	—1.5	—13.5	+ 3.5	— 7.5	19.0
20	9.2	16.2	20.2	17.2	19.2	+ 1.2	+0.2	—6.8	21.8	27.8	11.0	—1.5	—12.5	+ 4.5	— 7.0	19.5
21	9.2	15.2	21.2	18.2	17.2	+ 1.2	—0.8	—8.8	23.8	27.8	10.0	—1.5	—11.5	+ 1.5	— 6.5	17.5
22	8.7	15.2	22.2	20.2	17.2	— 0.8	—0.3	—6.8	22.8	28.8	10.0	—2.5	— 9.5	+ 1.5	— 6.8	18.0
23	7.2	14.2	22.2	19.2	16.2	— 1.8	+1.2	—8.8	23.8	29.3	5.5	—2.5	— 9.0	+12.5	— 8.5	18.0
Midn't	+ 6.2	+14.2	+21.2	+18.2	+13.2	— 1.8	+1.2	—8.8	—23.3	—29.3	— 5.5	—2.5	— 8.0	+12.5	— 8.5	—17.7
Means	+11.80	+11.80	+20.08	+20.53	+18.74	+ 6.43	—2.40	—0.57	—14.99	—25.20	—16.34	—0.48	— 6.38	— 0.31	— 0.97	—13.68

Hour.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th.	27th.	28th.	29th.	30th.	31st.	Means.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1h.	—14.5	—11.5	—14.5	— 9.5	—21.5	(—16.2)	(—20.7)	—13.5	—16.0	—24.0	—25.5	—34.5	—27.0	—26.5	—22.0	— 8.89
2	14.5	8.5	10.5	12.3	21.5	(—14.8)	(—22.4)	14.0	16.0	24.5	25.6	32.5	27.0	22.3	21.0	— 8.59
3	15.5	8.2	7.9	13.5	22.0	—13.5	—24.0	10.0	17.0	25.5	26.0	36.5	29.0	22.0	22.0	— 8.76
4	15.5	8.0	6.7	15.5	21.5	13.0	23.5	9.0	18.0	26.5	27.0	34.5	27.0	20.0	21.0	— 8.65
5	14.5	8.0	6.5	13.5	19.2	13.2	24.0	5.0	18.0	26.5	28.0	35.5	24.0	20.0	20.0	— 8.38
6	13.5	7.9	6.0	13.5	19.5	13.4	24.0	3.0	22.0	18.0	28.0	37.8	23.0	19.0	20.0	— 8.00
7	11.5	7.5	6.5	13.5	20.0	16.0	18.0	4.0	22.5	17.0	31.0	37.0	27.0	18.0	19.5	— 7.84
8	14.0	8.5	6.5	14.0	21.7	15.0	14.0	7.5	22.0	15.0	32.0	37.0	27.0	18.0	20.0	— 7.85
9	13.5	12.5	6.5	14.0	20.5	13.0	13.0	9.0	22.0	17.0	34.0	34.0	23.5	18.3	21.0	— 7.70
10	14.5	8.5	6.8	13.2	20.0	10.5	12.5	9.5	23.0	23.0	33.5	25.0	20.0	17.5	22.5	— 7.15
11	14.5	8.5	10.0	16.7	19.5	9.0	12.0	9.5	25.0	27.0	34.8	20.0	20.0	19.5	23.0	— 7.60
Noon	14.5	8.5	7.5	17.9	19.5	8.0	11.0	9.0	26.0	30.0	34.5	19.5	20.0	20.0	22.0	— 8.16
13	15.5	10.5	7.5	18.0	19.0	8.0	11.0	9.0	26.0	32.5	34.0	15.5	20.0	21.0	22.0	— 8.10
14	16.5	13.5	8.0	17.5	18.5	8.0	12.0	7.0	25.5	32.0	34.5	14.7	22.0	22.5	22.0	— 8.37
15	18.0	14.0	3.5	18.5	17.5	8.5	11.0	5.5	24.5	29.0	34.0	16.0	21.0	23.0	18.0	— 8.33
16	19.5	14.9	3.5	19.0	18.5	9.5	13.0	3.0	22.0	22.0	34.0	18.0	23.0	24.0	19.0	— 8.34
17	18.5	13.5	4.5	17.0	18.5	11.0	13.0	4.5	23.4	24.0	33.5	14.0	24.0	25.3	19.5	— 8.76
18	18.5	17.5	4.5	17.5	18.5	9.0	14.0	5.3	24.0	26.0	31.0	19.0	21.0	26.3	20.0	— 9.26
19	20.5	17.5	8.7	19.7	18.5	11.0	14.0	6.5	27.0	26.0	29.0	22.5	26.0	27.0	22.0	—10.17
20	19.5	18.0	8.0	19.9	17.5	12.0	13.0	7.5	25.5	24.0	30.0	26.0	27.0	27.0	24.5	—10.30
21	15.5	18.5	7.5	20.5	17.5	13.0	13.0	7.0	22.0	24.5	30.0	27.0	30.0	25.5	24.0	—10.32
22	14.0	14.5	6.8	21.5	17.0	13.5	15.0	7.5	21.0	24.0	34.5	27.0	29.5	24.0	28.0	—10.29
23	12.5	13.5	6.5	20.5	18.5	18.0	15.0	9.0	18.0	25.0	36.0	28.0	29.0	24.0	30.0	—10.26
Midn't	—11.5	—11.5	— 7.5	—21.5	—17.5	—19.0	—15.0	—10.5	—23.0	—26.0	—36.0	—27.0	—30.0	—23.0	—30.5	—10.59
Means	—15.44	—11.81	— 7.18	—16.59	—19.31	—12.34	—15.75	— 7.72	—22.06	—24.54	—31.52	—26.60	—24.88	—22.24	—22.23	— 8.78

Oct. 11th. Shade thermometer No. 12 was withdrawn, and mercurial thermometer *B* substituted. From four comparisons with the spirit standard on shore, I deduced the correction +1°.5. This thermometer was used for 11 days.

Oct. 18th. The sun at meridian no longer reaches our brig.

Oct. 22d. Spirit thermometer *A* was used from this date. This thermometer was uniformly exposed in a wind protected case, suspended near foremast, 16 feet above water-line. From 16 comparisons, I deduce the correction +2°.0.

TEMPERATURE OF THE AIR IN SHADE OBSERVED AT VAN RENSSELAER HARBOR,

In November, 1854, in Lat. 78° 37′, Long. 70° 53′ W. of Greenwich.

Expressed in degrees of Fahrenheit's scale. On deck of the brig Advance.

Hour.	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.	16th.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1h.	—30.5	—37.7	—24.0	...	...	...	...	...	...	...	—12.0	—20.5	—20.5	—28.5	—31.0	—32.0
2	31.0	35.5	27.0	...	...	...	...	...	...	...	12.5	21 0	20.0	28.0	32.0	29.0
3	29.0	35.5	26.5	...	...	...	...	...	...	...	12.0	22.0	19.0	28.0	31.0	29.0
4	30.0	35.5	26.5	...	...	...	...	...	...	...	13.0	22.6	21.0	30.0	32.0	28.0
5	31.0	36.5	26.0	...	...	...	...	...	...	...	13.0	21.0	21.1	28.0	33.3	37.0
6	31.0	38.0	26.2	...	...	...	...	...	...	...	13.0	19.0	21.4	29.0	34.3	37.5
7	30.0	33.0	26.7	...	...	...	...	...	...	...	12.8	21.0	19.8	27.0	34.4	33.0
8	32.0	31.5	25.0	...	...	...	...	...	...	...	19.3	21.5	23.9	25.5	35.3	33.5
9	24.0	32.0	31.0	...	...	...	...	...	...	...	21.5	16.6	23.0	25.5	34.0	34.8
10	27.0	33.0	30.0	...	...	...	...	...	...	...	22.0	17.5	22.1	22.5	36.0	35.0
11	19.0	31.0	27.0	...	...	...	...	...	...	...	19.0	16.5	25.5	25.5	35.5	35.0
Noon	18.5	31.0	23.5	...	...	...	...	...	...	...	20.5	14.5	26.0	26.0	33.5	35 0
13	18.0	24.0	26.0	...	...	...	...	...	...	...	22.0	14.6	24.0	27.0	37.0	36.0
14	18.0	24.5	28.0	...	...	...	...	...	...	...	22.0	15.0	24.5	27.0	38.0	37.0
15	18.5	27.0	30.0	...	...	...	...	...	...	...	21.5	17.0	25.0	27.0	38.5	37.0
16	18.5	29.5	28.0	...	...	...	...	...	...	...	21.8	18.0	26.0	26.0	39.0	37.5
17	23.0	30.5	30.0	...	...	...	...	...	...	...	22.0	15.8	28.0	26.4	38.0	36.0
18	25.0	29.0	32.0	...	...	...	...	...	...	...	23.0	13.5	29.0	27.2	38.0	36.4
19	29.2	31.0	34.0	...	...	...	...	...	...	...	21.5	15.5	24.3	28.7	39.0	38.0
20	31.0	30.5	35.5	...	...	...	...	...	...	...	22.0	16.0	26.0	30.0	37.0	38.2
21	32.0	33.0	36.5	...	...	...	...	...	...	...	21.0	16.0	27.0	32.0	37.0	39.0
22	30.0	34.0	37.0	...	...	...	...	...	...	...	21.0	15.0	26.5	32.5	37.0	38.0
23	35.0	36.0	38.0	...	...	...	...	...	...	...	21.0	15.0	25.0	33.0	34.0	40.0
Midn't	—36.0	—35.0	—39.0	...	...	...	...	...	...	...	—20.0	—16.5	—26.0	—32.0	—33.0	—40.0
Means	—26.97	—32.26	—29.72	—28.35 *	—26.98 *	—25.61 *	—24.23 *	—22.86 *	—21.48 *	—20.11 *	—18.73	—17.57	—23.94	—28.01	—35.33	—35.50

Hour.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th.	27th.	28th.	29th.	30th.	Means.	Corrected means.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1h.	—38.5	—31.0	— 5.5	— 6.5	— 9.0	—16.0	—3.5	+7.0	0.0	— 5.7	—11.8	—18.0	—23.3	—36.8	—18.93	—19.90
2	39.0	33.0	6.0	— 3.0	10.0	14.0	—2.0	+6.5	— 2.0	6.7	15.0	19.9	23.3	35.7	—19.09	—20.03
3	41.0	33.0	7.0	— 2.0	12.0	14.3	—3.0	+3.0	1.5	6.7	17.5	21.5	21.7	35.1	—19.36	—20.28
4	41.5	31.0	6.0	— 2.0	13.0	14.5	—3.5	+3.0	2.0	8.8	17.9	20.5	20.5	35.2	—19.65	—20.54
5	41.0	(28.8)	10.3	— 2.0	15.8	12.0	—2.0	0.0	3.5	10.4	19.3	24.4	20.5	35.7	—20.55	—21.35
6	40.0	(26.6)	10.6	— 1.0	15.0	11.0	—2.0	+1.0	4.0	13.5	22.9	24.4	21.6	37.3	—20.80	—21.62
7	38.0	24.5	15.5	+ 1.0	15.0	12.0	—5.0	0.0	4.0	9.9	23.5	25.4	26.4	38.8	—20.64	—21.41
8	36.0	24.0	17.0	+ 1.0	17.0	12.0	—7.0	—4.0	3.0	13.0	22.0	25.6	23.8	40.1	—21.35	—22.05
9	36.0	25.0	18.0	0.0	17.5	11.5	—6.0	—1.5	5.0	11.8	21.5	25.6	24.9	40.8	—21.20	—21.90
10	35.0	24.5	19.0	+ 2.0	18.5	9.8	—7.0	—1.5	5.8	12.0	21.0	25.8	26.4	41.8	—21.36	—22.01
11	35.5	13.5	15.0	— 0.3	19.0	9.5	—3.3	—1.5	6.3	12.0	19.8	24.9	24.9	39.7	—19.97	—20.77
Noon	34.0	5.0	15.1	— 2.3	21.0	9.5	—4.7	—1.0	6.8†	15.5	19.5	24.4	26.4	37.8	—19.63	—20.48
13	36.0	4.0	15.0	— 0.7	24.0	9.0	—4.0	—0.5	8.0	17.0	18.9	24.4	30.4	43.2	—20.16	—20.98
14	34.0	3.5	17.5	— 1.0	24.0	8.8	—2.0	—0.5	7.5	17.0	19.5	25.8	31.5	39.7	—20.27	—21.09
15	32.0	3.5	18.0	— 1.5	23.0	8.0	+4.0	0.0	9.4	15.5	19.3	25.4	35.8	38.8	—20.33	—21.14
16	25.0	4.0	21.4	— 2.0	19.0	8.0	+2.0	0.0	14.3	15.5	19.4	25.5	41.9	39.7	—20.78	—21.58
17	25.0	2.1	22.0	— 2.0	16.0	7.0	+1.0	—2.0	14.5	17.5	19.0	24.7	43.2	41.6	—21.10	—21.90
18	24.0	4.0	23.0	— 4.0	16.0	7.6	+2.0	+1.0	14.5	17.0	19.3	27.7	43.7	42.1	—21.43	—22.23
19	25.5	4.5	15.0	— 5.0	16.0	7.4	+5.0	+1.0	11.4	16.5	19.5	28.4	45.6	45 6	—21.[illegible]5	—22.39
20	26.0	5.0	16.0	— 7.0	19.0	6.0	+6.0	+1.0	9.9	11.4	19.7	29.1	47.9	39.7	—21.56	—22.43
21	34.0	4.7	18.0	— 6.5	19.7	6.0	+5.0	+0.5	11.4	11.4	19.2	26.9	47.3	39.3	—22.28	—23.10
22	32.0	4.0	16.3	— 7.3	19.0	6.7	+5.0	0.0	9.1	10.9	19.5	23.3	43.2	37.8	—21.53	—22.40
23	34.0	4.0	8.0	— 8.0	20.5	7.0	+5.4	—1.0	7.4	14.5	19.5	23.3	38.8	37.9	—21.55	—22.42
Midn't	—34.0	— 4.0	—12.0	—10.0	—21.0	— 6.0	+5.0	—0.5	— 7.4	—14.5	—22.0	—19.5	—35.7	—37.8	—21.60	—22.49
Means	—34.04	—14.47	—14.47	— 2.92	—17.50	— 9.73	—0.61	+0.42	— 7.03	—12.70	—19.44	—24.35	—32.03	—39.08	[—20.70]	—21.52

* Mean daily temperatures not given in Appendix XII. Vol. II. of the narrative. The above values are interpolated. On account of this, a correction was applied to the mean daily values (—0°.82). Besides this correction, a small one was applied to the hourly means to refer them to the middle of the month.

† From noon, Nov. 25th, the second spirit standard was used. From a number of comparisons, its corrections were found the same as those made out for spirit standard *S*.

Nov. 11th. The thermometer can hardly be observed at noonday without a light. Nov. 15th. Can read Parry's type at noon, but with great difficulty. Nov. 19th. Could not read the type at noon. Nov. 20th. Spirit standard and long ether thermometer on shore, and long mercurial standard on board, broken by last night's gale. Nov. 29th. Mercury congealed at —42°.7; resumes its fluidity at —38°.

TEMPERATURE OF THE AIR IN SHADE OBSERVED AT VAN RENSSELAER HARBOR,

In December, 1854, in Lat: 78° 37′, Long. 70° 53′ W. of Greenwich.

Expressed in degrees of Fahrenheit's scale. On deck of the brig Advance.

Hour.	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.	16th.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1h.	—35.7	—22.4	—35.7	—32.6	—40.8	—39.7	(—48.6)	(—43.2)	(—44.8)	(—41.7)	(—26.8)	(—52.8)	(—49.4)	—46.3	—47.9	—37.2
2	34.7	30.4	34.7	33.8	41.9	38.8	(41.7)	(42.6)	(44.0)	(41.8)	(27.1)	(51.6)	—50.4	43.2	47.2	37.3
3	43.2	29.5	35.7	32.6	41.9	40.8	—34.8	(42.0)	—43.2	—41.9	—27.4	—50.4	50.4	45.0	48.0	39.7
4	43.2	28.0	34.3	32.6	39.9	41.9	38.8	(41.4)	41.9	42.5	28.4	46.8	52.9	47.0	48.8	50.7
5	41.9	26.9	32.6	36.2	39.2	42.5	40.8	—40.8	(42.8)	(42.0)	27.4	41.8	51.6	47.9	48.2	42.3
6	39.7	26.8	31.5	34.2	37.8	42.6	41.9	41.8	(43.6)	(41.4)	29.5	40.0	45.0	47.3	48.0	41.8
7	43.7	34.8	29.0	35.8	44.4	42.8	41.4	41.2	44.5	40.8	25.9	31.9	37.8	46.1	51.6	45.6
8	44.5	35.7	27.3	36.8	38.2	43.2	41.6	43.2	43.8	38.7	25.6	31.5	38.2	46.1	49.4	45.0
9	43.2	29.5	22.4	35.8	37.2	41.9	38.8	45.9	42.7	41.1	29.1	32.5	39.0	49.1	47.9	49.3
10	41.9	29.5	20.5	34.8	37.3	39.0	40.8	44.6	42.8	41.3	29.5	31.0	38.8	49.5	47.9	50.4
11	40.8	30.0	23.3	37.5	35.8	38.8	39.3	43.2	40.8	40.0	32.0	27.9	37.8	51.2	48.6	46.8
Noon	39.3	31.5	20.0	35.8	33.1	43.7	40.5	43.2	39.0	39.7	35.1	26.9	35.0	52.4	47.9	46.0
13	43.2	35.7	15.5	35.8	32.6	44.7	40.8	42.3	38.3	39.7	37.8	28.4	35.7	53.3	46.8	46.8
14	43.2	33.8	17.0	36.8	32.6	45.6	42.5	41.3	41.9	37.5	39.1	28.7	37.8	52.9	46.4	47.5
15	36.8	41.3	18.7	37.2	31.5	45.0	43.4	40.3	(42.5)	37.3	40.8	28.7	37.2	50.0	47.3	47.6
16	32.5	41.9	18.5	37.8	30.5	44.4	44.2	34.8	(43.1)	37.6	48.4	30.8	37.8	50.4	41.4	47.3
17	32.5	41.9	19.5	39.0	29.7	43.6	44.5	31.1	43.7	38.0	49.1	30.8	38.1	51.6	40.2	47.3
18	33.2	43.2	20.0	35.2	29.5	45.1	44.0	29.2	44.6	32.0	49.1	31.5	38.8	52.1	39.7	45.2
19	33.5	42.5	20.5	36.8	30.5	44.5	44.1	34.5	41.9	36.8	50.7	31.8	39.1	51.6	44.5	45.6
20	29.0	38.5	19.5	38.6	31.5	44.5	—46.2	37.8	43.2	37.1	53.2	37.8	39.3	48.2	—50.8	45.9
21	26.1	37.8	29.0	38.3	31.8	44.5	(45.6)	40.2	41.2	27.7	56.2	42.5	52.1	46.0	(48.1)	45.6
22	21.5	36.2	32.6	38.1	32.5	44.8	(45.0)	42.3	—41.3	—25.9	—56.4	—46.3	46.5	42.5	(45.4)	45.1
23	17.5	37.6	32.8	40.2	35.8	51.8	(44.4)	43.2	(41.4)	(26.2)	(55.2)	(47.3)	40.3	41.3	(42.7)	39.7
Midn't	—16.7	—35.7	—32.8	—39.7	—38.0	—55.5	(—43.8)	—45.6	(—41.5)	(—26.5)	(—54.0)	(—48.4)	—39.7	—43.2	(—40.0)	—38.8
Means	—35.73	—34.42	—25.98	—36.33	—35.58	—43.74	—42.40	—40.65	—42.44	—37.30	—38.91	—37.42	—42.03	—48.09	—46.45	—44.77

Hour.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th.	27th.	28th.	29th.	30th.	31st.	Means.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1h.	—36.8	—38.1	— 8.9	—19.7	—25.9	—19.7	—47.2	(—49.0)	—54.4	—47.9	—47.9	—29.0	—34.8	—18.5	—43.2	—37.63
2	33.8	38.8	12.5	20.0	24.4	18.1	47.6	—48.3	(50.6)	47.9	48.2	28.5	34.2	19.7	44.5	—37.36
3	29.5	40.8	13.0	24.8	23.8	18.0	(48.1)	50.4	46.8	46.1	47.9	28.2	35.8	20.5	44.8	—37.58
4	25.4	39.7	12.2	25.0	22.9	18.8	48.7	54.4	46.6	46.3	47.9	29.0	38.3	21.5	43.2	—38.03
5	29.4	35.3	11.0	24.3	22.4	22.4	49.4	51.6	47.5	44.8	47.6	26.4	37.8	19.5	40.1	—37.24
6	31.8	39.7	17.0	24.0	23.3	26.4	48.3	49.1	41.9	40.8	48.1	24.6	38.1	16.8	37.1	—36.77
7	43.9	40.9	12.0	23.0	23.3	37.8	51.6	46.8	39.7	39.7	47.9	22.4	38.8	15.0	32.6	—37.18
8	44.5	40.8	20.0	26.3	23.3	37.8	52.9	47.1	35.1	39.1	48.6	21.7	38.0	14.5	29.6	—37.04
9	42.6	24.1	22.2	23.0	22.9	41.8	52.9	47.3	33.1	38.3	45.6	21.4	37.3	14.0	26.3	—36.07
10	42.5	23.3	25.0	23.5	22.6	41.3	53.1	48.1	32.6	39.0	43.7	20.8	31.0	14.5	25.4	—35.68
11	42.5	21.6	25.3	22.7	21.6	43.2	52.9	49.1	29.5	39.7	42.5	20.5	27.4	16.5	24.0	—35.25
Noon	43.5	14.5	24.5	23.3	19.8	42.5	55.2	49.7	29.2	44.5	41.8	19.0	20.0	18.0	23.8	—34.79
13	46.2	14.0	23.3	34.0	17.5	41.8	52.9	49.1	29.2	44.5	42.3	19.5	20.4	19.5	23.4	—35.32
14	47.1	9.8	24.0	35.3	13.8	43.5	54.6	50.4	30.5	43.5	43.2	17.0	22.6	22.4	23.7	—35.84
15	47.9	7.0	25.5	34.8	11.4	41.8	54.5	51.0	33.2	45.6	42.3	15.8	24.9	28.9	22.8	—35.90
16	47.4	7.4	26.6	35.5	13.0	42.3	51.8	51.6	35.2	47.9	40.8	14.5	26.4	38.1	21.4	—36.17
17	45.6	8.0	26.2	35.7	14.1	43.7	50.7	54.0	35.1	48.3	41.1	17.4	23.3	41.6	22.7	—36.39
18	48.1	8.5	27.5	35.9	15.9	43.7	49.7	54.8	36.6	47.9	46.8	15.5	23.6	40.8	23.3	—36.48
19	45.6	9.4	27.0	35.8	18.5	45.0	51.0	58.3	40.2	47.3	34.8	19.5	22.4	42.5	23.6	—37.09
20	42.5	10.4	27.5	36.0	18.5	45.6	49.6	57.3	41.3	46.8	32.6	20.0	21.0	45.6	22.7	—37.05
21	43.2	11.6	(27.4)	37.0	(23.0)	45.6	(50.5)	56.9	43.4	46.3	31.5	22.4	19.5	45.6	22.4	—38.03
22	45.9	—12.7	(27.2)	34.8	27.4	45.6	51.3	59.1	43.7	45.8	29.0	22.8	17.5	45.6	24.4	—38.23
23	47.0	(11.4)	(27.1)	31.7	25.4	46.2	50.4	59.9	45.6	45.6	25.4	32.6	17.5	46.8	26.4	—37.95
Midn't	—44.5	(—10.1)	—26.0	—26.9	—21.9	—46.1	—49.8	—59.9	—47.2	—46.7	—28.5	—33.6	—17.9	—46.8	—26.4	—37.84
Means	—41.55	—21.58	—21.66	—28.88	—20.69	—37.45	—51.03	—52.22	—39.51	—44.60	—41.50	—22.59	—27.85	—28.05	—29.08	—36.79

Dec. 19th. From 3h. to 20h., the readings were supplied from thermometer *A*.

Dec. 20th. From 1h. to 14h., the readings were supplied from thermometer *A*.

TEMPERATURE OF THE AIR IN SHADE OBSERVED AT VAN RENSSELAER HARBOR,

In January, 1855, in Lat. 78° 37′, Long. 70° 53′ W. of Greenwich.

Expressed in degrees of Fahrenheit's scale. On deck of the brig Advance.

Hour.	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.	16th.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1h.	—25.4	—45.6	—38.4	—39.2	(—47.6)	(—34.4)	(—51.6)	—65.5*	—55.8	—40.8	—41.3	—44.9	—26.4	—19.5	—36.8	—31.5
2	25.4	43.7	37.8	39.4	—48.3	(34.6)	(52.2)	64.5	55.5	42.8	43.2	45.6	26.4	21.5	37.3	35.1
3	25.7	42.3	37.1	40.4	48.5	—34.8	—52.9	65.0	55.9	43.2	42.5	47.1	27.4	20.5	35.8	34.1
4	26.4	43.2†	37.3	41.8	48.7	34.2	54.8	64.5	55.9	41.8	42.3	47.9	27.0	20.7	35.8	34.8
5	26.9	43.7†	36.8	43.7	49.1	35.2	51.6	63.7	55.5	39.8	40.8	48.3	26.4	21.5	36.1	35.1
6	29.0	45.6†	37.1	44.8	48.3	38.1	50.0	62.9	57.6	39.0	39.0	49.1	25.7	22.4	35.3	35.3
7	30.5	47.9	37.3	46.8	47.9	43.7	47.3	63.1	58.7	39.2	34.8	50.4	24.9	23.7	33.8	35.8
8	22.7	47.6	36.8	46.6	44.5	43.2	50.4	58.3	58.3	35.7	30.0	49.7	23.4	24.4	37.1	38.3
9	34.1	46.8	36.3	49.4	42.3	43.2	50.7	56.2	56.0	35.2	24.4	47.9	24.4	23.4	30.5	41.4
10	34.8	47.1	35.7	49.6	43.5	45.0	51.1	55.5	56.9	35.0	23.4	45.6	17.5	23.4	31.0	39.7
11	36.3	47.3	35.7	51.3	42.3	49.9	50.9	55.8	57.5	34.8	21.5	43.2	14.5	23.4	31.5	39.3
Noon	37.1	42.5	36.8	49.6	41.8	54.6	50.4	55.8	57.7	35.1	18.5	41.8	10.4	23.4	30.5	36.7
13	37.5	43.2†	37.1	48.3	39.2	54.8	50.4	55.5	56.9	34.8	21.5	41.8	11.0	23.7	30.0	(35.5)
14	38.3	43.5†	37.8	48.1	38.8	54.6	51.0	55.5	56.6	35.1	27.3	41.8	10.7	23.4	29.5	(34.4)
15	38.8	43.7†	38.0	46.8	38.3	55.5	51.6	54.8	54.8	35.7	32.9	41.1	11.5	24.9	31.8	(35.2)
16	39.2	44.5†	38.3	47.1	37.8	56.1	52.9	54.6	54.2	36.8	36.3	40.8	11.8	25.4	32.6	(32.0)
17	38.8	44.5	39.2	45.6	36.0	56.2	53.5	54.2	51.6	37.1	38.9	41.8	12.8	25.7	33.0	(30.9)
18	38.1	46.5	39.7	45.0	35.7	58.5	56.9	55.0	48.5	37.8	39.7	42.5	14.0	26.4	32.0	(29.8)
19	34.8	43.2†	40.7	45.0	35.2	58.3	61.4	56.2	49.9	38.8	41.0	40.8	16.5	26.9	31.5	28.7
20	35.1	41.3†	41.0	46.2	32.6	56.2	61.6	53.5	51.5	39.2	43.2	40.8	17.8	27.7	32.0	28.5
21	34.0	40.8	40.8	48.1	32.4	56.9	64.4	52.9	49.7	37.8	43.2	46.0	18.5	(29.5)	(31.9)	28.0
22	34.8	41.1	40.8	46.2	34.8	(54.9)	64.3	53.5	47.4	39.7	44.5	34.8	19.0	(31.3)	(31.8)	27.9
23	40.1	39.2	40.8	46.8	34.6	52.9	64.4	53.8	43.2	40.2	44.5	31.0	19.0	(33.1)	(31.7)	37.7
Midn't	—46.0	—39.0	—39.7	—47.0	—34.2	—51.0	—65.3	—55.1	—40.0	—40.8	—44.5	—27.8	—19.3	(—34.9)	(—31.6)	(—35.1)
Means	—33.74	—43.91	—38.21	—45.95	—40.93	—48.20	—54.65	—57.77	—53.57	—38.17	—35.80	—43.02	—19.01	—25.03	—32.95	—34.12

Hour.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th.	27th.	28th.	29th.	30th.	31st.	Means.	Corrected means.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1h.	—32.5	—23.3	—25.9	—18.5	—36.3	—26.4	—35.0	—24.4	...	...	...	...	...	...	...	—36.13	—28.28
2	30.5	18.5	26.2	20.5	36.4	27.9	34.9	22.4	...	...	...	...	...	...	...	—36.27	—28.40
3	30.0	17.5	23.5	27.4	33.8	31.5	33.8	21.4	...	...	...	...	...	...	...	—36.34	—28.44
4	27.4	19.5	23.3	25.9	33.8	32.0	33.1	22.4	...	...	...	...	...	...	...	—36.44	—28.47
5	27.7	(19.7)	(23.7)	(26.5)	(33.2)	(33.0)	(32.6)	20.5	...	...	...	...	...	...	...	—36.30	—28.41
6	26.9	(19.8)	(24.0)	(27.0)	(32.5)	(33.9)	(32.0)	20.5	...	...	...	...	...	...	...	—36.49	—28.64
7	26.4	20.0	24.4	(27.5)	(31.9)	(34.9)	(31.5)	20.0	...	...	...	...	...	...	...	—36.77	—28.85
8	26.9	20.5	22.9	(28.0)	(31.2)	(35.8)	(31.0)	19.5	...	...	...	...	...	...	...	—35.95	—27.98
9	26.4	22.4	21.4	28.5	30.5	36.8	30.5	18.5	...	...	...	...	...	...	...	—35.72	—27.76
10	25.4	21.5	21.9	28.5	30.5	36.8	31.5	17.5	...	...	...	...	...	...	...	—35.35	—27.37
11	6.5‡	23.3	22.4	28.5	28.4	36.8	32.5	15.5	...	...	...	...	...	...	...	—34.55	—26.59
Noon	5.0	23.8	23.3	27.4	27.9	37.6	33.8	13.5	...	...	...	...	...	...	...	—33.96	—25.98
13	(6.2)	(22.8)	(23.0)	(27.7)	(27.4)	(38.2)	34.0	12.5	...	...	...	...	...	...	...	—33.88	—25.79
14	(7.4)	(21.8)	(22.6)	(28.0)	(26.9)	(38.8)	33.8	11.0	...	...	...	...	...	...	...	—34.03	—25.92
15	(8.5)	(20.7)	(22.2)	(28.3)	(26.4)	(39.5)	34.0	8.6	...	...	...	...	...	...	...	—34.23	—26.09
16	(9.7)	(19.7)	(21.8)	(28.7)	(25.9)	(40.1)	33.8	7.4	...	...	...	...	...	...	...	—34.48	—26.32
17	(10.9)	18.6	21.4	29.0	25.4	40.8	34.3	(—6.3)	...	...	...	...	...	...	...	—34.44	—26.32
18	(12.1)	19.5	22.0	29.5	24.9	41.4	33.8	(—5.2)	...	...	...	...	...	...	...	—34.77	—26.68
19	(13.3)	16.5	(22.6)	(30.5)	(25.1)	(40.5)	(32.5)	(—4.1)	...	...	...	...	...	...	...	—34.33	—26.16
20	(14.5)	17.3	(23.2)	(31.5)	(25.3)	(39.6)	(31.3)	(—3.0)	...	...	...	...	...	...	...	—34.75	—26.61
21	15.7	(19.0)	(23.8)	(32.4)	(25.5)	(38.7)	30.0	(—1.9)	...	...	...	...	...	...	...	—35.08	—26.94
22	17.5	(20.7)	24.4	(33.4)	(25.7)	(37.8)	28.6	(—0.8)	...	...	...	...	...	...	...	—34.82	—26.72
23	28.4	(22.4)	26.7	(34.4)	(26.0)	(36.8)	27.2	(+0.3)	...	...	...	...	...	...	...	—35.61	—27.55
Midn't	—22.4	(—24.1)	—25.4	(—35.3)	(—26.2)	(—35.9)	26.9	(+1.4)	...	...	...	...	...	...	...	—35.25	—27.21
Means	—19.05	—20.12	—23.42	—28.45	—29.05	—36.31	—32.18	—12.30	+14.62 §	—0.98 §	+3.30 §	+6.45 §	+4.72 §	—7.20 §	—19.08 §	[—35.25]	—27.23

* Lowest temperature observed this winter. † Readings supplied from thermometer *C*. ‡ Blowing hard between 10h. and 12h.

§ Means supplied from the second volume of the narrative, the values being corrected by +1°.34, from comparisons on Jan. 13th.

The constant correction applied to the last vertical column is —27°.23 +35°.25 = +8°.02, to which has been added small corrections to refer the diurnal variation and the means to the middle of the month.

The following is an example (of a somewhat extreme case) of the method of interpolation adopted in the preceding abstract. Required, the hourly temperatures between, 1854, April 2d, $20^{h.}$, and April 3d, $13^{h.}$. The monthly means of each hour (omitting the observations on the 2d and 3d) were first compared with their monthly mean, when the mean diurnal variation (for the 15th of the month) became known. In like manner, the variation for the preceding month was obtained; and then, by a simple interpolation, the mean diurnal variation for the time between the 2d and 3d was found. Let $v_1\ v_2\ v_3\ v_4 \cdots v_{24}$ equal the hourly values of the diurnal variation, t equal the mean temperature, and T resulting or interpolated temperatures; then $T = t + v\,p$, where p a factor depending principally on the transparency of the atmosphere. To find the hourly values of t and p for the above interval, we select a convenient number of consecutive observations before and after the interval, which, in the present case, gives the equations—

April 2, $15^{h.}$	$-21.2 = t + 3.7\,p$	April 3, $13^{h.}$	$-26.9 = t + 3.4\,p$
16	$-22.3 = t + 3.2\,p$	14	$-26.5 = t + 4.0\,p$
17	$-23.0 = t + 2.8\,p$	15	$-24.0 = t + 3.7\,p$
18	$-25.0 = t + 2.1\,p$	16	$-25.8 = t + 3.2\,p$
19	$-28.0 = t + 1.1\,p$	17	$-29.0 = t + 2.8\,p$
20	$-27.0 = t + 0\,2\,p$	18	$-30.4 = t + 2.1\,p$
Mean	$-24.4 = t + 2.2\,p$		$-27.1 = t + 3.2\,p$

And from comparison with each equation $\left\{\begin{array}{l} t = -29.1 \\ p = 2.14 \end{array}\right\}$ for $17\frac{1}{2}^{h.}$ $\quad$ $\left\{\begin{array}{l} t = -36.8 \\ p = 3.03 \end{array}\right\}$ for $15\frac{1}{2}^{h.}$

Hence, hourly variation in t $-0°.35$, and in p $-0°.04$.

The above sets of equations were then corrected for this hourly change of t and p, when the following corrected results were obtained:—

$t = -27.9$ $\qquad$ $t = -33.2$

$p = 1.60$ $\qquad$ $p = 1.90$

These values, when substituted in the equations, leave the following residuals:—

In first set	-0.1	-0.1	$+0.2$	-0.3	-1.3	$+1.5$	Prob. error of each $\pm 0°.6$
In second set	-1.1	-1.5	$+2.0$	$+1.5$	-0.5	-0.3	" " ± 1.0

The true hourly variation in t becomes $-0°.24$

" " p " -0.01

The following table contains the interpolated values of t and p, and the resulting hourly temperatures for the interval.

1854	t	v	p	T	1854	t	v	p	T
April 2, $21^{h.}$	$-28°.7$	$-0°.7$	$1°.65$	$-29°.9$	April 3, $5^{h.}$	$-30°.6$	$-2°.9$	$1°.75$	$-35°.6$
22	-29.0	-1.6	1.66	-31.7	6	-30.9	-2.4	1.77	-35.2
23	-29.2	-2.1	1.68	-32.8	7	-31.1	-1.6	1.79	-33.9
24	-29.5	-2.8	1.69	-34.2	8	-31.3	-0.7	1.80	-32.6
April 3, 1	-29.7	-3.4	1.70	-35.5	9	-31.6	$+0.7$	1.82	-30.3
2	-29.9	-3.4	1.72	-35.8	10	-31.8	$+1.5$	1.83	-29.1
3	-30.2	-3.6	1.73	-36.4	11	-32.0	$+2.4$	1.85	-27.6
4	-30.4	-3.4	1.74	-36.3	12	-32.3	$+3.0$	1.86	-26.7

Which values in the last column will be found in their proper place in the preceding abstract.

Diurnal Variation.—Before giving the table of the diurnal change of the atmospheric temperatures, it will be proper to remark that, astronomically, the upper limb of the sun ceases to be visible at noon on Oct. 25th, and reappears at noon Feb. 16th; between April 19th and Aug. 24th, the lower limb will continue above the horizon without setting. On account of the considerable annual variation of the temperature, the figures in the last vertical column of each month in the preceding abstracts, headed "mean," require a small correction for the effect of the annual change during twenty-four hours; they will then represent the diurnal variation for the middle of each month. Thus, for September, 1853, the effect of the annual change during twenty-four hours is 0°.50 decreasing, hence the maximum corrections applied are —0°.25 and +0°.25 for $1^{h.}$ and $24^{h.}$ respectively; and for the intermediate hours an aliquot part of this is applied, according to the interval from noon, where the correction is zero. The following table presents the summary of the diurnal variation for each month of the year; for the first five months, the figures are the mean from two sets. The highest and lowest values, for better distinction, are placed between parentheses.

MEAN DIURNAL VARIATION OF THE TEMPERATURE FOR THE MIDDLE OF EACH MONTH OF THE YEAR.

Hour.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March.	April.	May.	June.	July.	August.
	°	°	°	°	°	°	°	°	°	°	°	°
1	(+10.92)	—3.76	—21.51	—31.54	—28.04	(—34.36)	—38.56	—11.77	(+ 9.31)	(+27.21)	+36.67	(+28.99)
2	10.97	3.79	21.54	31.39	28.49	34.32	38.40	11.82	9.62	27.25	36.76	29.33
3	11.28	3.74	21.46	31.65	28.62	34.14	38.61	(12.26)	10.26	27.40	36.79	29.27
4	11.21	3.58	21.42	(31.82)	28.67	33.54	(38.86)	11.77	10.78	27.71	36.78	29.67
5	11.23	3.47	22.00	30.97	28.66	34.20	38.81	10.96	12.05	28.98	36.94	29.55
6	11.85	3.47	(22.35)	30.83	28.71	33.62	38.60	10.33	12.91	29.61	37.60	30.17
7	12.87	3.29	22.13	30.97	(29.02)	33.19	37.91	9.32	13.64	30.46	37.76	30.83
8	14.32	3.32	22.27	31.04	28.43	32.87	37.52	8.28	14.56	31.69	38.43	31.84
9	15.07	3.00	22.06	30.69	28.56	32.63	36.23	6.64	14.45	30.89	39.42	32.96
10	15.75	(2.72)	22.18	30.68	28.29	32.10	35.68	6.00	15.11	31.08	39.63	33.83
11	16.15	2.81	21.68	30.52	27.75	32.42	34.51	5.07	15.38	31.43	40.00	34.00
Noon	16.40	2.97	(21.37)	(30.04)	(27.26)	31.79	33.97	4.46	15.89	32.18	(40.04)	34.20
13	(16.47)	3.03	21.73	30.12	27.55	31.30	33.60	4.05	16.09	(32.31)	39.83	34.26
14	16.12	3.18	21.72	30.44	27.57	(31.29)	(33.20)	3.27	16.31	32.17	39.69	(34.29)
15	15.65	3.08	21.77	30.77	28.08	31.44	33.86	(3.17)	16.38	31.85	39.65	33.90
16	15.11	3.18	21.86	31.08	28.32	31.52	34.97	3.51	(16.65)	31.52	39.65	33.38
17	14.51	3.43	21.69	31.18	28.00	31.78	35.67	3.67	16.04	31.31	38.85	33.11
18	14.07	3.79	21.93	31.32	28.00	31.64	36.32	4.57	15.17	31.08	38.50	32.62
19	13.28	4.28	22.06	31.53	27.87	31.58	36.85	6.01	14.29	30.66	38.23	32.25
20	12.78	4.36	22.14	(31.81)	28.18	31.73	37.75	7.01	13.41	30.41	37.66	31.91
21	12.46	4.34	(22.64)	31.74	28.09	32.15	37.90	8.37	12.56	29.75	37.22	31.63
22	12.07	4.38	22.30	31.62	28.01	33.22	38.17	9.94	11.43	29.30	(36.65)	31.00
23	11.36	4.34	22.54	31.51	(28.66)	33.25	38.42	10.71	10.37	28.38	36.81	30.63
Midn't	+11.05	(-4.39)	—22.37	—31.35	—28.34	—33.53	—38.61	—11.87	+ 9.90	+27.98	+36.92	+30.07
Mean	+13.45	—3.57	—21.95	—31.12	—28.22	—32.65	—36.79	— 7.70	+13.45	+30.12	+38.19	+31.82
Amplitude	5.55	1.67	*1.00	*1.65	*1.55	3.07	5.66	9.09	7.34	5.10	3.37	5.30

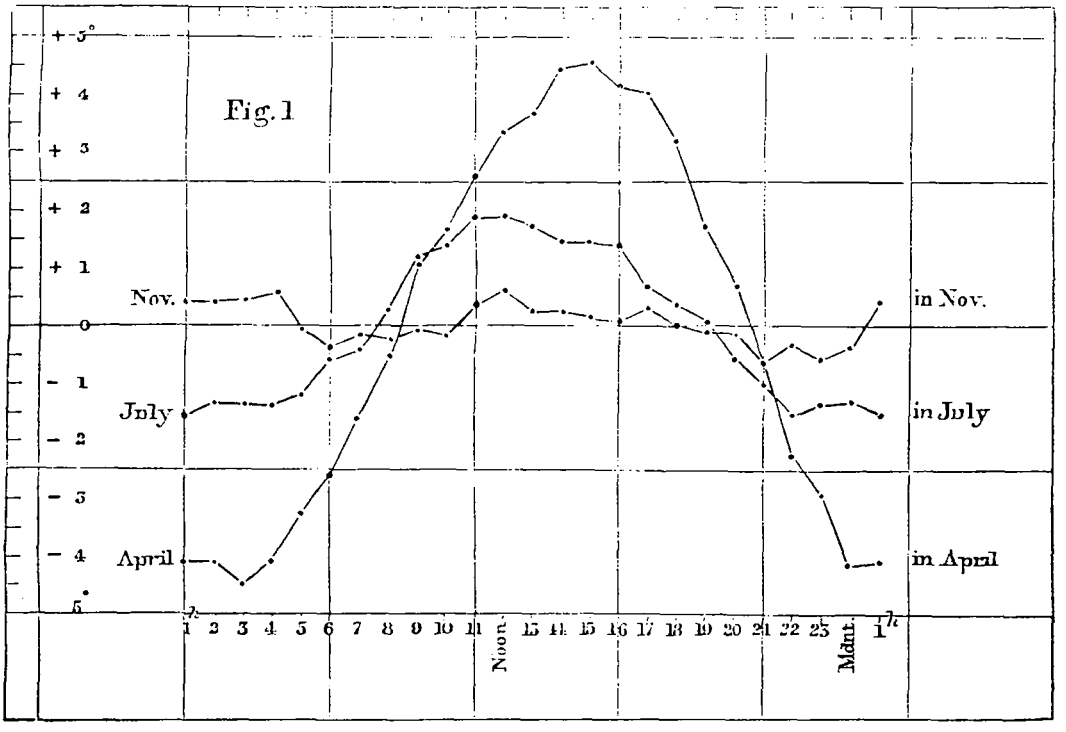
* The amplitude for November, December, and January, was derived from a graphical representation of the hourly values through which a curve was thrown with a free hand in order to eliminate the effect of the accidental variations, which, during these months, approach in magnitude to the range of the diurnal variation itself.

According to the preceding table, the epoch of the diurnal maximum temperature occurs in the months of October and November (when the diurnal amplitude is a minimum) about one hour before noon, and in April and May (when the diurnal

amplitude is a maximum) about three hours after noon, the whole mean range (obtained graphically) being four hours during the year. In the months of November, December, and January, there are two minima, one at about 6 A. M. (whether this represents the primary or secondary minimum cannot well be decided from these observations alone), and the other at about 9 P. M. During the remaining months of the year, there is but one minimum during twenty-four hours, which occurs at 1 A. M.

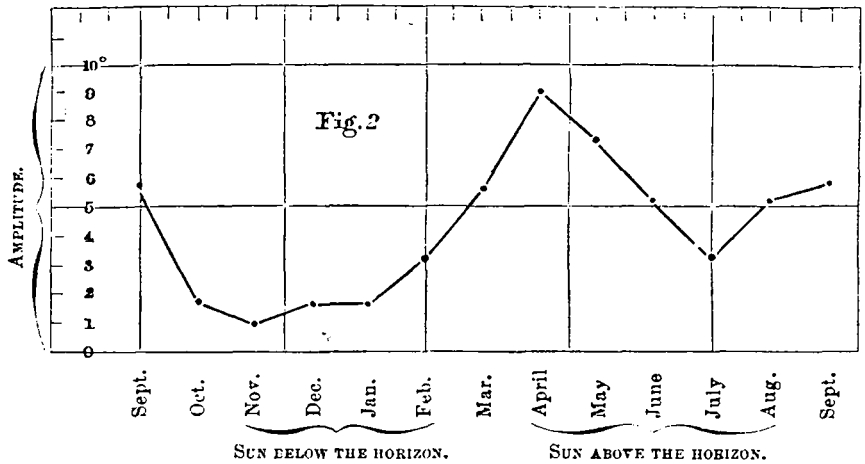
At about 7½ in the morning, and a little before 8 in the afternoon, the temperature equals the mean temperature of the day, excepting the months of November, December, and January. The greatest deviations from these hours are ±1½ hours. For the remaining three months, the means are reached at 9½ in the morning, and also between 4 and 10 in the afternoon; the latter (as well as another hour at about 4 A. M.) being very irregular.

For three months of the year, the diurnal variation is exhibited graphically.



The diagram shows the maximum diurnal variation in the month of April, the secondary minimum variation in the month of July, and the diurnal variation in the month of November when nearest to its absolute minimum. ± indicates a $\left\{\begin{matrix}\text{higher}\\ \text{lower}\end{matrix}\right\}$ temperature than the mean of the day. The month of November exhibits considerable anomalies. In July the sun never set, and in November he never rose above the horizon.

In the following diagram, I have exhibited the annual march of the diurnal amplitude for each month.



The absolute maximum value of the amplitude was observed in April (9°.09), and the absolute minimum in November (1°.00); the diurnal variation never disappearing altogether, although the sun remained for 2⅔ months below the horizon. A secondary minimum was reached in July (3°.37), somewhat later than the middle of the time the sun made his circuit round the points of the compass without setting.[1] The mean amplitude of the diurnal variation during the whole year is 4°.20—the maximum rising 4°.9 above, and the minimum falling 3°.2 below. The daily range of the effect of the thermal wave propagated northward during the long arctic darkness, may be set down to 1°.6 on the average.

For the purpose of comparing with similar results at other stations, I add a table of the mean daily variation during the year. Each figure is simply the mean of the twelve values corresponding to the same hour, and was taken from the preceding table. No attention was paid to the small anomalies noticed in three winter months, which cannot sensibly affect the means. The second column contains the mean values, and the third the same after the general mean has been subtracted from each of them, and, consequently shows the mean variation proper, ± indicating a $\left\{\begin{matrix}\text{higher}\\ \text{lower}\end{matrix}\right\}$ value than the mean. The fourth column exhibits the hourly differences of the variation.

MEAN DIURNAL VARIATION FOR THE YEAR, DERIVED FROM ITS MONTHLY VALUES.

Hour.	Mean temperature.	Diurnal variation.	Its hourly difference.	Hour.	Mean temperature.	Diurnal variation.	Its hourly difference.
1	—4°.70	—1°.79	—0°.05	13	—1.°04	+1°.87	—0°.03
2	—4.65	—1.74	—0.03	14	—1.01	+1.90	+0.22
3	—4.62	—1.71	—0.16	15	—1.23	+1.68	+0.28
4	—4.46	—1.55	—0.27	16	—1.51	+1.40	+0.29
5	—4.19	—1.28	—0.38	17	—1.80	+1.11	+0.38
6	—3.81	—0.90	—0.45	18	—2.18	+0.73	+0.44
7	—3.36	—0.45	—0.62	19	—2.62	+0.29	+0.45
8	—2.74	+0.17	—0.57	20	—3.07	—0.16	+0.40
9	—2.17	+0.74	—0.32	21	—3.47	—0.56	+0.46
10	—1.85	+1.06	—0.37	22	—3.93	—1.02	+0.39
11	—1.48	+1.43	—0.38	23	—4.32	—1.41	+0.23
Noon	—1.10	+1.81	—0.06	Midn't	—4.55	—1.64	+0.15

[1] A more complete understanding of the diurnal variation can only be had in connection with hygrometric observations.

Accordingly the mean is reached at $7^{h}.7$ A. M. and $7^{h}.6$ P. M; the maximum at 2 P. M., and the minimum at 1 A. M. The mean range equals 3°.69, a quantity necessarily smaller than the mean amplitude for the whole year as given above. Maximum mean hourly difference or change 0°.62 between 7^{h} and 8^{h} A. M., and 0°.45 between the same hours P. M.

We now return to the last vertical columns of the general monthly abstracts, and examine the

Observed Hours of Mean Daily Temperature.—The following table contains the hours of the day when the temperature equals its mean daily value, made out for each month of the year. Also shows their difference, or the "critical interval." These values are derived directly from the general abstracts of observed temperatures, and, for the first five months, are mean values derived from two sets of observations in the first and second years.

Month.	Morning hour.	Evening hour.	Critical interval.	Month.	Morning hour.	Evening hour.	Critical interval.
September . .	7.4	18.4	$11^{h}.0$	April	8.4	20.7	12.3
October . . .	Uncertain,	17.1	11.1	May	6.9	20.2	13.3
November . .	probably one	Uncertain, one		June	6.7	20.7	14.0
December . .	near 3^{h}., the	near 15^{h}., the	12.0	July	7.6	19.1	11.5
January . . .	other near 9^{h}.	other near 21^{h}.		August . . .	7.9	19.8	11.9
February . .	8.9	21.4	12.5				
March . . .	8.5	19.1	10.6	Means . . .	7.2	19.2	12.0

In the following table, I have exhibited the greatest absolute changes of temperature observed between any two successive hours, between the highest and lowest of any day of 24 consecutive hours, any month, and for the whole year.

Month.	Hourly.	Daily.	Monthly.	Month.	Hourly.	Daily.	Monthly.
September . . .	7°.0	15°.6	32°.3	June	8°.0	15°.0	24°.2
October	8.0	24.1	41.0	July	8.0	14.6	23.0
November . . .	10.8	25.0	42.8	August	8.0	20.8	29.8
December . . .	19.4	30.4	60.5	September . . .	16.0	24.0	36.0
January	8.1	21.8	69.8	October	11.0	25.0	61.0
February . . .	12.3	37.8	56.4	November . . .	11.0	32.0	54.9
March	13.5	24.1	56.7	December . . .	16.7	41.1	52.9
April	10.0	33.1	56.7	January	18.9	35.6	81.6
May	7.8	17.8	46.5				
				Means	11.4	25.7	48.6

The following values are the absolute maximum and minima observed :—

Minimum in winter, 1853–54	—66°.4,	observed on	Feb. 5th
Maximum in summer, 1854	+51.0,	"	July 23d
Minimum in winter, 1854–55	—65.5,	"	Jan. 8th

Absolute maximum difference, 117°.4 Fahr.

Mean Monthly Temperatures and Annual Variation.—In the following recapitulation of the mean monthly temperatures, the values have been taken directly from the general abstracts. The means for the months of February, March, and April, of 1855, have been added by means of the table given in Vol. II. of the Narrative, p. 425, corrected from ten comparisons of monthly means between —14° and —34°, so as to refer the quantities to the same system of corrections as used in the present

paper. This correction, from consistent separate values, is +0°.99. On account of the occasional omissions of observations in the hourly abstract, the daily means in the Narrative for these three months are probably not reliable, the calculator, as has been found on other occasions, having paid no attention to such omissions in taking his mean; the monthly means may, nevertheless, be nearly correct.

MEAN MONTHLY TEMPERATURES AT VAN RENSSELAER HARBOR.

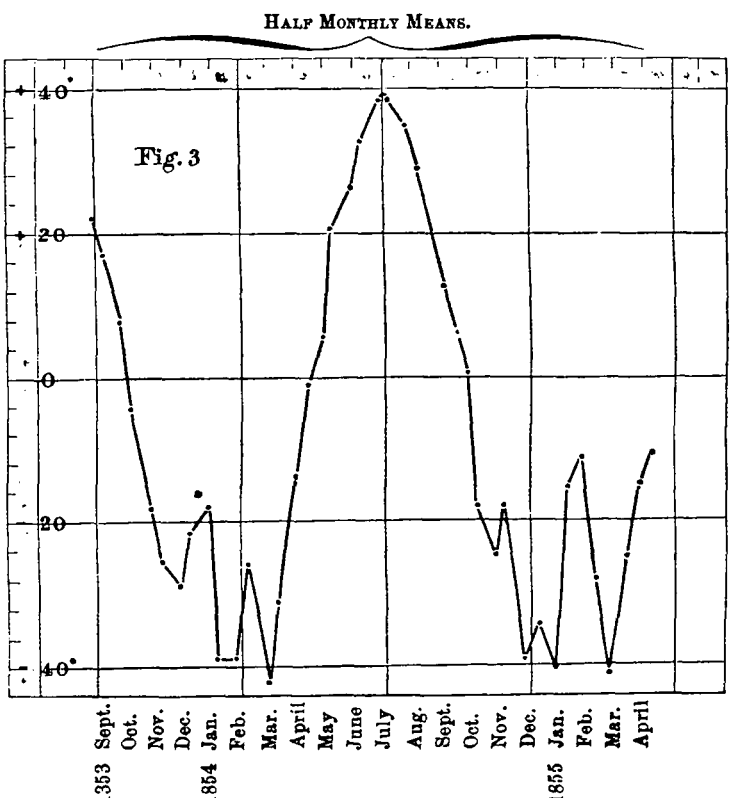
(Degrees of Fahrenheit's scale.)

1853	September	+17°.16	1854	July	+38°.19
	October	+ 1.62		August	+31.82
	November	—22.39		September	+ 9.74
	December	—25.46		October	— 8.78
1854	January	—29.21		November	—21.52
	February	—32.65		December	—36.79
	March	—36.79	1855	January	—27.23
	April	— 7.69		February	—20.22
	May	+13.45		March	—32.98
	June	+30.12		April	—13.01

If we unite the temperatures for the same months in one mean, we obtain the following mean temperatures for each month of the year:—

1853–54	September	+13.°45	1854–55	March	—34°.88
	October	— 3.58		April	—10.35
	November	—21.95	1854	May	+13.45
	December	—31.12		June	+30.12
1854–55	January	—28.22		July	+38.19
	February	—26.43		August	+31.82

These values, when thrown into a curve, present a great regularity during the summer months; not so, however, during the winter months, when the direct effect of the sun is very feeble, and the winds probably become the main source of the variability of temperature. To exhibit this difference in the variation of the summer and winter temperatures, I have graphically presented the half monthly means, when the steadiness of the summer curve becomes very striking.



It must be considered a fortunate circumstance that the observations extend over *two* winters, and thus give us a more exact mean temperature for that season.

The warmest month is July, and the coldest is March; the temperature of December, however, does not differ much from it, and December actually was the coldest month in the second winter. The highest mean monthly temperature seems to fall almost exactly to the middle of July, and the lowest would probably occur in February, if we had a longer series of observations extending over several winters. From the observations on hand, we find the December temperature only 3¾° higher than the March temperature. The range of the mean temperature for the warmest and coldest month is 73°.07. The temperatures for the meteorological seasons—December, January, and February being regarded as winter—become as follows:—

Winter	—28°.59	Mean temperature for the whole year, —2°.46.
Spring	—10.59	
Summer	+33.38	
Autumn	— 4.03	

The mean annual temperature is reached in the middle of spring (April), and again in the middle of autumn (October). The difference in the winter and summer temperature is 61°.97.

The seasons of the second year compare with the corresponding ones of the first as follows:—

Autumn in the second year colder by	5°.65
Winter " " warmer by	1.03
First two months of spring colder by	0.76

The lowest mean monthly temperature of the first winter (March, —36°.79) was precisely the same as that of the second winter (December, —36°.79), both months falling in the year 1854.

For the purpose of continuing the discussion of the atmospheric temperatures, it becomes necessary to express the annual variation analytically. On account of the great range of this variation, I have first applied a small correction to the preceding monthly means, in order to refer them to the middle of months of average length of $30^{d}.4$ in common, and $30^{d}.5$ in leap years. Thus, the mean temperature of January, 1854, refers to (noon) $15^{d}.5$, when it ought to refer to $15^{d}.2$; difference, $0^{d}.3$. The fifteenth part of the difference of the January half monthly means is —1°.40; hence the correction +0°.40. For convenience of reference, the number of days for which a correction is to be applied to refer the means of the true to an average month are here inserted. Commencing with January, these numbers for the several months in their proper order become—

$-0^{d}.3$	+0.6	+1.5	+1.5	+1.4	+1.3	+1.2	+0.7	+0.6	+0.5	+0.4	$+0^{d}.3$
—0.2	+0.2	+0.8	+0.8	+0.8	+0.8	+0.8	+0.2	+0.2	+0.2	+0.2	+0.2

The first line is for a common year, the second for a leap year. The maximum correction applied was +1°.34 (to the mean of March). To the following monthly

means, referring to months of an average length, I have added the probable uncertainty obtained by comparison with the daily means.

January . . .	—28°.26	± 1°.5	July	+38°.18	± 0°.3
February . . .	—26.53	± 1.4	August . . .	+31.59	± 0.4
March . . .	—33.54	± 1.3	September . .	—13.15	± 0.6
April . . .	— 9.48	± 1.2	October . . .	— 4.13	± 1.1
May . . .	+14.78	± 1.2	November . . .	—21.96	± 0.9
June . . .	+30.76	± 0.5	December . . .	—31.00	± 0.9
Annual mean from 12 average months				— 2 20	± 0.3

For the purpose of interpolation, and for the representation of the annual variation, a function involving terms of the sine or cosine of multiples of an angle is usually adopted. In the present case, I prefer a form of discussion which makes the law of the change of the monthly temperatures analogous to that of a falling body. This method was adopted by Mr. J. Wiessner, and applied to the discussion of the Washington observations. (See p. 322 of the Annual Report of the Regents of the Smithsonian Institution for 1857.) The annual variation may thus be represented by a parabolic wave. The diurnal variation has previously been represented by others by parabolic arcs. Whatever form of expression we may adopt, the winter curve is so irregular, owing to the short number of observations, that no continuous law can be deduced; the temperatures during this season will, therefore, be treated separately. If the observations were continued for several years, it is probable that the lowest temperature would fall in February, near the time of sunrise; as it is, we have a slight increase of temperature during January and February.

A uniformly retarded motion is represented by $s = ct - \frac{1}{2} gt^2$, and the condition for the turning point is $o = c - gt$, corresponding to the middle of July, or the third month, commencing with the middle of April as zero. For $t = 3$, $c = 3g$, and, putting for convenience $g = 2$, we find $c = 6$; hence, if $t =$ number of months after the middle of April, the arguments for the several months become—

0 1 2 3 2 1 0 —1 —2 —3 —2 —1 0

the temperature in April being the same as in June, etc. Substituting these numbers successively in the formula $s = 6t - t^2$, we find the values (R) 0, 5, 8, 9, 8 ..... for the months of April, May, June — ..... Each month furnishes an equation of the form $T = t_m + Rp$, where $t_m =$ the mean temperature and p a factor depending on the amplitude of the annual variation. t_m and p, when found for spring, summer, and autumn, are found to vary, and hence an interpolation is made for each month. We have next to introduce a second term to allow for a shifting of the epoch. Let x be the quantity addition to the arguments 0 1 2 3 2, etc., for the change in the epoch, and expressed in parts of a month, we have for—

$0 + x$	$s = 6\,(0 + x) - (0 + x)^2$	or $s = 0 + 6x$
$1 + x$	$6\,(1 + x) - (1 + x)^2$	$5 + 4x$
$2 + x$	$6\,(2 + x) - (2 + x)^2$, etc.	$8 + 2x$, etc.

omitting terms containing the second power of x. Putting $px = q$, we obtain, in place of the first expression for the temperature—

$$T = t_m + Rp + Q_q$$

For the day or summer period we thus obtain the equations :—

$$\left.\begin{array}{lll} \text{May} & +14^\circ.78 = t_m + 5p + 4q \\ \text{June} & +30.76 = t_m + 8p + 2q \\ \text{July} & +38.18 = t_m + 9p \\ \text{August} & +31.59 = t_m + 8p - 2q \\ \text{September} & +13.15 = t_m + 5p - 4q \end{array}\right\} \begin{array}{l} \text{Whence } t_m = -15^\circ.73,\ p = 5.918, \text{ and } q = \\ \quad +0.12 \text{ as resulting from the normal equations.} \\ T = -15^\circ.73 + 5.918\,R + 0.12\,Q \pm 0^\circ.7 \end{array}$$

For the spring months:—

$$\left.\begin{array}{lll} \text{March} & -33^\circ.54 = t_m - 5p + 4q \\ \text{April} & -\ 9.48 = t_m \qquad + 6q \\ \text{May} & +14.78 = t_m + 5p + 4q \end{array}\right\} T = -9^\circ.18 + 4.832\,R - 0.05\,Q$$

For the autumn months:—

$$\left.\begin{array}{lll} \text{September} & +13^\circ.15 = t_m + 5p - 4q \\ \text{October} & -\ 4.13 = t_m \qquad - 6q \\ \text{November} & -21.96 = t_m - 5p - 4q \end{array}\right\} T = -4.91 + 3.510\,R - 0.13\,Q$$

The above 3 values for t_m, p, and q are represented by the formulæ:—

$$\left.\begin{array}{l} t_m = -15.73 + 0.71n + 0.96n^2 \\ p = +\ 5.918 - 0.220n - 0.1942n^2 \\ q = +\ 0.12 - 0.01n - 0.022n^2 \end{array}\right\} \begin{array}{l} \text{Where } n = \text{number of months from the mid-} \\ \text{dle of July. For March } n = -2; \text{ for} \\ \text{Nov. } +2. \end{array}$$

The following table contains their computed values for each month (under discussion).

Month.	t_m	p	q		Obs. — comp. temperatures.
March	—13°.31	4.082 (—0.750)	+0.06	*If we now compare the com-*	—0.°20
April	— 9.18	4.832 (—0.750)	—0.05	*puted and observed tempera-*	—0.14
May	—13.31	5.582	+0.06	*tures for each month, we yet*	—0.20
June	—15.48	5.944 Differences.	+0.11	*find a constant correction to*	—1.67
July	—15.73	5.918	+0.12	*t_m of +0°.14. Applying it to*	+0.51
August	—14.06	5.504	+0.09	*the tabular quantities, the for-*	+1.66
September	—10.47	4.701 (—1.191)	+0.02	*mulæ represent the observa-*	+0.06
October	— 4.91	3.510 (—1.191)	—0.11	*tions as follows:—*	—0.02
November	—10.47	2.319	+0.02		+0.04
Correct. to tabular t_m =	+ 0.14				

These differences between the observed and computed values are very nearly within the probable uncertainty as given in a preceding table.

For the winter season, the most simple interpolation seems to be the best that can be adopted. We find for December 1st the temperature —26°.5, the mean of the temperatures for November 15th and December 15th, and for March 1st, in like manner; the mean temperature —30°.0. The following table[1] was used for interpolation :—

Mean temperature	Dec. 1st	—26°.5	
"	Jan. 15th	—28.2	$\Delta = 1^\circ.7$
"	March 1st	—30.0	1.8

[1] For the purpose of a ready comparison and uniformity of method, the following expression of the annual variation of the temperature at Van Rensselaer Harbor is here inserted; it compares directly with similar expressions for other stations given by Kämtz and inserted in the article (Sir John Herschel's)

Influence of Winds on Temperature.—To ascertain the temperature of the winds, the following method was employed. By means of the preceding formula, expressing the temperature, a set of tables was formed—partly by direct computation, partly by interpolation between these computed values—of the daily mean temperature throughout the year, and the same was set down opposite the respective hours of the day when the mean temperature is reached. Next, by means of the known diurnal variation, interpolated from its mean monthly value, for each day, these tables were completed by inserting the temperature for every hour of the day to the nearest whole degree. They were then compared, hour for hour, with the abstract of observed temperature, and the difference $\left\{\begin{matrix} + \text{ for excess} \\ - \text{ for defect} \end{matrix}\right\}$ placed in the column for the respective wind as observed at the same hour. For this latter purpose, an hourly abstract of the wind was prepared. The abstract of differences contains eight columns for each of the principal directions, and an additional one for calms. By this process, the effect of the annual and diurnal variation is at once eliminated, and the remaining differences can safely be left to their own compensation. The results for the months from September to January (both inclusive, have been combined for the two years. The following table exhibits the results of this somewhat lengthy process. The first column contains the magnetic directions of the wind, including a line for the calms; the second, the sum of the differences as explained above; the third, the number of times the wind blew from each of the eight directions during the seventeen months of registered hourly temperatures and winds; the sum total, or Σn, equals 11534, and the number by which it falls short of 12264, indicates the number of hours observations were wanting; the last figure in the column gives the number of hours during which the atmosphere was calm. The fourth column shows the values of $\frac{\Sigma \Delta}{n}$, or the quantity by which each wind affected the temperature, the sign + corresponding to an effect of raising the temperature above its mean.

"Meteorology," Vol. XIV. 8th edition of the *Encyclopædia Britannica.* The value $\theta = 0$ corresponds to January 1st and T is expressed in degrees of Fahrenheit's scale.

$$T = -2^\circ.20 + 35^\circ.39 \sin(\theta + 251^\circ 43') + 6^\circ.72 \sin(2\theta + 69^\circ 47') + 3^\circ.20 \sin(3\theta + 17^\circ 5').$$

The formula leaves the following differences (0.—C.) between the observed and computed monthly means:—

In January	—0°.2	In July	+1°.2
February	+3.4	August	+1.5
March	—4.9	September	—2.4
April	+2.7	October	+1.4
May	+0.3	November	+1.3
June	—2.5	December	—1.9

And a probable error of any single determination of $\pm 1^\circ.6$. The warmest day is accordingly July 8th, and the coldest March 1st. The mean temperature of the year is attained April 29th and October 12th. The mean diurnal variation for the whole year, as derived from its monthly values, is represented by the formula—

$$t = +1^\circ.85 \sin(\theta + 64^\circ 55') + 0^\circ.08 \sin(2\theta + 97^\circ) + 0^\circ.03 \sin(3\theta + 128^\circ),$$

with a probable error for any single hour of $\pm 0^\circ.03$, the angle θ counting from noon.

Mag. direction of wind.	$\Sigma\Delta$	n	$\frac{\Sigma\Delta}{n}$	Mag. direction of wind.	$\Sigma\Delta$	n	$\frac{\Sigma\Delta}{n}$
N.	+ 34	323	+0°.1	S. W.	+ 2729	955	+2°.9
N. E.	+ 138	92	+1.5	W.	+ 509	313	+1.6
E.	+ 220	159	+1.4	N. W.	+ 99	744	+0.1
S. E.	+2879	1182	+2.4	C.	—22923	6655	—3.4
S.	+2346	1111	+2.1				

These results are necessarily imperfect, on account of the impossibility of obtaining a correct mean temperature from so short a series of observations, yet their ratio may be depended upon. We notice that all winds tend to elevate the temperature, and the calms to lower the same. The frequency of the calms is greater than that of all the winds combined. The difference in the temperature of the warmest and coldest wind is 2°.8; N. E., E., and W. (magnetic) winds show a mean value; S. E., S., and S. W. winds are from 0°.6 to 1°.4 above, and N. and N. W. winds 1°.4 below, this mean temperature. The region included by the directions S. E. and S. W. (magnetic), or N. N. E. and E. S. E. (true),[1] being the quarter of the warmer winds, and the space between W. S. W. and S. S. W. (true) that of the colder winds. It must be remarked that, since a true north wind the longer it blows assumes a more and more easterly direction, the true directions between N. N. E. and E. point to a more northerly origin of the wind than actually indicated.[2]

Of the rise of temperature during certain gales, the explanatory foot-notes in the temperature abstract may be referred to; the more remarkable cases are the following ones:—

Gale of	November 28, 1853,	from the	S. E.	(a little snow falling).
"	December 10, "	"	S. E.	(not snowing).
"	December 28, "	"	S. E. and S. W.	(no snow).
"	February 7, 1854,	"	S.	(no snow).
"	May 7–8, "	"	S'd	"
"	November 20, "	"	S. W.	"
"	December 18, "	"	S. E.	"
"	January 29, 1855,	"	S. E.	"
"	February 13–14, 1855,	"	S. E.	"

The reader may also be referred to pp. 17, 30, 39, 40, and 55, of the 2d vol. of the Narrative.

Effect of Snow (and Rain) on the Temperature.—If we combine in like manner the differences of observed and mean temperature of all hours during which snow fell, we find a great regularity in the monthly values expressing the elevation of temperature during the hours of the fall of snow, due to the conversion of latent into sensible heat. The following table exhibits in the first column the algebraic

[1] See my discussion of Dr. Kane's magnetical observations, in Vol. X. of the Smithsonian Contributions to Knowledge, 1858. The magnetic declination is found 108° west.

[2] The bearing of this investigation on an open (partially so) polar sea, can only be fully made out after the construction of a hygrometric and barometric wind-card. The direction of the warmer winds points towards the Spitzbergen Sea, and the relative colder winds come in a direction from the northernmost part of continental America.

sum of the above differences for the hours during which snow fell, the second column the number of hours, and the last column the rise of temperature above the mean. In 17 months, it snowed during 680 hours, and rained during 60 hours. This small quantity of rain fell in the month of July; snow also fell during 10 hours in this (warmest) month.

	$\Sigma\Delta$	n			$\Sigma\Delta$	n	
2 January . . .	+1403°	74	+19°.0	July	+ 50°	70	+ 0°.7
February . . .	+ 250	16	+15.6	August	+ 54	26	+ 2.1
March	+ 130	14	+ 9.3	2 September . .	+ 419	111	+ 3.8
April	+ 176	21	+ 8.4	2 October . . .	+ 623	80	+ 7.8
May	+ 534	136	+ 4.0	2 November . . .	+1323	79	+16.7
June	— 48	36	— 1.3	2 December . . .	+ 819	77	+10.6

On the average, during the whole year, the sensible heat was increased during the fall of snow by 7°.7.

The bearing of this source of change of the temperature on the alternation of relative cold and warm periods during the winter season, will be further illustrated in the following analyses of these undulations.

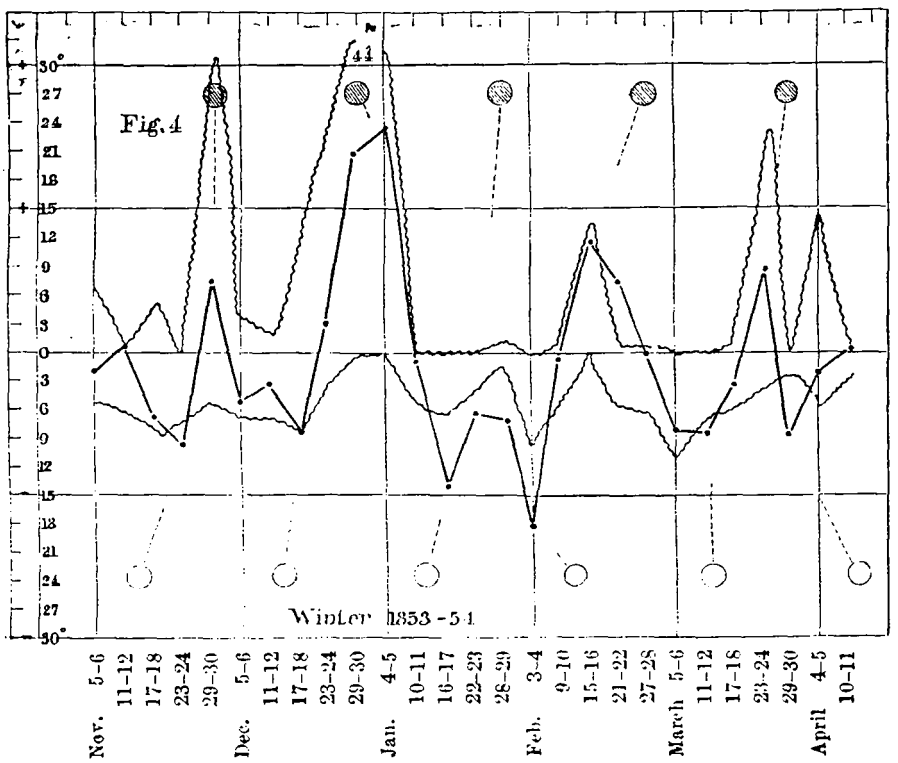
Recurrence of Maxima of Cold during Winter.—An alternate variation from comparatively warmer to colder extremes, taking weeks to perform their cycles, has before been noticed in the arctic regions of America. These returns of maxima of cold, their causes, periods, and amplitudes, now deserve our particular attention. Dr. Kane, from various notes in his log-book, seems to be inclined to consider the phases of the moon as intimately connected with the subject; on page 55, Vol. II. of the Narrative, he remarks: "There is a seeming connection between the increasing cold and the increasing moonlight." Under date Nov. 28th, 1854, he entered the following remark in the log: "The moon first appeared above the hills to S. and S. E. The depression of the temperature, and the general transparency of the atmosphere, is again noted as material for discussion." Dec. 1st, 1854, he says: "With the cessation of wind, the absence of cirri, and the increased brightness of the moon, the atmosphere grows sensibly colder. * * * This immediate influence of the moon is a matter of frequent observation. The full moon season, with cloudless nights is always in correspondence with the lowest mean temperatures of our meteorological record." The following discussion has been made in accordance with these notes.

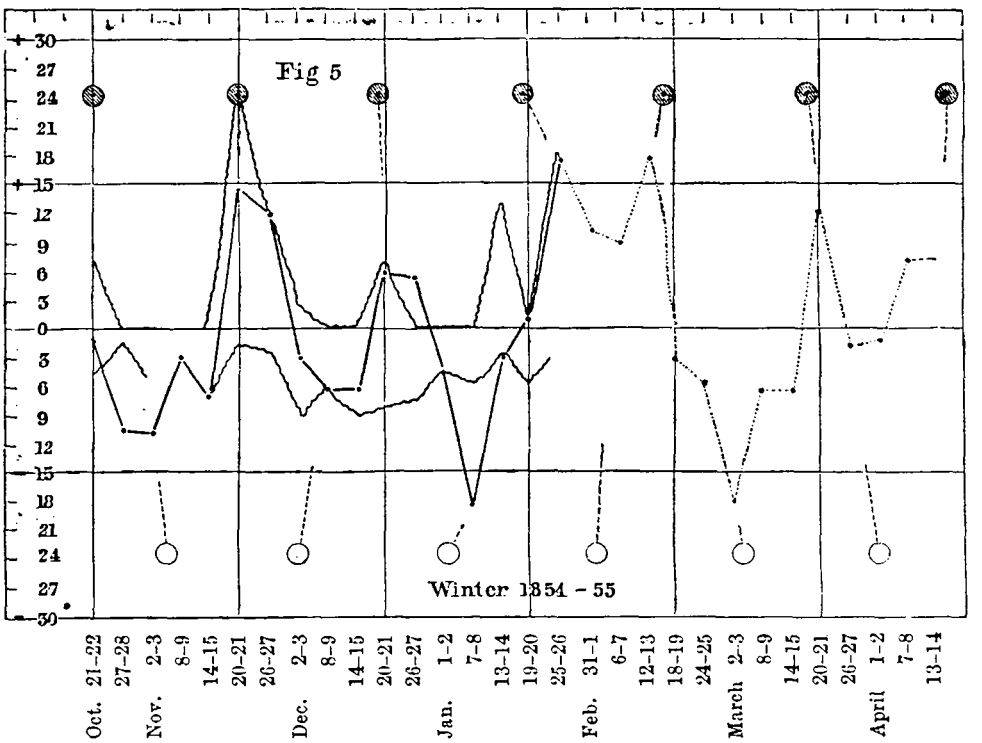
To eliminate as much as possible disturbing influences, particularly those produced by the winds and precipitations, the average of the mean daily temperature of a number of consecutive days has been taken, and it was found, after trials with 3, 5, 6, and 7 days, that the period of 6 days answered best, that is, brought out in the plainest manner, the march of the temperature during the winter season, the general features of the curves being the same for any of the above periods.

The epoch of the 6 day period was so selected that the highest and lowest temperatures should, as near as may be, fall towards the middle of a period. These average values were next compared with the mean temperature deduced from the half monthly means in order to exhibit the deviation of the observed average values

above or below the mean temperature, ± indicating $\left\{\begin{matrix}\text{warmer}\\ \text{colder}\end{matrix}\right\}$ than the mean. These differences are herewith presented graphically by full lines; the phases of the moon are marked opposite the corresponding dates, the new moons being given at the top, the full moons at the bottom, of each diagram. The investigation commences with Nov. 3d, and ends with April 13th, for the winter 1853–54, and includes the time between Oct. 19th and April 16th of the second winter. Between these intervals, the mean half monthly temperatures are below —10°. Temperatures observed after Jan. 24th, 1855, have been taken from the abstract in Vol. II. of the Narrative (corrected for index error). They are probably subject to small corrections, and hence have been dotted in the diagram.

The wavy line above the zero line indicates the number of hours during which snow fell in the corresponding 6 day period; the numbers in the vertical column answering also for the hour scale. The wavy line below, or on the negative side of the temperatures, indicates the number of clear days in each 6 day period, and in order to use the side figures also for this day-scale, the number of clear days was doubled, 12 being the maximum indication of 6 clear days.





These diagrams fully bear out the observer's remarks, viz: that the lowest temperatures are reached about the time of full moon. Setting aside some small deviations in the regularity of the curves (of temperature), there is not a single exception to the correspondence of relative maxima of cold near the epoch of the full moon, and of relative minima of cold near the time of new moon. The period between any two consecutive maxima of cold from five intervals is $25^{d}.2 \pm 1^{d}.9$, and the same between the minima of cold from four intervals $28^{d}.5 \pm 2^{d}.4$, for the first winter, and $28^{d}.8 \pm 1^{d}.5$ (from five intervals), and $28^{d}.8 \pm 3^{d}.3$ (from five intervals), for the second winter, respectively. Combining these four values with the application of weights according to the respective probable errors, the resulting period for the recurrence of cold becomes $27^{d}.7 \pm 1^{d}.0$. The synodic period of the moon is $29^{d}.5$; somewhat longer than the period just deduced, but by no means incompatible therewith.

If we now follow the curve indicating the duration of the fall of snow, we find, in the two winters, maxima near the period of new moon, thus accounting, in conformity with the previous investigation, for the rise in the temperature; the average elevation above the mean temperature for the six winter months, during the hours of snow fall, being, according to the table, 13°. The superior maximum of Dec. 27th to Jan. 1st (first winter), when it snowed during 44 hours, is particularly instructive.

The lower wavy line indicates maxima in the amount of serenity of atmosphere near the time of full moon, better marked in the first than in the second winter. The above special case of Dec. 29–30, is again interesting as conspiring to an ele-

vation of temperature by the nearly total obscurity of the atmosphere during the six days in question.

The mean amplitude of the wave in the winter 1853–54 is 19°.4, and in the winter 1854–55, 20°.1, or 19°.8 from an average during these two winters.

It has been remarked by an eminent astronomer that, if the moon emits any sensible heat, it is probably expended and becomes apparent by a tendency to disappearance of clouds under the full moon. Supposing this to be a fact, it would seem that the powerful radiating force of the earth's surface, called into activity under a clear sky, produces, as a secondary effect, the phenomenon of greatest cold at the time of full moon. The process is going on gradually, and, when combined with the tendency of a fall of snow about the period of new moon, would favor the production of the caloric waves observed during the winter season. These waves could not be explained either in range, duration, or regularity, by the effect of various winds and calms, since their total effect could only amount in maxima to 6½°, according to the previous investigation.

A maximum cold will be produced, as stated by Dr. Kane, by a concurrence of the time of full moon with a perfect calm and a great transparency of the atmosphere, during the middle of the winter season. The opposite effect requires, for its full development, a concurrence of the time of new moon with a continued fall of snow, a generally obscured atmosphere, and winds from a direction between N. N. E. and E. S. E. (true).

Enough has been shown to make these alternations of relative cold and warm periods in winter an interesting and instructive subject for further study, specially with a view of tracing out and confirming the apparent connection of the concurrence of the two principal lunar phases, with a tendency to obscurity and transparency of the atmosphere.

In accordance with Prof. Dove's investigations of the return of cold about the 11th of May, the mean daily temperature on May 13th (1854) of +2°.8 was 9°.3 lower than the computed (by preceding formula) temperature.[1]

Hourly Corrections for Periodic Variations.—The following table for reducing the mean of observations taken at any hour of the day to the true mean temperature of the day, has a similar arrangement, and was prepared for the same use, as those given for other stations in the Smithsonian *Miscellaneous Collections of Meteorological and Physical Tables*, by Prof. A. Guyot (2d edition, Washington, 1858). The figures necessarily present some anomalies, since they are derived directly from a series of hourly observations extending over seventeen months; they present, therefore, only the differences between the hourly and the true means.

[1] While this paper was going through the press, I received the March number (1859) of the *London, Edinburgh, and Dublin Philosophical Magazine*, containing J. Park Harrison's article on the "Lunar Influence on Temperature as connected with Serenity of the Sky." He states that, from 20 years of observations at Greenwich, the mean temperature is above the average at the period of the new moon (also at first quarter and before last quarter), it is below the average before and after full moon (also between new moon and first quarter, and at and after last quarter).

ARCTIC AMERICA—VAN RENSSELAER HARBOR, Lat. 78° 37′, Long. 70° 53′ W. of Greenwich.

Corrections to be applied to any hourly or set of hourly observations to obtain the mean temperature of the day. Degrees of Fahrenheit.

Hours.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
	°	°	°	°	°	°	°	°	°	°	°	°	°
1 A. M.	+0.07*	+1.65	+1.97	+4.50	+4.45	+3.11	+1.54	+2.60	+2.22	—0.12	—0.68	+0.37	+1.81
2	+0.31	+1.61	+1.79	+4.51	+4.11	+3.06	+1.45	+2.29	+2.20	—0.07	—0.61	+0.22	+1.74
3	+0.44	+1.44	+1.98	+4.92	+3.45	+2.89	+1.42	+2.37	+1.92	—0.15	—0.68	+0.48	+1.71
4	+0.48	+0.84	+2.21	+4.39	+2.90	+2.56	+1.42	+1.99	+2.02	—0.22	—0.70	+0.66	+1.55
5	+0.47	+1.51	+2.14	+3.55	+1.60	+1.27	+1.26	+2.13	+2.03	—0.30	0.00	—0.18	+1.29
6	+0.49	+0.94	+1.91	+2.88	+0.71	+0.62	+0.60	+1.51	+1.44	—0.27	+0.27	—0.33	+0.90
7	+0.82	+0.51	+1.20	+1.83	—0.05	—0.24	+0.43	+0.87	+0.45	—0.42	+0.07	—0.17	+0.44
8	+0.23	+0.20	+0.79	+0.75	—0.99	—1.49	—0.24	—0.12	—0.97	—0.36	+0.23	—0.11	—0.17
9	+0.35	—0.03	—0.52	—0.93	—0.91	—0.71	—1.23	—1.22	—1.70	—0.66	+0.04	—0.45	—0.66
10	+0.09	—0.56	—1.09	—1.61	—1.60	—0.92	—1.44	—2.07	—2.35	—0.91	+0.18	—0.45	—1.07
11	—0.47	—0.23	—2.27	—2.58	—1.90	—1.29	—1.81	—2.72	—2.22	—0.79	—0.39	—0.60	—1.44
Noon	—0.95	—0.86	—2.82	—3.23	—2.44	—2.06	—1.85	—2.38	—2.96	—0.62	—0.58	—1.08	—1.83
1 P. M.	—0.67	—1.35	—3.20	—3.67	—2.67	—2.21	—1.64	—2.42	—3.00	—0.53	—0.20	—1.00	—1.88
2	—0.65	—1.35	—3.61	—4.49	—2.91	—2.09	—1.50	—2.43	—2.62	—0.35	—0.20	—0.68	—1.91
3	—0.15	—1.20	—2.97	—4.62	—3.01	—1.79	—1.46	—2.02	—2.13	—0.44	—0.12	—0.34	—1.69
4	—0.10*	—1.11	—1.88	—4.32	—3.30	—1.48	—1.46	—1.48	—1.57	—0.30	—0.01	—0.04	—1.42
5	—0.24	—0.85	—1.20	—4.20	—2.72	—1.29	—0.66	—1.19	—0.94	—0.03	—0.17	+0.07	—1.12
6	—0.24	—0.98	—0.57	—3.33	—1.89	—1.17	—0.32	—0.68	—0.47	+0.36	+0.09	+0.22	—0.75
7	—0.34	—1.03	—0.05	—1.93	—1.04	—0.67	—0.05	—0.29	+0.34	+0.87	+0.25	+0.78	—0.26
8	—0.07	—0.88	+0.83	—0.96	—0.18	—0.44	+0.52	+0.07	+0.86	+0.98	+0.35	+0.72	+0.15
9	—0.16	—0.45	+0.96	+0.36	+0.65	+0.21	+0.95	+0.37	+1.20	+0.98	+0.86	+0.61	+0.55
10	—0.24	+0.62	+1.21	+1.90	+1.76	+0.64	+1.52	+1.02	+1.63	+1.06	+0.54	+0.53	+1.02
11	+0.40	+0.66	+1.45	+2.64	+2.80	+1.55	+1.36	+1.40	+2.37	+1.04	+0.79	+0.44	+1.41
Midn't	+0.08	+0.94	+1.62	+3.76	+3.24	+1.94	+1.25	+1.98	+2.70	+1.11	+0.65	+0.27	+1.63
6, 6	+0.12	—0.02	+0.67	—0.22	—0.59	—0.27	+0.14	+0.44	+0.48	+0.04	+0.18	—0.05	+0.08
7, 7	+0.24	—0.26	+0.57	—0.05	—0.54	—0.45	+0.19	+0.29	+0.40	+0.22	+0.16	+0.31	+0.09
8, 8	+0.08	—0.34	+0.81	—0.11	—0.58	—0.96	+0.14	—0.02	—0.05	+0.31	+0.29	+0.30	—0.01
9, 9	+0.10	—0.24	+0.22	—0.28	—0.13	—0.25	—0.14	—0.42	—0.25	+0.16	+0.45	+0.08	—0.06
10, 10	—0.07	+0.03	+0.06	+0.15	+0.08	—0.14	+0.04	—0.52	—0.36	+0.07	+0.36	+0.04	—0.02
7, 2, 9	0.00	—0.43	—0.48	—0.77	—0.77	—0.71	—0.04	—0.40	—0.32	+0.07	+0.24	—0.08	—0.31
6, 2, 10	—0.13	+0.07	—0.16	+0.10	—0.15	—0.28	+0.21	+0.03	+0.15	+0.15	+0.20	—0.16	0.00
7, 2, 9, 9	—0.04	—0.43	—0.12	—0.49	—0.41	—0.48	+0.21	—0.20	+0.06	+0.30	+0.40	+0.09	—0.09
3, 9, 3, 9	+0.12	—0.06	—0.14	—0.07	+0.05	+0.15	—0.08	—0.12	—0.18	—0.07	+0.03	+0.08	—0.02

* The tabular quantities for 1 A. M. and 4 P. M., in January, are mean values of the directly observed values for these hours combined with those of the preceding and following hours.

The hours 7 A. M., 2 P. M., and 9 P. M., are those of the Mannheim Meteorological Society, adopted at the military posts of the United States and by the Smithsonian Institution; the hours 3 and 9 A. M. and 3 and 9 P. M., are those proposed by the Royal Society. Of the bi-hourly series, the observations at 10 A. M. and 10 P. M., will give a very close approximation; the sum of the squares of the tabular monthly values is a maximum, and the temperature at these hours does not change as rapidly as at other hours. Of the three-hour series, the hours 7, 2, and twice 9 are most convenient, but less accurate than the hours 6, 2, 10. The hours 3 and 9 A. M. and P. M., have the least sum of the squares of the monthly values; these hours are most suitable for cases having a sufficient number of observers, or for fully organized expeditions.

Solar Radiation.—After the return of light in the spring of 1854, a thermometer was exposed to the direct action of the sun. On and after April 10th, the statical measure by means of a black bulb thermometer was adopted. In connection with these observations, the estimated amount of solar light was also noted. From a

note, Oct. 19th, 1854, it appears that the numbers expressive of the quantity of solar light have the following signification:—

1 Entirely clear.
2 Slightly obscured.
3 Clouded.
4 Misty and dark.
5 Excessive obscurity.

The sign 0, which occasionally occurs, probably indicates either no observation, or snowy or rainy atmosphere. There are a few apparent anomalies in the following tables, the temperature indicated by the black bulb being somewhat lower than that indicated by the shade thermometer with an overcast sky. These may arise from a slightly erroneous index error, or occasional observing errors, or different localities of exposure.

The following record of the observations of the temperature by the black bulb thermometer exposed to the solar rays, contains the corrected readings, which renders them directly comparable with the readings of the preceding general record, and has been inserted for the use of those who may desire to further investigate the subject.

READINGS OF THE BLACK BULB THERMOMETER, AND CORRESPONDING NOTES ON THE SOLAR LIGHT, OBSERVED AT VAN RENSSELAER HARBOR,

In April, 1854, in Lat. 78° 37′, Long. 70° 53′ W. of Greenwich.

Expressed in degrees of Fahrenheit's scale. At meteorological observatory.

Hour.	10th.	11th.	12th.	13th.	14th.	15th.	16th.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1h.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	...	...	...	...	...	...	...	...	—10.0	...	...	— 8.0	— 8.0	...	...
4	...	...	...	...	...	...	...	...	...	— 1.0	...	+ 4.0	— 1.0	...	+1.0
5	...	— 7.0	—17.0	...	...	— 5.0	...	0.0	—10.0	+ 9.0	— 4.0	+ 2.0	+ 5.0	...	2.0
6	...	— 6.0	—10.0	...	...	— 4.5	+ 7.0	+ 5.0	— 2.0	+10.0	0.0	+12.0	+14.0	...	3.0
7	— 4.0	+ 5.0	— 6.0	...	...	— 4.5	16.0	4.0	+ 2.0	+ 8.0	+ 8.0	?	+ 7.0	+ 8.0	7.0
8	— 4.0	+10.0	— 2.0	...	...	+ 2.0	12.0	4.0	+ 5.0	+ 4.0	+12.0	?	+16.0	7.6	8.0
9	— 2.0	+ 6.0	*+1.0	+ 6.2	...	+ 4.5	12.0	6.0	+10.0	+ 5.5	+ 8.0	+20.0	+22.0	13.0	15.0
10	+ 0.5	+10.0	+ 1.0	6.0	...	+ 6.0	12.0	8.0	+11.0	+14.0	+14.0	+17.0	+13.5	13.0	15.0
11	+ 1.0	†+10.0	+ 2.0	12.0	+6.0	+ 9.0	‡15.0	8.0	+ 6.0	+17.5	+ 9.0	+ 4.0	+24.0	16.0	19.5
Noon	+ 2.0	+ 4.0	+ 2.3	10.0	+6.0	+10.0	?	...	+14.0	+24.0	+25.0	+18.0	+17.0	21.0	27.0
13	+ 1.8	+ 1.8	+ 5.0	12.0	...	+10.0	25.0	26.0	+ 8.0	+12.0	+16.0	+26.0	+27.0	20.0	23.0
14	— 0.6	+ 2.0	+ 7.0	10.0	+5.0	+ 6.0	25.0	24.0	+18.0	+15.0	+25.0	+18.0	+30.0	23.0	24.0
15	— 1.5	+ 3.5	+ 8.0	9.0	+4.5	+ 3.0	20.0	22.0	+10.0	+18.0	+22.0	+17.0	+33.0	30.0	20.0
16	— 2.0	+ 5.0	+ 7.0	+ 8.0	+5.0	+ 3.3	20.5	20.0	+ 9.0	+15.0	+20.0	+15.0	+28.0	21.0	14.0
17	— 2.5	— 8.0	— 1.0	...	+5.0	...	16.0	8.0	?	+15.0	+17.0	+14.2	+22.0	14.0	9.5
18	§—7.5	—11.0	— 1.9	...	+4.5	...	14.0	6.0	— 2.0	+ 8.0	+ 7.0	+14.0	+ 9.0	13.0	2.0
19	—10.0	—18.0	— 3.6	...	+4.0	...	+ 5.0	4.0	— 3.0	+ 3.0	+ 4.0	+11.0	+ 8.0	6.5	+3.0
20	— 9.0	—20.5	...	...	+2.0	...	0.0	+ 4.0	— 4.0	— 4.8	+ 3.0	+ 9.0	+ 2.0	3.0	...
21	...	...	...	...	—1.5	...	...	...	...	— 5.2	— 4.0	— 3.2	...	+ 1.8	...
22	...	...	...	...	...	...	...	...	...	?	— 4.5	— 3.0	...	0.0	...
23	...	...	...	...	...	...	...	...	...	?	...	...	...	...	...
Midn't	...	...	...	...	...	...	...	...	...	—13.9	...	...	...	...	...

Hour.	10th.	11th.	12th.	13th.	14th.	15th.	16th.	17th	18th.	19th.	20th.	21st.	22d.	23d.	24th.
1h.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
2	...	...	...	...	...	...	...	...	...	...	...	1	...	...	1
3	...	...	...	...	...	...	...	...	...	...	...	1	1	...	1
4	...	...	...	...	...	...	...	...	...	1	...	1	1	...	1
5	3	3	1	...	...	1	...	1	1	1	1	1	1	...	1
6	3	4	1	...	4	1	3	1	1	1	1	1	1	...	1
7	3	4	1	...	...	1	2	1	1	1	1	1	1	4	1
8	3	4	1	...	...	1	1	1	1	1	1	1	1	?	1
9	4	1	1	4	‖4	1	...	...	1	1	1	1	2	2	1
10	4	1	1	4	‖4	1	...	...	1	1	1	1	1	2	1
11	4	2	1	4	4	2	...	...	1	1	1	1	1	2	1
Noon	4	2	1	4	4	2	...	...	1	1	1	1	2	2	1
13	4	2	1	4	‖4	2	1	1	1	1	1	1	2	1	1
14	4	2	1	4	4	2	1	1	1	1	1	1	2	1	1
15	4	2	1	4	4	4	1	1	1	1	1	1	2	1	1
16	4	2	2	4	4	‖4	1	1	1	1	1	1	2	1	1
17	4	1	2	4	4	‖4	1	1	1	1	1	1	3	1	1
18	4	1	3	4	4	‖4	1	1	1	1	...	1	3	2	1
19	4	1	3	...	4	‖4	1	1	1	2	...	1	4	1	1
20	4	1	4	...	4	‖4	1	1	1	3	...	1	4	1	1
21	...	...	...	...	4	...	...	...	...	3	...	...	...	...	1
22	...	...	...	...	...	...	...	...	...	3	...	...	...	...	1
23	...	...	...	...	...	...	...	...	...	3	...	...	...	...	1
Midn't	...	...	...	...	...	...	...	...	...	4	...	...	...	...	1

* Corrected from 10° to 1°.0.

† In the original, it has the sign —.

‡ Changed from 5 to 15.

§ Corrected reading, the original being 9°.

‖ The original has 0; the column for clouds indicates 4, as above.

NOTE.—The observations are made with mercurial thermometer No. 1; by comparison with the observatory standard at +42°, its correction was —0°.1. It was not thought necessary to apply this small correction.

READINGS OF THE BLACK BULB THERMOMETER, AND CORRESPONDING NOTES ON THE SOLAR LIGHT, OBSERVED AT VAN RENSSELAER HARBOR,

In April and May, 1854, in Lat. 78° 37′, Long. 70° 53′ W. of Greenwich.

Expressed in degrees of Fahrenheit's scale. At meteorological observatory.

Hour.	25th.	26th.	27th.	28th.	29th.	30th.	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1h.	...	...	...	+ 4.0	...	...	...	...	...	*—6.5	+ 2.1	...	...	+ 6.3	...
2	...	— 1.0	...	4.0	...	...	...	...	...	*—6.0	3.5	...	...	9.8	+14.0
3	+ 3.0	+ 1.0	— 3.8	3.0	+ 5.0	+ 7.0	+ 9.0	...	+ 1.0	*—4.5	5.0	+ 0.5	+ 7.5	9.7	17.0
4	4.0	4.0	+ 4.2	3.0	7.0	8.0	12.0	...	12.0	*—4.0	6.5	1.0	10.5	11.3	20.0
5	6.0	5.0	5.0	4.3	8.0	8.3	14.5	...	17.0	+ 2.0	7.0	6.0	10.0	16.0	22.0
6	7.5	7.0	5.6	5.5	10.0	8.0	24.0	...	18.0	+ 2.0	8.0	8.0	10.0	18.0	26.5
7	8.0	12.0	5.9	6.0	12.0	13.0	21.5	...	21.0	+ 1.5	8.0	14.0	13.0	20.0	26.0
8	11.0	16.0	6.8	8.5	13.0	14.0	29.0	...	19.0	+ 1.0	9.0	14.0	20.0	20.0	21.0
9	6.0	20.0	10.0	10.0	15.0	15.0	26.0	...	16.0	+ 5.0	10.0	10.0	26.0	18.0	16.0
10	8.0	25.0	12.0	16.0	16.0	25.0	28.0	...	20.0	+10.0	10.5	14.5	21.0	19.0	17.0
11	10.0	26.0	15.0	17.0	16.0	23.0	28.0	...	27.0	+16.0	11.0	20.1	18.0	23.0	28.0
Noon	12.0	30.0	18.0	20.0	16.0	22.0	19.0	...	32.0	+18.0	11.2	20.0	20.0	26.0	30.0
13	12.5	32.0	23.0	22.0	18.0	20.0	22.0	...	30.0	+19.0	11.5	17.5	16.0	27.0	28.0
14	12.0	28.0	24.0	24.0	22.0	21.0	29.0	...	27.0	+16.4	13.0	16.0	13.0	30.0	29.0
15	15.0	26.0	22.5	22.0	20.0	20.0	24.0	...	22.0	+13.0	11.5	12.4	13.0	29.0	30.0
16	18.0	25.0	22.0	14.0	18.0	22.5	20.0	...	21.0	+ 9.2	12.0	11.0	15.0	28.0	32.0
17	13.0	22.0	23.0	13.0	15.0	22.0	17.0	...	18.0	+ 9.0	13.0	7.0	13.0	25.0	30.0
18	8.0	20.0	20.0	12.0	15.0	11.0	14.0	...	14.5	+ 7.5	12.0	6.0	14.3	24.0	26.0
19	7.0	18.0	17.0	8.0	13.0	9.0	+10.0	...	+ 6.0	+ 5.0	10.0	5.0	13.0	22.0	27.0
20	+ 7.5	15.0	12.0	8.0	11.0	8.0	...	...	0.0	+ 2.0	+ 6.0	4.0	14.0	21.5	24.0
21	...	+ 8.0	+ 8.0	6.0	10.0	5.0	...	...	— 5.0	+ 1.5	— 1.0	3.8	11.5	16.0	13.0
22	...	...	0.0	+ 4.0	+ 9.0	+ 1.0	...	...	...	— 1.0	...	3.0	11.0	14.0	12.5
23	...	...	...	...	...	...	...	...	...	...	...	+ 2.8	+10.0	8.0	10.2
Midn't	...	...	...	...	...	...	...	...	...	...	...	...	...	+ 7.0	+11.0

Hour.	25th.	26th.	27th.	28th.	29th.	30th.	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.
1h.	...	1	1	1	1	1	1	...	1	1	4	3	3	2	1
2	...	1	1	1	1	1	1	...	1	1	4	3	3	2	1
3	1	1	1	1	1	1	1	...	1	1	4	2	4	2	1
4	1	1	1	1	1	1	1	...	1	1	4	2	3	1	1
5	1	1	1	1	1	1	1	...	1	1	4	1	3	2	1
6	1	1	1	1	1	1	1	...	1	1	4	1	4	3	1
7	1	1	1	1	1	1	1	...	1	1	4	1	3	3	1
8	1	1	1	1	1	1	1	...	1	1	4	1	3	3	1
9	1	1	1	1	1	1	1	...	1	1	4	2	2	3	1
10	1	1	1	1	1	1	2	...	1	1	4	1	4	3	1
11	1	1	1	1	1	1	3	...	1	1	3	1	4	3	1
Noon	1	1	1	1	1	1	3	...	1	1	3	1	4	1	1
13	1	1	1	1	1	1	1	...	1	1	3	1	†4	2	1
14	1	1	1	1	1	1	1	4	1	1	3	2	†4	1	1
15	1	1	1	1	1	1	2	4	1	1	3	2	2	1	1
16	1	1	1	1	1	1	2	3	1	1	3	2	1	2	1
17	1	1	1	1	1	1	2	3	1	1	3	2	1	1	1
18	1	1	1	1	1	1	2	3	2	1	2	2	1	1	1
19	1	1	1	1	1	1	3	1	2	1	2	3	1	1	1
20	1	1	1	1	1	1	4	1	2	2	3	3	1	1	1
21	...	1	1	1	1	1	4	1	2	2	3	3	2	1	1
22	...	1	1	1	1	2	...	1	2	3	3	4	2	1	1
23	...	1	1	...	1	2	...	1	2	...	4	3	2	1	1
Midn't	...	1	1	...	1	2	...	1	1	...	4	4	2	1	1

* The sign is wanting in the original. † Zeros in the abstracts.

On May 2d, the sun was obscured during the greater part of the day.

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In May, 1854, in Lat. 78° 37′, Long. 70° 53′ W. of Greenwich.

Expressed in degrees of Fahrenheit's scale. At meteorological observatory.

Hour.	10th.	11th.	12th.	13th.	14th.	15th.	16th.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1h.	+14.0	+ 5.0	+ 5.0	+ 6.0	+ 6.0	+ 9.0	+15.0	+14.0	...	+10.0	+13.0	+12.0	+11.0	+19.0	+17.0
2	15.0	7.6	4.0	7.0	7.0	10.0	20.5	13.0	...	12.0	16.5	13.5	12.0	17.0	18.0
3	18.0	7.7	2.0	10.8	12.0	9.0	23.0	15.0	...	13.0	23.2	14.8	16.0	22.0	26.0
4	20.0	8.0	5.0	13.0	14.0	13.0	20.0	15.0	...	14.0	27.0	16.0	22.0	20.0	26.0
5	23.0	6.2	8.0	14.0	17.0	13.0	18.0	16.0	...	20.0	30.2	17.0	28.0	21.0	36.0
6	23.2	7.0	9.6	14.5	18.5	18.0	20.0	16.5	...	30.0	38.0	20.0	30.0	24.0	21.0
7	22.8	9.0	11.0	16.0	22.2	20.0	21.0	18.0	...	36.0	36.0	28.0	40.0	28.0	28.0
8	23.0	11.5	13.2	16.8	23.8	24.0	22.0	19.5	...	39.0	35.0	30.0	34.0	32.0	38.0
9	23.0	13.5	15.0	18.0	29.0	17.0	30.3	21.0	...	31.0	27.0	28.0	27.5	27.0	32.1
10	20.0	17.5	20.0	20.0	31.5	20.0	28.0	24.0	...	34.0	29.5	30.0	34.0	34.0	32.0
11	15.0	20.0	26.0	27.0	31.0	22.5	34.0	31.0	...	33.0	30.0	30.0	39.0	31.5	35.0
Noon	11.5	25.0	32.0	24.0	30.2	24.0	40.0	40.0	...	38.6	30.5	30.0	48.0	34.0	31.0
13	13.0	26.0	34.0	22.0	32.0	25.5	36.0	36.0	...	43.1	32.0	30.0	40.0	31.0	32.5
14	11.5	28.0	38.0	24.0	31.0	26.0	29.0	23.0	...	46.0	38.0	29.0	44.0	29.0	35.0
15	13.2	24.0	34.0	24.0	31.5	28.5	27.0	23.5	...	40.0	36.0	31.0	43.0	24.0	39.4
16	13.1	18.0	20.0	22.0	29.0	29.0	23.0	25.0	...	30.7	37.0	27.0	35.0	23.0	34.0
17	12.0	14.0	21.0	21.0	29.0	27.0	24.5	24.0	...	29.0	33.0	24.0	31.5	25.0	39.0
18	11.0	13.5	17.0	17.0	30.4	25.0	23.5	17.5	...	23.0	32.0	23.0	29.5	28.0	29.0
19	9.0	12.3	12.0	14.5	25.0	22.0	22.0	+13.0	...	20.0	31.2	19.0	27.0	27.0	27.0
20	10.0	10.0	8.3	10.0	14.5	18.0	20.0	...	...	17.0	29.0	17.5	24.0	27.0	28.0
21	10.0	9.0	10.5	8.0	18.0	12.0	17.0	...	+10.0	15.0	20.0	16.2	21.0	18.0	+23.0
22	10.4	8.0	11.0	7.0	12.0	11.0	16.0	...	9.0	12.0	17.5	11.0	19.5	16.0	...
23	+ 9.0	7.0	13.0	3.0	14.0	10.5	14.5	...	8.0	9.0	17.0	11.0	18.0	18.0	...
Midn't	...	+ 8.0	+ 9.0	+ 2.0	+ 8.0	+ 8.0	+12.0	...	+ 9.0	+ 8.0	+13.4	+10.0	+14.0	+16.0	...

Hour.	10th.	11th.	12th.	13th.	14th.	15th.	16th.	17th.	18th.	19th.	20th	21st.	22d.	23d.	24th.
1h.	1	*4	1	2	1	1	1	1	*4	2	1	2	1	1	2
2	1	*4	1	1	1	1	1	2	*4	2	1	2	1	1	2
3	1	*4	1	1	1	1	1	2	...	2	1	2	1	1	1
4	1	*4	1	1	1	1	1	2	...	2	1	2	1	1	1
5	2	4	1	1	1	1	1	2	...	2	1	2	1	1	2
6	2	4	1	1	1	1	1	2	...	1	1	2	1	1	3
7	3	4	1	1	1	1	1	2	...	1	1	2	1	1	2
8	3	3	1	1	1	2	1	2	...	1	1	2	1	1	1
9	3	3	1	1	1	2	1	2	...	2	1	2	1	1	1
10	4	4	1	1	1	1	1	2	*4	2	1	1	1	1	1
11	*4	4	1	1	1	1	1	2	4	4	1	1	1	2	1
Noon	*4	4	1	1	1	1	1	2	4	3	1	1	1	3	1
13	4	3	1	1	1	1	1	1	4	2	1	1	1	4	1
14	4	2	1	1	1	1	1	1	4	2	1	2	1	4	1
15	4	2	1	1	1	1	1	2	4	1	1	2	1	4	1
16	4	3	1	1	1	1	1	3	4	1	1	1	1	3	1
17	4	3	1	1	1	1	1	3	4	1	1	1	1	2	1
18	4	2	3	1	1	1	1	3	4	1	1	2	1	1	1
19	4	3	3	1	1	1	1	*4	4	1	1	2	1	1	1
20	4	3	4	1	1	1	1	*4	4	1	1	3	1	1	2
21	4	2	4	1	1	1	1	*4	3	1	1	2	1	1	3
22	4	1	4	1	1	1	1	*4	3	1	1	2	1	1	...
23	4	1	4	1	1	1	1	*4	3	1	1	1	1	1	...
Midn't	4	1	4	1	1	1	1	4	3	1	1	1	1	1	...

* The original has 0s.

May 14th. McGary returned, reporting open water at Fog Inlet as far as the eye could see across the channel.

May 20th. The sun is now acquiring power in the middle of the day sufficient to soften the snow on the surface, and black objects lying upon it sink quite fast.

READINGS OF THE BLACK BULB THERMOMETER, AND CORRESPONDING NOTES ON THE SOLAR LIGHT, OBSERVED AT VAN RENSSELAER HARBOR,

In May and June, 1854, in Lat. 78° 37′, Long. 70° 53′ W. of Greenwich.

Expressed in degrees of Fahrenheit's scale. At meteorological observatory.

Hour.	25th.	28th.	29th.	30th.	31st.	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1h.	...	+37.0	...	+31.0	+30.0	+25.0	+32.0	+30.0	+27.0	+28.0	+20.0	+23.0	+25.0	+26.0	+26.0
2	...	38.0	...	31.0	35.0	28.0	31.0	34.5	28.0	25.0	19.5	23.5	23.0	26.0	32.0
3	...	36.0	...	31.0	33.0	25.0	32.0	38.7	28.0	26.2	21.0	28.0	33.0	26.0	33.0
4	+20.5	37.5	...	32.0	31.0	32.0	33.0	42.0	28.0	28.0	22.0	34.0	35.0	26.0	38.0
5	...	...	...	32.0	30.0	32.0	38.0	...	...	32.0	24.0	38.3	36.0	27.5	36.0
6	...	...	...	36.0	32.0	26.4	40.0	...	...	31.6	24.0	29.1	37.3	28.3	37.0
7	...	...	...	40.0	36.0	29.0	50.0	...	...	31.3	30.0	30.0	38.0	29.2	38.0
8	...	45.0	+46.0	45.0	37.0	34.0	45.0	...	...	29.5	32.0	32.5	39.5	31.7	38.0
9	28.0	42.0	44.0	42.0	35.0	39.0	42.0	44.0	35.0	35.1	34.0	34.0	40.0	33.2	35.0
10	31.0	41.0	...	44.0	36.0	37.0	38.5	38.0	36.0	38.0	35.0	38.0	40.0	34.0	41.0
11	27.0	43.0	...	40.0	37.0	38.0	38.0	42.0	37.0	34.0	32.0	40.0	44.0	35.0	40.0
Noon	33.0	40.0	...	43.0	36.0	42.0	37.0	40.0	38.0	34.0	33.0	34.0	42.0	36.0	41.0
13	32.0	41.0	40.0	43.5	42.0	38.0	34.0	37.0	33.7	36.0	36.0	38.0	42.0	35.0	41.3
14	33.0	42.0	42.0	42.0	41.0	39.0	34.5	37.0	34.5	36.0	38.0	44.0	38.0	42.5	42.0
15	34.0	41.3	38.0	39.4	40.0	37.5	34.5	36.0	35.0	36.2	36.0	44.0	34.0	46.0	44.0
16	32.0	41.0	42.0	39.0	40.0	38.0	34.0	33.0	34.0	37.2	31.5	35.0	34.0	36.0	43.5
17	31.0	...	40.0	36.0	39.0	38.0	34.0	32.5	31.0	35.0	32.0	35.0	34.0	36.0	44.0
18	30.0	...	40.0	35.0	39.0	38.0	34.0	31.7	30.0	30.0	28.2	35.0	34.0	35.5	45.0
19	30.5	...	39.0	34.5	36.0	38.0	34.5	34.5	29.0	29.0	30.0	38.0	31.0	34.0	32.0
20	30.6	...	38.0	31.0	37.0	35.0	34.0	31.5	30.0	28.0	26.0	37.0	+30.0	28.0	31.0
21	30.0	...	31.0	30.0	37.0	34.0	33.0	28.0	30.0	26.0	28.0	36.0	...	34.0	29.0
22	29.0	...	30.5	26.0	34.0	34.0	32.0	28.0	29.0	29.0	27.0	30.0	...	30.0	28.0
23	25.0	...	+30.0	27.0	32.0	28.0	30.0	28.0	29.0	28.0	25.0	31.0	...	30.0	28.0
Midn't	+26.0	...	...	+25.0	+29.0	+27.5	+29.0	+28.0	+28.0	+24.0	+23.0	+24.0	...	+28.0	+27.0

Hour.	25th.	28th.	29th.	30th.	31st.	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.
1h.	...	4	...	4	2	1	2	...	...	4	4	4	1	4	1
2	...	4	...	4	2	2	2	...	...	4	4	4	...	4	1
3	...	4	...	4	1	2	2	...	...	4	2	3	...	4	1
4	4	4	...	4	1	1	2	...	...	4	2	1	...	4	1
5	...	...	...	*4	1	1	1	...	...	...	...	...	...	...	...
6	...	...	...	4	1	1	1	...	...	...	...	...	...	...	...
7	...	...	...	3	1	2	1	...	...	...	...	...	...	...	...
8	...	4	2	3	1	2	2	...	...	...	...	...	...	...	...
9	4	4	4	2	1	2	2	1	...	...	3	1	...	...	...
10	4	4	*4	3	1	2	3	1	...	1	4	1	3	4	2
11	4	4	*4	3	1	3	3	1	...	4	2	2	3	4	2
Noon	4	4	*4	3	1	3	4	1	1	4	2	3	1	3	2
13	4	4	4	3	2	3	*4	1	1	4	3	1	1	...	2
14	4	4	3	3	2	3	*4	1	1	4	...	1	...	3	2
15	4	4	4	3	2	3	*4	1	1	1	3	1	2	3	2
16	4	4	*4	3	1	3	*4	1	...	1	4	...	2	2	2
17	4	...	*4	3	1	3	*4	1	...	1	4	...	2	2	2
18	4	...	*4	*4	1	2	*4	1	...	1	4	...	2	1	2
19	4	...	*4	*4	1	1	3	1	...	...	...	...	...	...	1
20	4	...	*4	4	1	1	3	*4	...	...	...	...	...	...	1
21	4	...	4	4	1	1	3	3	...	...	...	...	...	...	...
22	4	...	4	3	1	1	2	3	...	...	...	...	...	...	...
23	4	...	4	3	1	1	1	3	...	...	...	...	...	...	...
Midn't	4	...	4	2	1	1	1	4	...	...	...	...	...	...	...

* Zeros in the original.

No observations on the 26th and 27th.

May 26th. The effect of the higher temperature is very apparent on the snow and ice, rendering the former very soft, and the latter spongy and porous.

May 27th. The snow is melting fast, the water rising through the cracks in the ice foot, and forming large basins every tide.

May 28th. Ice foot decaying rapidly.

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Hour.	11th.	12th.	13th.	14th.	15th.	16th.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1h.	+28.0	+23.5	+25.0	+28.0	+40.0	+41.0	+33.0	+38.0	+33.0	+34.0	+31.0	+31.0	+31.5	+31.0	+34.0
2	27.0	25.0	25.0	30.0	43.5	29.0	34.0	36.0	33.0	36.0	31.5	31.0	31.5	34.0	33.0
3	27.0	25.0	24.0	30.0	48.0	28.0	34.0	36.0	33.5	36.0	33.0	31.0	31.5	33.0	33.0
4	30.0	25.0	24.0	29.5	35.0	28.0	40.5	42.0	33.5	37.0	33.6	30.0	31.5	37.3	34.0
5	32.1	28.0	29.0	34.0	...	36.0	40.4	39.0	40.0	38.0	33.6	38.1	28.0	38.0	39.0
6	32.2	29.7	29.0	34.8	...	34.5	40.1	38.8	42.1	34.3	34.0	35.7	29.5	39.7	40.0
7	32.0	30.6	29.8	33.4	?26.7	34.3	40.0	38.5	46.0	32.0	34.6	36.2	30.0	40.0	41.3
8	36.0	37.0	30.0	36.0	34.0	32.0	38.0	38.0	49.0	34.0	34.8	38.7	33.1	42.3	42.0
9	38.0	40.0	30.0	39.0	38.0	38.0	40.0	44.0	50.0	34.0	34.0	44.3	34.0	40.2	43.0
10	41.0	41.0	32.0	40.0	40.0	44.0	42.0	45.0	53.0	34.0	34.0	37.2	34.0	42.1	45.0
11	40.0	40.5	33.0	45.0	46.0	48.0	39.0	46.0	54.0	34.0	35.0	38.0	35.0	44.2	45.0
Noon	40.5	41.0	33.0	48.0	45.0	44.0	42.0	49.0	50.0	40.0	52.0	38.2	37.0	46.2	45.0
13	40.0	41.0	32.5	48.0	48.0	43.0	41.0	49.0	48.0	40.0	54.0	44.0	36.0	45.0	43.0
14	41.0	41.5	33.0	48.7	47.0	38.0	38.0	46.0	49.0	34.0	52.0	37.0	40.0	44.0	40.0
15	41.0	41.0	34.0	49.0	45.0	39.0	39.0	45.5	49.0	29.0	52.0	37.0	43.0	42.0	40.0
16	40.0	41.0	33.0	48.0	45.0	39.0	39.5	43.0	44.0	29.0	56.0	37.5	46.0	41.0	37.5
17	40.0	41.0	33.0	46.0	46.0	39.0	40.0	38.0	43.0	30.0	56.0	35.0	46.0	41.0	34.0
18	40.5	41.0	33.0	44.0	49.0	39.0	40.0	38.0	42.0	31.0	42.0	35.0	45.0	40.0	35.0
19	38.0	31.0	33.0	41.0	41.0	36.0	47.0	38.0	42.0	30.9	38.0	34.0	38.0	38.0	35.0
20	36.0	32.0	29.0	38.0	40.0	35.0	46.0	39.0	38.0	31.0	36.2	33.0	36.0	38.0	35.0
21	35.0	*32.0	29.0	38.0	41.0	34.0	44.0	38.0	38.0	31.0	33.5	33.0	31.0	37.0	34.5
22	34.0	26.0	29.0	38.0	40.0	32.0	40.0	34.5	40.0	32.0	?31.4	33.0	32.0	36.0	33.5
23	32.0	25.0	30.0	36.0	34.0	33.0	38.0	34.0	34.0	30.2	32.0	+32.0	33.0	35.0	34.0
Midn't	+33.0	+28.0	+31.0	+31.0	+40.0	+33.0	+38.0	+34.0	+34.0	+29.7	+32.0	...	+32.0	+35.0	+34.0

Hour.	11th.	12th.	13th.	14th.	15th.	16th.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.
1h.	4	4	3	1	1	1	2	1	4	1	4	4	4	2	3
2	4	4	2	1	1	3	2	1	4	1	4	4	4	2	3
3	...	3	3	1	1	4	2	1	4	1	4	4	4	2	3
4	...	3	4	1	1	4	1	1	4	1	4	4	4	...	2
5	4	3	2	1	1	3	1	1	4	1	4	4	4	...	2
6	4	2	2	1	1	2	1	1	4	1	4	4	4	...	2
7	3	2	2	1	1	2	1	1	4	1	4	4	4	...	2
8	4	2	2	1	1	2	...	1	3	1	4	4	4	...	2
9	2	2	3	1	1	2	...	2	1	1	...	4	1	3	1
10	2	2	3	1	1	2	...	2	1	1	...	...	1	3	1
11	2	3	3	1	1	1	2	2	1	1	...	...	1	3	2
Noon	2	4	3	1	1	2	1	2	1	2	1	...	1	3	2
13	2	4	2	1	1	2	1	2	1	2	1	...	4	2	2
14	2	4	3	1	1	2	1	2	1	4	1	4	4	3	1
15	2	4	3	1	1	2	1	2	1	4	2	4	4	2	2
16	2	4	3	1	1	2	1	2	1	4	3	4	2	2	2
17	1	4	3	1	1	2	1	4	1	4	4	4	1	3	2
18	1	4	3	1	1	2	1	4	1	4	4	4	1	3	...
19	...	...	4	1	1	2	1	4	1	4	4	4	2	3	3
20	...	...	4	1	1	3	1	4	1	4	4	4	2	3	3
21	...	...	4	1	1	3	1	4	1	4	4	4	2	3	3
22	...	...	4	1	1	3	1	4	1	4	4	4	2	3	3
23	...	...	4	1	1	3	1	4	1	4	4	4	2	3	3
Midn't	...	...	4	1	1	3	1	4	1	4	4	4	2	3	3

* Corrected from 23° to 32°.

READINGS OF THE BLACK BULB THERMOMETER, AND CORRESPONDING NOTES ON THE SOLAR LIGHT, OBSERVED AT VAN RENSSELAER HARBOR,

In June and July, 1854, in Lat. 78° 37′, Long. 70° 53′ W. of Greenwich.

Expressed in degrees of Fahrenheit's scale. At meteorological observatory and Fern Rock Island.

Hour.	26th.	27th.	28th.	29th.	30th.	1st.	2d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1h.	+37.0	+36.5	+37.0	+38.0	+38.5	+36.0	+40.0	+50.0	+44.0	+45.0	+34.0	+37.0	+32.0	+36.0	+40.0
2	37.0	28.0	35.5	38.2	38.8	38.0	40.0	48.5	49.0	45.0	34.0	37.0	31.0	44.0	41.0
3	37.5	29.0	37.0	38.5	38.0	38.0	41.0	47.0	40.0	43.0	35.0	37.0	32.0	49.0	41.5
4	39.0	*47.0	37.0	40.0	39.0	38.0	41.0	48.0	48.0	43.0	34.0	36.0	36.0	44.0	49.5
5	39.0	37.0	35.0	45.2	40.0	39.0	...	53.0	45.0	44.0	34.0	...	36.0	39.0	50.0
6	39.0	39.0	35.1	45.2	46.0	39.5	...	66.0	47.0	41.0	35.0	...	37.0	40.0	49.0
7	39.0	38.0	35.1	45.0	48.0	38.0	...	56.0	50.0	45.0	36.0	...	38.0	46.0	52.0
8	40.0	41.0	36.2	45.0	51.0	38.0	...	67.0	53.0	44.0	36.5	...	38.5	44.0	51.0
9	39.5	43.0	38.0	46.0	50.0	40.0	...	61.0	60.0	46.5	37.0	38.0	38.0	44.0	49.0
10	39.5	44.0	39.0	46.0	52.0	41.0	...	54.0	64.0	?39.0	38.0	38.0	38.0	45.0	49.0
11	39.0	44.5	41.0	48.0	53.0	43.0	...	52.0	54.0	?39.0	39.0	38.0	40.0	43.0	47.0
Noon	44.0	46.0	41.5	49.0	53.0	43.0	...	49.0	49.0	40.0	37.5	39.0	41.0	43.0	46.0
13	54.0	49.0	44.0	51.0	53.0	48.0	...	49.0	48.0	40.0	37.0	?37.0	43.0	43.0	44.0
14	53.0	...	41.0	50.0	53.0	47.5	...	58.0	61.0	38.0	37.0	37.0	42.0	41.0	45.5
15	47.0	53.0	38.0	45.0	48.0	49.5	...	57.0	53.0	40.0	36.0	36.0	41.0	42.0	51.0
16	45.0	56.0	37.5	46.0	44.0	57.5	...	51.0	61.0	40.0	+34.0	37.0	39.0	41.0	47.0
17	45.0	51.0	37.3	42.0	43.0	54.0	...	51.0	†70.0	35.0	...	...	40.0	43.0	46.0
18	43.0	49.0	37.2	39.0	39.0	54.0	...	56.0	62.0	35.0	...	+53.0	44.0	44.0	41.0
19	41.0	50.0	34.5	39.5	37.5	46.0	...	59.0	57.0	36.0	...	...	42.0	42.0	40.0
20	40.0	49.0	34.5	38.0	35.5	?45.0	...	54.0	57.0	+35.0	...	...	42.0	42.0	39.0
21	41.0	49.0	34.0	38.5	35.0	40.5	...	51.0	50.0	...	...	...	41.0	38.0	+38.0
22	41.0	39.0	34.0	38.0	35.5	40.0	...	47.0	53.0	...	...	...	40.0	40.0	...
23	38.0	37.0	33.0	39.0	36.0	43.0	...	46.0	49.0	...	...	...	38.0	41.0	...
Midn't	+38.0	+37.0	+33.0	+38.0	+36.0	+37.0	...	+49.0	+43.0	...	...	...	+37.0	+42.0	...

Hour.	26th.	27th.	28th.	29th.	30th.	1st.	2d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.
1h.	2	4	3	2	2	3	2	4	4	2	?0	?0	?0	3	2
2	2	2	3	2	2	2	2	4	4	3	?0	?0	?0	1	2
3	2	2	3	2	2	2	2	4	4	2	?0	?0	?0	1	2
4	2	4	3	2	2	2	2	3	4	1	?0	?0	3	1	1
5	2	4	2	2	...	3	3	1	4	3	?0	?0	?0	1	1
6	2	4	2	2	...	4	4	1	4	3	?0	?0	?0	1	1
7	2	4	2	2	...	3	5	4	4	4	4	?0	3	1	1
8	2	4	2	2	...	3	5	1	4	4	4	?0	2	1	1
9	1	4	1	1	2	3	4	1	3	2	4	4	3	1	2
10	1	4	1	1	2	2	4	1	2	3	4	4	3	1	1
11	3	4	2	1	2	2	4	1	3	4	4	4	2	1	2
Noon	2	4	2	1	2	2	3	1	2	4	4	4	2	1	1
13	3	4	4	4	4	2	3	1	1	4	4	?0	3	1	1
14	3	...	4	4	4	1	3	2	1	4	4	?0	3	1	1
15	2	4	4	3	4	1	5	1	1	4	4	?0	2	1	1
16	2	4	4	...	3	2	5	2	1	4	4	?0	2	1	1
17	2	4	4	...	3	2	1	1	1	...	4	4	...	1	2
18	2	4	4	...	3	2	1	1	1	...	4	2	...	1	3
19	2	4	2	4	3	3	1	1	1	...	4	1	...	1	3
20	3	3	2	4	2	4	1	1	1	...	4	?0	...	1	4
21	3	3	3	4	2	2	2	4	?1	1	1	1	4	3	2
22	3	3	2	4	2	2	2	4	?1	1	1	1	4	2	?0
23	2	3	2	4	2	1	1	4	?1	1	1	1	3	1	?0
Midn't	4	3	2	4	2	1	1	4	?1	1	1	1	3	1	?0

* Probably 37°.0. † Highest temperature observed.

June 26th. Thermometer No. 1 broke; mercurial thermometer No. 17 supplied its place. By comparison with the observatory standard, its index error is 1°.0, or its correction —1°.0, which has been applied.

July 1st. The ice, the past two days, has changed remarkably; the water streams from the hills commenced running yesterday, and the warm weather has caused large pools on the surface of the ice in the bay, covering it to the depth of several inches.

July 2d. Thermometer No. 17 broke at 9 A. M. Its place was supplied by No. 16; its correction, from comparison with observatory standard, is —1°.2, and, with Tagliabue's standard, —0°.7. The correction —1°.0 was applied in the table. The water in the streams is still increasing, and the snow disappearing fast from the hills.

July 3d. No observations. On the 3d and 4th, young ice forms under the effect of a clear sky.

July 5th and 7th. The streams from the hills increase.

READINGS OF THE BLACK BULB THERMOMETER, AND CORRESPONDING NOTES ON THE SOLAR LIGHT, OBSERVED AT VAN RENSSELAER HARBOR,

In July, 1854, in Lat. 78° 37′, Long. 70° 53′ W. of Greenwich.

Expressed in degrees of Fahrenheit's scale. At Fern Rock Island and on board the brig.

Hour.	12th.	13th.	14th.	15th.	16th.	22d.	23d.	24th.	25th.	26th.	27th.	28th.	29th.	30th.	31st.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1h.	+34.0	+37.0	+36.0	+38.0	...	+40.5	+55.0	+45.0	+42.0	...	+36.0	+37.5	...	+37.0	+39.0
2	34.0	38.0	37.5	36.5	...	40.0	53.0	43.0	44.0	...	37.5	39.0	...	37.0	40.0
3	34.0	38.0	35.0	36.0	...	40.5	51.0	43.0	44.0	...	36.2	39.0	...	36.0	41.0
4	37.0	38.0	35.5	38.0	...	41.3	53.0	43.0	45.0	...	35.0	39.0	...	38.0	42.0
5	37.0	37.5	36.0	38.0	+35.5	42.0	54.0	43.5	46.0	+38.0	41.0	?36.5	...	41.0	...
6	39.0	40.0	35.5	39.0	38.2	41.0	57.0	45.0	46.5	39.0	39.0	?37.0	...	46.2	...
7	40.0	40.0	36.6	38.5	39.5	41.0	64.0	45.0	47.0	42.0	43.3	?37.8	...	51.0	...
8	40.0	41.0	39.0	38.0	40.0	42.0	63.0	44.0	47.5	42.0	44.0	41.0	...	58.0	...
9	39.0	41.0	41.0	38.5	39.5	49.0	64.0	48.0	40.0	35.0	47.0	48.0	...	58.0	46.0
10	39.0	41.0	48.5	38.0	39.8	57.0	65.0	49.0	39.0	37.0	46.0	48.0	...	60.0	48.0
11	39.0	41.0	47.5	37.0	40.0	59.0	63.0	55.0	39.0	39.0	45.0	49.0	...	61.0	53.0
Noon	38.0	41.0	49.0	35.5	39.5	59.0	60.0	56.0	39.0	44.0	44.0	50.0	...	59.0	59.0
13	38.0	42.0	50.5	38.0	38.0	60.0	60.0	57.0	58.0	45.0	42.0	52.0	+44.0	57.0	59.0
14	39.0	43.0	52.0	36.0	37.0	59.0	60.0	56.6	59.0	45.3	41.0	54.0	47.0	54.0	59.0
15	41.0	42.0	52.0	36.0	35.0	58.0	62.0	55.0	57.0	44.5	39.0	54.0	46.0	49.0	54.0
16	41.0	43.0	51.0	35.0	+35.0	57.5	62.0	56.0	57.0	44.0	37.0	+50.0	46.0	42.0	42.0
17	40.0	...	50.0	?34.0	...	57.0	61.0	55.0	41.0	?41.0	38.0	...	44.5	43.0	40.0
18	39.0	...	...	36.0	...	56.0	60.0	55.0	39.0	43.0	38.0	...	43.0	46.0	39.0
19	39.0	38.5	...	36.0	...	55.5	59.0	50.0	38.5	43.0	38.0	...	44.0	46.0	38.0
20	+37.0	+37.0	...	36.0	...	56.0	58.0	46.0	38.0	42.0	37.0	...	43.0	47.0	42.0
21	...	...	41.0	38.0	...	55.0	57.5	40.0	39.0	38.5	37.6	...	38.0	47.0	41.0
22	...	...	38.7	36.0	...	56.0	58.0	41.4	38.0	37.0	37.9	...	37.0	43.0	41.0
23	...	...	38.5	35.0	...	57.0	59.0	41.5	37.5	37.0	38.3	...	44.0	41.0	39.0
Midn't	...	...	+37.0	+34.0	...	+57.0	+58.0	+43.0	+36.0	+37.0	+38.2	...	+42.0	+42.0	+36.0

Hour.	12th.	13th.	14th.	15th.	16th.	22d.	23d.	24th.	25th.	26th.	27th.	28th.	29th.	30th.	31st.
1h.	...	4	1	4	...	...	...	4	?0	4	3	...	...	2	1
2	...	4	1	4	...	...	...	4	?0	4	3	...	...	2	1
3	...	4	...	4	...	...	...	3	?0	4	3	...	...	3	1
4	...	4	...	4	...	...	...	3	2	4	3	...	...	3	1
5	4	4	...	4	3	...	...	3	2	*4	3	4	...	2	...
6	4	4	3	4	3	...	...	3	2	*4	2	4	...	1	...
7	4	4	3	4	4	4	1	3	2	*4	2	4	...	1	...
8	4	2	3	4	4	3	1	3	2	*4	1	4	...	1	...
9	4	2	3	4	4	2	1	3	4	4	2	*4	1	1	1
10	4	2	3	4	4	1	1	2	4	4	1	*4	1	1	1
11	4	2	3	4	4	1	1	2	4	4	2	*4	3	1	1
Noon	4	2	3	4	4	1	1	2	3	4	1	*4	3	1	1
13	3	4	2	4	4	1	1	4	1	3	4	*4	2	1	1
14	4	4	1	4	4	1	1	4	2	2	4	*4	2	1	1
15	4	4	2	4	3	1	1	4	2	1	4	*4	2	1	3
16	4	...	3	4	2	1	1	4	1	2	4	2	2	1	4
17	4	...	4	4	4	1	1	4	4	2	4	2	2	1	4
18	4	...	4	4	*4	1	1	4	4	?0	4	2	1	1	4
19	4	4	4	4	*4	1	2	4	4	?0	4	3	1	1	4
20	4	4	4	4	*4	1	3	4	4	?0	4	4	1	1	2
21	?0†	...	4	4	*4	1	3	4	3	3	4	4	2	1	3
22	?0	...	4	4	*4	1	2	4	3	3	4	4	2	1	4
23	?0	...	4	4	*4	1	2	4	2	4	4	4	2	1	4
Midn't	?0	...	4	4	*4	1	2	4	2	4	4	...	1	1	4

* Zeros in the original.

† These and other zeros are inserted by G. Riley, who had been on watch from 8 to 12 since the 5th inst.

July 17th, etc. No observations on the 17th, 18th, 19th, 20th, and 21st, of the black bulb temperatures.

July 28th. The two sun thermometers were taken from the island. At noon, July 29th, these thermometers were suspended on board the brig, 8 feet from deck.

July 31st. Messrs. Sonntag, Ohlsen, and Stevenson returned. They found the sound perfectly open to the southward of the north cape of Bedevilled Reach, and open leads extending to within 6 miles of the brig.

READINGS OF THE BLACK BULB THERMOMETER, AND CORRESPONDING NOTES ON THE SOLAR LIGHT, OBSERVED AT VAN RENSSELAER HARBOR,

In August, 1854, in Lat. 78° 37′, Long. 70° 53′ W. of Greenwich.

Expressed in degrees of Fahrenheit's scale. On board the brig.

Hour.	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	16th.	17th.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1h.	+35.0	+31.0	+35.0	...	+38.0	+45.0	+42.0	+39.0	+39.0	+36.0	+43.0	+33.0	+32.0	+37.0	+33.0
2	35.0	31.5	35.5	...	37.0	43.0	42.0	39.0	42.0	37.0	41.0	36.0	32.5	30.0	32.5
3	35.0	31.0	35.0	...	36.0	39.0	40.0	37.0	43.0	36.0	41.0	37.0	44.0	31.0	35.0
4	36.0	31.0	36.0	...	37.0	43.0	40.5	35.0	47.0	36.3	42.0	38.0	50.0	31.0	39.0
5	36.6	33.0	37.0	+39.0	44.0	37.0	39.0	35.0	48.0	38.0	38.0	39.0	32.0	32.0	39.0
6	37.0	38.0	35.0	40.0	49.0	36.0	47.0	35.5	56.0	39.0	43.0	42.0	33.0	34.0	40.0
7	42.0	43.0	34.0	45.6	50.0	36.5	50.5	39.0	52.0	41.0	46.0	46.0	31.0	38.0	41.0
8	50.0	39.0	36.0	45.0	49.0	40.0	63.0	51.0	53.0	41.0	47.0	41.0	29.0	40.0	42.0
9	63.0	39.0	39.0	...	49.0	48.0	64.0	50.5	55.0	45.0	47.0	36.0	...	42.0	33.0
10	69.0	43.0	39.0	...	49.5	49.5	66.0	49.0	51.0	49.0	50.0	40.0	...	44.0	34.5
11	66.0	45.0	39.0	...	48.0	49.0	62.0	47.0	52.0	52.0	51.0	40.0	...	44.0	36.0
Noon	41.0	48.0	39.0	39.0	49.0	51.0	60.0	46.0	52.5	53.0	55.0	38.0	...	47.0	34.0
13	49.0	43.0	39.0	41.0	53.0	52.0	59.0	47.0	50.0	52.0	55.0	37.0	...	42.0	35.0
14	40.0	44.0	39.0	...	52.0	55.0	59.0	47.0	49.0	51.0	51.0	47.0	...	44.0	37.0
15	39.0	43.0	39.0	...	49.0	56.0	56.0	46.0	48.0	53.0	51.0	48.0	...	55.0	39.0
16	39.0	41.0	39.0	...	41.0	55.0	53.0	45.0	48.0	49.0	49.0	46.0	...	55.0	38.0
17	39.0	41.0	...	...	44.0	53.0	39.0	45.0	46.0	48.0	48.0	43.0	...	54.0	41.0
18	41.0	39.0	...	43.0	44.0	48.0	39.0	42.0	45.5	42.0	47.0	43.0	...	52.0	44.0
19	40.0	51.0	...	...	45.0	...	42.0	39.0	43.0	46.0	46.0	40.0	...	49.0	43.0
20	38.0	49.0	...	...	45.0	...	57.0	38.0	42.0	49.0	45.0	33.0	...	56.0	42.0
21	37.0	39.0	35.0	...	49.0	45.0	49.0	38.3	42.0	39.0	42.0	33.0	...	+42.0	33.0
22	32.0	35.0	35.0	...	48.0	45.0	41.0	36.0	41.0	39.0	42.5	34.0	...	...	33.0
23	31.0	33.5	36.0	...	47.0	44.0	39.0	36.0	39.0	39.0	42.0	34.5	30.0	...	32.0
Midn't	+28.5	+33.0	+37.0	+51.0	+49.0	+42.0	+39.0	+36.0	+37.0	+39.5	+40.5	+35.0	+33.0	...	+32.0

Hour.	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	16th.	17th.
1h.	4	3	4	4	2	4	4	2	1	1	1	1	1	1	1
2	4	3	4	4	1	4	...	2	1	1	1	1	1	2	1
3	4	3	4	4	1	4	...	3	1	1	1	1	1	1	1
4	4	3	4	4	1	4	...	3	1	1	1	1	1	1	1
5	4	3	4	3	1	4	1	3	1	1	1	1	1	1	2
6	4	3	4	3	1	2	1	3	1	1	1	1	4	2	2
7	3	2	4	3	1	2	1	3	1	2	1	2	4	2	1
8	2	3	3	2	1	1	1	2	1	2	1	3	4	1	1
9	1	4	4	4	1	1	1	3	1	2	1	3	*4	1	1
10	1	4	4	4	1	1	1	3	1	1	1	2	*4	1	1
11	1	3	4	4	1	1	1	3	1	1	1	1	*4	1	1
Noon	1	2	4	4	1	1	1	4	1	1	1	1	*4	2	2
13	2	2	4	4	1	1	1	3	1	...	1	2	...	4	1
14	4	2	4	4	1	1	1	2	1	...	1	1	...	4	1
15	4	2	4	4	1	1	1	1	1	...	1	1	...	4	1
16	4	3	4	4	1	1	1	1	1	...	1	1	...	4	1
17	4	3	4	4	1	1	2	...	1	...	...	1	*4	1	2
18	4	2	4	4	1	1	2	...	1	1	...	2	*4	1	3
19	4	1	4	4	1	1	2	...	1	1	...	3	*4	1	3
20	4	2	4	4	1	1	1	...	1	1	...	3	*4	1	3
21	4	3	2	4	1	1	1	...	1	1	...	3	*4	2	3
22	4	4	...	4	1	1	1	...	1	2	...	4	4	...	3
23	4	4	...	4	1	1	1	...	1	2	...	2	2	...	3
Midn't	4	4	...	1	1	1	1	...	1	2	...	1	2	...	3

* The original has zeros.

August 14th. At 4 A. M., black bulb +32°.0; solar light 2.

August 15th. At 11 and 12 P. M., black bulb +31°.0 and +30°.0; solar light 3 and 2.

August 17th. The young ice bears a man.

READINGS OF THE BLACK BULB THERMOMETER, AND CORRESPONDING NOTES ON THE SOLAR LIGHT, OBSERVED AT VAN RENSSELAER HARBOR,

In August and September, 1854, in Lat. 78° 37′, Long. 70° 53′ W. of Greenwich.

Expressed in degrees of Fahrenheit's scale. On board the brig.

Hour.	18th.	21st.	23d.	24th.	28th.	29th.	31st.	1st.	4th.	5th.	6th.	7th.	8th.	10th.	11th.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1h.	+41.0	...	+23.0	+19.0	...	...	...	...	...	...	...	...	...	...	...
2	...	...	...	21.0	...	...	...	...	...	...	...	...	...	...	...
3	...	...	...	29.0	...	...	...	...	...	...	...	...	...	...	...
4	36.0	...	...	31.0	...	...	...	...	...	...	...	...	...	...	...
5	40.0	...	...	23.0	...	+39.0	...	+18.0	...	+ 6.0	...	...	+11.5	...	...
6	41.0	...	...	23.0	...	39.0	...	18.5	...	9.0	...	...	11.0	+13.0	...
7	39.0	+36.0	...	27.0	...	38.0	+34.0	18.0	...	9.5	...	+10.0	16.0	...	+11.0
8	40.0	37.0	24.0	31.0	...	39.0	32.0	23.0	...	11.0	...	11.0	17.0	...	16.0
9	40.0	37.0	24.0	37.0	...	38.0	34.0	23.0	+19.0	16.0	+20.0	13.0	18.0	45.0	20.0
10	41.0	38.0	42.0	36.0	+41.0	37.0	35.0	31.0	21.0	18.0	21.0	17.0	29.0	57.0	23.0
11	42.0	31.5	41.0	34.0	42.0	?	30.0	34.0	28.0	21.0	25.0	24.0	31.0	31.0	23.0
Noon	48.0	41.0	46.0	37.0	40.0	35.0	30.0	...	33.0	20.0	28.0	29.0	19.0	33.0	26.0
13	43.0	38.0	43.0	...	38.0	...	30.0	...	31.0	22.0	33.0	30.0	+15.0	31.0	22.0
14	48.0	36.0	43.0	...	38.0	...	31.0	...	32.0	17.0	30.0	29.0	...	31.0	31.0
15	53.0	38.0	42.0	...	39.0	...	32.0	...	27.5	13.0	29.0	28.0	...	30.0	17.0
16	52.0	+41.0	41.0	...	45.0	...	31.0	...	26.5	+11.5	+26.0	+27.0	...	+27.0	+27.0
17	49.0	...	...	+33.0	36.0	...	30.0	24.0	25.0	...	...	...	...	...	...
18	47.0	...	39.0	...	39.0	...	...	22.0	21.0	...	...	...	...	...	...
19	39.0	...	37.0	...	37.0	...	...	19.0	19.0	...	...	...	...	...	...
20	38.5	...	35.0	...	+33.0	...	...	20.0	+17.0	...	...	...	...	...	...
21	+37.0	...	...	...	...	...	23.0	20.0	...	...	...	...	...	...	...
22	...	...	31.0	...	...	...	21.0	19.0	...	...	...	...	...	...	...
23	...	...	27.0	...	...	...	+20.0	+18.0	...	...	...	...	...	...	...
Midn't	...	...	+27.0	...	...	...	...	...	...	...	...	...	...	...	...

Hour.	18th.	21st.	23d.	24th.	28th.	29th.	31st.	1st.	4th.	5th.	6th.	7th.	8th.	10th.	11th.
1h.	1	*	3	1	...	...	...	...	...	...	...	...	...	...	...
2	...	*	*	1	...	...	5	...	...	...	...	...	...	...	...
3	...	*	*	1	...	1	4	...	...	...	...	...	...	...	...
4	1	*	*	1	...	1	3	...	...	...	...	...	...	...	...
5	1	*	*	1	...	1	?0	1	*	1	...	...	1	...	...
6	1	*	*	1	...	1	?0	1	*	1	...	...	1	1	...
7	1	1	2	1	...	2	1	1	*	1	...	1	1	?0	1
8	1	1	*	1	...	1	3	1	*	1	...	1	1	?0	1
9	1	...	*	2	1	4	2	1	3	1	...	1	1	1	1
10	2	...	1	2	1	4	2	1	3	1	...	1	1	1	1
11	2	...	1	*	1	4	2	1	1	1	...	1	1	1	1
Noon	2	1	1	1	1	4	2	1	1	1	...	1	1	1	1
13	1	1	1	*	1	4	2	...	1	1	...	1	1	1	1
14	1	1	1	*	1	3	2	...	1	1	...	1	3	1	1
15	1	1	1	*	2	4	2	...	1	1	...	1	3	1	1
16	1	1	1	*	2	2	2	...	1	1	...	1	3	1	1
17	1	*	...	4	...	*	2	...	1	1	2	...	3	1	1
18	2	*	2	*	...	*	...	3	1	1	2	...	3	1	1
19	1	*	2	*	...	*	...	...	1	1	2	...	3	1	...
20	1	*	2	*	...	*	...	...	1	1	2	...	1	1	...
21	1	*	1	*	2	*	1	...	...	...	...	...	...	...	...
22	4	*	1	*	2	*	3	...	...	...	...	...	...	...	...
23	4	*	1	*	?2	...	3	...	...	...	...	...	...	...	...
Midn't	4	*	2	*	?2	...	...	...	...	...	...	...	...	...	...

* Zero's in manuscript.

August 19th. The outside bergs no longer move either with tide or current. Black bulb at 9, 10, 11, 12 A. M., 31°, 32°, 36°, 34°; solar light, 4, 4, 3, 4.

August 20th. Black bulb at 3, 4, 5 P. M., 45°, 43°, 31°; solar light, 4, 4, 3.

August 22d. Black bulb at 10, 11, 12 A. M., 35°, 36°, 25°; solar light, 3, 2, 1.

August 24th. By calculation, the lower limb of the sun just grazes the horizon at the northern meridian.

August 25th. Black bulb at 5, 6, 7, 8 A. M., 28°, 28°.5, 28°.5, 30°; solar light, *.

August 25th, 26th, 27th, 30th, and September 2d, 3d, 9th. No observations.

READINGS OF THE BLACK BULB THERMOMETER AND CORRESPONDING NOTES ON THE SOLAR LIGHT—Continued and completed.

Sept. 12. At 6h., 7, 8, 9, 10, 11, 12, 1, 2, 3, 4, 5h.:	B. B. +6°, 12, 18, 21, 23, 21, 19, 18, 16, 14, 13, 8°	
	S. L. 3, .., .., 1, 1, 1, 1, 1, 1, 1, 1, 2	
Sept. 13. Same hours:	B. B. +2°, 7, 20, 33, 31, 31, 33, 34, 28, .., 19, 16°	
	S. L. 1, 1, 1, 1, 1, 1, 1, 1, 1, .., 1, 1	
Sept. 14 and 15. No. observations.		
Sept. 16. At 8 A. M., 1, 2, 3 P. M.:	B. B. +13°, 16, 17, 14°;	S. L. 1, 1, 1, 1
Sept. 17. At 1, 2, 4, 5 P. M.:	B. B. +19°, 16, 13, 9°;	S. L. 1, 1, 1, 2
Sept. 18. No observations.		
Sept. 19. At 11 and 12 A. M.:	B. B. +11°, 13°;	S. L. 1, 1
Sept. 20. At 11 A. M. and 3 and 4 P. M.:	B. B. +9°, 45, 5°;	S. L. 1, 3, 3
Sept. 21. At 9, 10, 12 A. M.:	B. B. +8°, 11, 18°;	S. L. 1, 1, 1
Sept. 22. At 12, 1, 2 P. M.:	B. B. +20°, 16, 12°;	S. L. 1, 2, 3
Sept. 23. At 10, 11, 12 A. M.:	B. B. +2°, 6.5, 5°;	S. L. 3, 1, 1
Sept. 24, 25, 26. No observations.		
Sept. 27. At 10, 11, 12 A. M.:	B. B. +13°, 13, 10°;	S. L. 1, 1, 2
Sept. 28. At 11 A. M.:	B. B. +13°;	S. L. 2
Sept. 29, 30, Oct. 1, to 14. No observations of the black bulb thermometer.		
Oct. 15. At 11 and 12 A. M.:	B. B. —3°, —4°;	S. L. 1, 1

The black bulb readings were discontinued on Oct. 18.

Decrease of Temperature with Elevation.—Readings of the temperature at the level of the sea, and at eighty feet elevation on the mast of the brig, were taken during the months of August, September, and October, 1853. These observations were made with the same thermometer at the upper and lower position. The following are the mean differences obtained from twelve observations (bi-hourly) a day for the months August, September, and October, in the two positions: —0°.14, —0°.67, and —0°.30, the minus sign indicating "colder above." We have, therefore, for an elevation of eighty feet, an average change of —0°.37 of temperature during these three months; or the elevation corresponding to a decrease of temperature of 1° Fahr. becomes 210 feet.

Surface Temperature of Sea Water.—The following table contains the mean monthly values, from hourly observations, of the temperature of the surface water in Van Rensselaer Harbor. On the 19th of October, 1854, an order was given to immerge the thermometer four feet below the surface. On the previous day, the water alongside gave at the surface 32°; at three feet deep, 30°.5. After November 27th, the readings remaining constant at +29°, the observations were discontinued.

1853	September	29°.1	1854	May	28°.9
	October	28.8		June	30.3
	November	28.7		July	32.3
	December	28.7		August	31.8
1854	January	28.7		September	31.3
	February	28.7		October	30.9
	March	28.7		November	29.0
	April	28.8		December	..

The index error of thermometer is not known; it must be small.

For a preliminary project of the isothermal lines of Baffin's Bay and adjacent islands, constructed for each month of the year, the reader is referred to Appendix No. XIII. of the 2d Vol. of the Narrative.

APPENDIX.

(See note on preceding page 2.)

Extract from Appendix No. XI. 2d volume of the Narrative, p. 405, on the Determination of Temperatures.

* * * * SIR EDWARD PARRY, and more recent Arctic voyagers, have shown that there is a difference, amounting sometimes to two degrees, between the temperatures adjacent to, and at a distance from, the vessel. This was abundantly confirmed by our experience. During the intense cold of our winters, the instruments became very impressible to artificial elevation of temperature. The approach of the observer, the use of the lantern, the neighborhood of articles taken from a heated apartment, &c. &c., were at once perceptible in our records.

Except in naval expeditions, Arctic temperatures, whether Asiatic or American, have been recorded with a limited number of instruments. The results of these must be received with extreme caution; for the differences which alcoholic thermometers exhibit, at temperatures below the freezing point of mercury, are so varying as to require a large number of comparisons, and upon many instruments, to determine their proper correction. It was not uncommon for thermometers which had given us correct and agreeing temperatures as low as —40°, to show at —60° differences of from fifteen to twenty degrees. Such, too, was the case with the well-constructed instruments of Sir James Ross at Leopold Harbor.

To give an example of this, I may refer to the record of six thermometers suspended near each other, as above described, and observed for purposes of comparison at noon February 5th, 1854.

—71°, —63°, —54°, —53°, —50°, and —50°.

All of these, at temperatures above —40°, agreed within 1°.8, and were selected as the most consistent of nearly thirty spirit thermometers.

At 9 A. M. of the same day, eleven similar thermometers gave, under like circumstances, a mean of 68°, the extreme readings being —56°.4 and —80°. For the purpose of obtaining the most probable temperature from these conflicting records, my first impulse was to reject the lowest (coldest) extremes, and take the mean of those which accorded best; but upon advising with our astronomer, Mr. Sonntag, I determined to take the mean of all without rejecting any, the view which he took being simply that those instruments which indicated the extremes in the low scale had never, in temperatures above —40°, shown any anomaly which deprived them of an equal claim to confidence with the rest, and that there was no reason, *à priori*, to consider the results which they gave as less probable than those shown by the others.

In a word, I adopted the views of Professor Airy, as published in the 95th number of the *American Astronomical Journal*. The causes which had produced the errors were mostly unknown, and the quantity to which these errors might amount was entirely so.

Our thermometers were made with great care by Tagliabue, of New York. But, independently of other mechanical sources of error, I am obliged to say that I do not regard the contraction of colored alcohol, at very low temperatures, as sufficiently investigated to enable us to arrive at the causes or the quantity of error. In most of the spirit thermometers, the uniform thickness of the tube was tested before leaving New York; and the freezing of carefully distilled mercury, which I had taken with me for the purpose, gave excellent determinations of absolute temperature.

But it may not be uninteresting to state that the freezing point of this metal varied between —38°.5 and —41°.5, and that its rate of contraction as a solid was so uniform that, in our long and excel-

lent 36 inch standards, it descended after freezing as low as —44°. This result is in accordance with that obtained by Sir Edward Belcher, whose experiments go even further than my own, the mercury having been observed by him to descend as low as 46° below zero.

I may mention the fact, as in some degree confirming the propriety of not excluding an eccentric result from the computation of means, that two or more instruments may agree well together and still differ considerably from the most probable temperatures. This was the case with two long spirit thermometers, which never, even at the lowest temperatures, showed differences amounting to one degree, but which, at —68°, varied 7°.7 from the mean of eleven others. The cause was in this instance easily explained. The two instruments were *fac-similes* of each other; any errors of division of the scale, or from the unequal contraction of the fluid, which was the same in both, and the same in quantity, and probably taken from the same preparation of spirits, were of course common to both. The error induced by the coloring matter of the fluid adhering in small particles to the sides of the tube became very marked at low temperatures. Our routine of daily observation was as follows: Two 36 inch register spirit thermometers were noted hourly, as well as a varying number of instruments of smaller size. For purposes of comparison, the long spirit thermometers and from five to twelve of the others, in selected groups, were generally read at the same time. The difference between the mean of these observations and the reading of any one instrument, gave the correction which was applied to that instrument in order to get the true or most probable temperature. * * * * * *

PART II.

DIRECTION AND FORCE OF THE WIND.

RECORD AND DISCUSSION OF THE DIRECTION AND FORCE OF THE WIND.

THE observations of the direction and force of the wind at Van Rensselaer Harbor, North Greenland, extend over the same period as the other meteorological observations, viz: from September 1st, 1853, to May 1st, 1855. With few exceptions, these observations were made hourly, and their record available for discussion, extends to January 24th, 1855. Those taken after this date will be found recorded (three times a day) in Appendix No. XII. of the second volume of the Narrative of the Expedition.

No self-registering anemometric instrument was used. The direction of the wind is given uncorrected for magnetic variation of the needle, and was noted in reference to eight principal points of the compass. The course of the wind thus given refers to the lower or surface stratum of the atmosphere. The force of the wind has been estimated as near as possible according to a scale extending from 1 to 10; the former number indicating light airs, the latter a hurricane. Zero denotes a calm air. These figures, expressive of the relative force of the wind, are placed in front of the letters indicating the direction, as given by its initial letter, and their relation to the velocity and pressure of the wind is shown in the following table, used in the United States Coast Survey.[1]

Denomination of Wind.	Estimated No. of force.	Pressure in pounds per square foot.	Velocity in miles per hour.	Denomination of Wind.	Estimated No. of force.	Pressure in pounds per square foot.	Velocity in miles per hour.
Calm	0	0.000	0	Fresh gale . . .	6	7.9	40
Light air . . .	1	0.005	1	Strong gale . . .	7	12.0	50
Gentle breeze . .	2	0.08	4	Storm	8	18.0	60
Moderate breeze .	3	0.9	13	Tempest . . .	9	31.0	80
Fresh breeze . .	4	2.6	23	Hurricane . . .	10	49.0	100
Strong breeze . .	5	5.1	32				

The relation of the tabular numbers of pressure and velocity is according to Smeaton's table, and is practically the same as that following from D. Bernoulli's formula.[2] It may be questioned whether the upper limit (No. 10) of the above table has been reached among the few observations marked 10 in this latitude;

[1] The scale of winds adopted by the Smithsonian Institution does not materially differ from it; see directions on the blank forms furnished to observers. The Coast Survey table will be found p. 277 of the Superintendent's Annual Report of 1856.

[2] See art. Meteorology, in Encyclopædia Britannica, 8th edition.

and, since the force of the wind depends altogether on an estimation, I prefer, in the small number of cases in which the forces 9 and 10 occur, to adopt the numbers 70 and 80 as the corresponding velocity in miles per hour.[1]

In the following hourly abstract of the anemometric observations, the direction is indicated by the initial letter or letters of the compass point, and the force by a number preceding it, according to the scale given above. Any intermediate directions, dividing the compass into 16 points, have been placed alternately in the column of the preceding and following principal direction; thus two successive entries in the log-book of N. N. E., will be found noted in the abstract as N. E. and N. In this manner the mean directions have in all cases been preserved. These intermediate directions are of comparatively rare occurrence. In a few instances, particularly during the first ten days (of September), there is some doubt as to the true meaning of a blank in the log, all other meteorological observations being duly recorded, whether this indicates a calm or an omission of observation. In these cases, I have likewise left a blank in the record, if not otherwise guided by the abstract given in Appendix No. XII. of the Narrative. The first vertical column in the abstract contains the hour of mean local time. Horizontal dashes (- - -) in the body of the abstract indicate "no observation," and two inverted commas (") signify the same force and direction as for the hour immediately preceding. The fall of snow (and rain) is also noted.

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[1] Mr. Sonntag's views on this subject agree with mine; he thinks the forces rather over-estimated, produced by the greater sensation of cold.

DIRECTION AND FORCE OF THE WIND OBSERVED AT VAN RENSSELAER HARBOR,

In September, 1853, in Lat. 78° 37′, Long. 70° 53′ W. of Greenwich.[1]

The directions are magnetic. Variation of compass 108° W.

Hour.	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.
1h.	- - -	3 N.	3 N. W.	- - -	- - -	0	6 S. W.	2 N. W.	0	1 W.	2 W.	2 W.	0	0	1 E.
2	"	"	2 N. W.	"	"	"*	4 S. W.	"	"	"	"	"	"	"	"
3	"	"	1 N. W.	"	"	"*	3 S. W.	"	"	"	- - -	"	"	"	"
4	"	"	"	"	"*	"*	5 S. W.	3 N. E.	"	"	"	"	"	"	"
5	2 N. W.	3 N. W.*	- - -	"	"*	"	4 S. W.	1 N. E.	"	- - -	"	0	"	1 S. E.	2 E.
6	"	3 N.*	"	"	"	"	3 S. W.	"	"	"	"	2 S. E.	"	"	"
7	"	2 N. W.*	"	"	"	"	"	0	"	"	"	0	"	0	"
8	3 N. W.	2 N.	"	"	"	"	4 S. W.	1 N. W.	"	"	"	"	"	"*	"
9	4 N.	2 N. W.	"	"	"	1 S. W.	3 S. W.	0	4 N. W.	"	0	"	"	"*	"
10	"	1 N.	"	"	"	"	"	"	4 N.	"	"	"	"	"*	4 E.
11	"	1 N. W.	"	"	"	2 S. W.	2 S. W.	"	4 N. W.	"	1 W.	"	"	"*	3 E.
Noon	"	1 N.	"	"	"	"	"	"	3 N.	"	0	"	"	"*	2 E.
13	4 N. W.	5 N. W.	"	"	1 N. W.	"*	3 E.*	"	- - -	"	- - -	"	"	"	1 E.
14	"	"	"	"	"	"*	2 E.*	"	"	"	"	"	"	"	"
15	"	"	"	"	"	3 S. W.	"*	"	"	"	"	"	"	"	0
16	"	"	"	"	"	5 S. W.	1 E.	"	"	"	"	"	"	1 S.*	"
17	4 W.	4 N. W.	"	"*	"	6 S. W.	1 N. W.	"	"	"	"	"	"	1 N.*	2 N.
18	"	"	"	"*	0	"	0	"	"	"	"	"	"	"	"
19	"	4 N.	"	"	"	"	"	"	"	"	"	"	"	1 N. E.	"
20	"	3 N. W.	"	"	"	"	"	"	"	"	"	"	"	"	1 N.
21	4 N. W.	2 N.	"	"	"	"	"	"	2 W.	0	0	"	"	"	0
22	"	2 N. W.*	"	"	"	7 S. W.	"	"	2 S. W.	"	"	"	"	1 E.	"
23	"	2 N.	"*	"	"	"	"	"	3 W.	3 W.	"	4 N.	"	"	"
Midn't	3 N. W.	2 N. W.	"*	"	"	"	"	"	3 S.	4 W.	"	3 N.	"	"	"

Hour.	16th.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th.	27th.	28th.	29th.	30th.
1h.	0	1 N. W.	1 S.	0	0	0	2 S.	3 S.†	0	1 S. W.	0	2 S. E.	2 S. E.	2 N.	0
2	"	"	"	"	"	"	1 S.	4 S.†	"	2 S. W.	"	"	"	"	"
3	"	"	"	1 W.	"	"	"	3 S.†	"	3 S. W.	"	"	3 S. E.	"	"
4	"	"	"	0	"	"	"	2 S.†	"	4 S. W.	"	1 S. E.	2 S. E.	"	"
5	1 N.	"	0	1 N. E.	"	1 S.	1 S. W.	2 S. W.	"	2 S. W.	1 S. W.	2 W.	2 S. W.	"	1 W.
6	"	1 W.	"	2 N. E.*	"	"	1 S.	"	1 S. W.	1 S. W.	"	3 W.	1 S. W.	"	"
7	1 N. E.	"	"	2 E.	"	"	"	"	"	"	"	"	- - -	"	"
8	2 N. E.	"	"	"	"	"	"	"	"	"	"	1 W.	"	"	1 S. W.
9	0	- - -	"	0	"	0	0	"	1 S. E.	1 S.	0	2 E.	1 N. W.‡	"	1 S. E.
10	"	"	"	"	"	"	"	3 S. W.	2 S. E.	"	"	2 N. E.†	"‡	"	"
11	"	"	"	"	"	"	"	2 S. W.	"	2 S.‡	"	1 N. E.†	2 N. W.‡	"	1 E.
Noon	"	"	1 N. W.	"	"	"	"†	1 S. W.	"	1 S.‡	"	"†	2 W.	"	1 N. E.
13	"	0	0	"	"	"	1 S.†	"	1 S. W.	"	"	1 S. E.	3 N.	2 N. W.	"
14	"	"	"	"	"	"	"†	"	"	"	"	"	"	3 N. W.	1 S. E.
15	"	"	"	"	"	"	"†	"	"	"	"	"	"	2 N. W.	"
16	"	"	"	"	"	"	"†	"	"	"	"	"	"	"	0
17	"	1 W.	"	"	"	2 S. W.	3 S. E.†	"*	0	0	1 S. E.	"	2 N.	0	1 S.
18	"	"	"	"	"	3 S. W.	2 S. E.	"*	"	"	"	"	3 N.	"	2 S. W.
19	"	0	"	"	"	"	"	"*	"	"	"	"	"	"	1 S. W.
20	"	"	"	"	"	4 S. W.	3 S. E.	"*	"	"	2 S. E.	3 S.	"‡	1 N.	"
21	"	"	"	"	2 N.	3 S. W.	3 S.	"*	"	1 S. W.	"	- - -	"	0	1 W.
22	"	"	"	"	4 N. W.	"	"	"*	"	"	"	"	2 N.	"	"
23	"	"	"	"	1 N.	"	- - -	"*	"	"	3 S. E.	"	1 S.	"	0
Midn't	"	"	"	"	0	"	3 S. W.	"	"	"	"	"	"	"	1 S.

[1] This longitude resulted from the discussion of the moon culminations.

* Light snow falling.

† Light snow falling occasionally. At 17h., light spiculæ of snow falling, having been preceded for three hours by a misty atmosphere.

‡ Very light snow falling.

DIRECTION AND FORCE OF THE WIND OBSERVED AT VAN RENSSELAER HARBOR,

In October, 1853, in Lat. 78° 37′, Long. 70° 53′ W. of Greenwich.

The directions are magnetic. Variation of compass 108° W.

Hour.	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.
1h.	0	2 S. E.	1 E.	4 S.	2 S.	3 S.	1 S. E.	3 N. W.	5 S. E.	1 S.	3 S. E.	0	1 S. W.	0	0
2	"	"*	0	5 S.	"	2 S.	"	4 N. W.	6 S. E.	3 W.	2 S. E.	"‡	2 S. W.	"	"
3	"	"	"	5 S. E.	"	"	2 S. E.	"	"	1 W.	"	"	1 S. W.	"	"
4	"	"	"	5 S.	3 S.	"	3 S. E.	5 N. W.	4 S. E	2 W.	1 S. E.	"	0	"	"
5	"	3 S.	1 S.	"	"	3 S.	2 S. E.	"	5 S. E.	2 S. E.	"	2 S. W.	1 S.	"	"
6	"	"	"	"	3 S. E.	"	"	"	1 S. E.	3 S. W.	"	"	"	1 S. E.	"
7	"	"	"	"	3 S.	"	"	"	"	2 S. E.	"	"	"	"	"
8	"	"	"	"	3 S. E.	"	"	"	"	"†	1 S. W.	1 S. W.	"‡	"	"
9	"	3 N.	1 S. E.	"	"	2 S. E.	"	3 N. W.	"	2 S.	0	1 S.	"‡	2 N. W.	"
10	"	"	"	5 S. E.	"	"	"	2 N. W.	"	"‡	"	0	"‡	1 N. W.	"
11	"	2 N.	"	"	2 S.	"	3 S. E.	2 N.	0	1 S.	"	"	"‡	0	"
Noon	"	"	"	4 S. E.	"	"	3 S.	2 N. W.	"	3 S. E.	1 S. E.	"	"‡	"	"
13	"	"	1 E.	3 S. E.	2 S.	3 S.	2 S.	1 N. W.	1 S. E.	2 S. E.	"	1 S. W.	"‡	"	"
14	"	1 N.	"	"	2 S. E.	3 S. W.*	"	1 N.	"	"	"	1 S.	"‡	"	"
15	"	"	"	"	2 S.	3 E.	"	1 N. W.	"	"	"	"	"	"	"
16	"	"	"	2 S. E.	2 S. E.	"	"	1 N.	"	"	"	1 S. W.	"	"	"
17	"	1 N. E.	"	"	2 S.	2 E.	4 S.	1 N. W.	"	3 S. E.	"	"	2 S. E.	1 S. E.‡	"
18	"	1 E.	"	"	2 S. E.	1 E.	5 S. E.	"	"	"	0	4 S. W.	"	"‡	"
19	"	"	2 S. E.*	3 S. E.	1 S.	"	4 S. E.	"	2 S. E.	"	"	1 S. W.	3 S. E.	"‡	"
20	2 S. E.	"	4 S. E.	"	1 S. E.	"	0	"	3 S. E.	"	"	0	"	"‡	"
21	- - -	"	4 S.	4 S.	4 S.	2 S. E.	4 N. W.	4 N. W.	0	1 S. E.	"	"	2 S. E.	1 S.	"
22	"	"	"	"	"	1 S. E.	0	6 N. W.	"	3 S. E.	"	"	"	"	"
23	"	"	"	"	3 S.	"	"	"	"	"	"	"	4 S. E.	"	"
Midn't	"	"	"	5 S. W.	"	"	"	"	"	"	"	"	1 S. E.	"	"

Hour.	16th.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th.	27th.	28th.	29th.	30th.	31st.
1h.	0	0	0	1 S. W.	3 S. W.	3 S.	1 S.	1 S.	1 S. E.‡	2 S. E.	0	0	1 S.	0	0	0
2	"	"	"	2 S. W.	2 S. W.	"	"	"	"‡	1 S. E.	"	"	2 S.	"	"	"
3	"	"	"	"	4 S.	1 S.	2 S.	0	"‡	2 S. E.	2 S. E.	"	3 S.	"	"	"
4	"	"‡	"	"	3 S.	2 S.	"	"	"‡	"	0	"	0	"	"	"
5	1 S.	"	"	"	6 S.	1 S.	- - -	"	"‡	"	"	"	"	"	"	"
6	"	"	"	1 S. W.	1 S.	"	"	1 S. E.	"‡	"	"	"	"	"	"	"
7	3 S.	"	"	"	"	"	"	2 S. E.	"‡	2 S.	"	"	"	"	"	"
8	"	"	"	"	"	"	"	"	"	1 S.	"	"	"	"	"	"
9	0	"‡	"	2 S. W.	"	0	2 S.	- - -	2 S.	2 S.	"	"	"	"	"	"
10	"	"‡	"	"	"	"	1 S.	3 S. E.	2 S. W.	"	"	"	"	"	"	"
11	"	1 S. E.‡	"	1 S. W.	2 S.	"	0	1 S. E.	3 S. W.	"	"	"	"	"	"	"
Noon	"	"	"	"	1 S.	"	"	- - -	6 S. W.	1 S.	"	"	"	"	"	"
13	"	1 S.	1 S. E.	"	"	"	1 S.	2 S.	5 S. W.	5 S. E.	1 S. E.	"	2 S.	"	"	1 S. E.
14	"	"	"	"	"	"	0	"	6 S. W.	2 S. E.	"	"	1 S.	"	"	"
15	"	"	"‡	"	- - -	"	"	3 S. E.	"	1 S. E.	2 S. E.	"	0	"	"	"
16	"	"	"‡	"	"	"	"	2 S. E.	5 S. W.	"	"	"	"	"	"	2 S. E.
17	"	"	3 S. E.	2 N. W.	4 S.	"	"	1 S. E.	1 S. W.	1 S.	3 S. E.	"	"	"	"	3 S. E.
18	"	0‡	1 S. E.‡	"	"	"	2 S. E.	"	3 S. W.	"	2 S. E.	"	"	"	"	1 S. E.
19	"	"‡	"‡	"	3 S.	"	1 S. E.	2 S. E.	"	1 S. E.	"	2 S. E.	"	"	"	"
20	"	"‡	"‡	1 N. W.	0	1 S.	"	1 S. E.§	"‡	"	1 S. E.	1 S. E.	"	"	"	"
21	"	"	2 S. E.‡	1 S. W.	"	"	"	"	0‡	0	0	0	"	"	"	0
22	"	"	"‡	3 S. W.	"	0	"	"	"‡	"	"	"	"	"	"	"
23	"	"	0	1 S. W.	"	"	"	"	"‡	"	"	"	"	"	"	"
Midn't	"	"	"	"	"	"	"	"	"‡	"	"	"	"	"	"	"

* Dark and threatening.

† Very light snow falling; wind squally and varying. At 3 o'clock P. M. clouds dispersing.

‡ Snowing. § Snowing slightly.

DIRECTION AND FORCE OF THE WIND OBSERVED AT VAN RENSSELAER HARBOR,

In November, 1853, in Lat. 78° 37′, Long. 70° 53′ W. of Greenwich.

The directions are magnetic. Variation of compass 108° W.

Hour.	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.
1h.	0	0	0	0	0	0	0	2 N. W.*	1 S. E.	1 S. E.	3 E.	3 S. E.	0	0	0
2	"	"	"	"	1 S. W.	"	"	"*	"	"	"	1 S. E.	"	"	"
3	"	"	"	"	"	"	"	3 N. W.*	"	2 S. E.	1 E.	0	"	"	"
4	"	"	"	"	- - -	"	"	1 N. W.*	2 S. E.	3 S. E.	"	"	"	"	"
5	"	"	"	"	1 W.	"	"	"*	0	2 S.	2 S. E.	"	"	"	1 S. W.
6	"	"	"	"	"	"	"	"*	"	1 S.	1 S. E.	1 S. E.	1 S. W.	"	"
7	"	"	"	"	"	"	"	1 S. E.*	"	"	"	2 S. E.	2 S. W.	"	0
8	"	"	"	"	"	"	"	2 S. E.	"	0	"	5 S.	"	"	"
9	"	"	"	"	0	"	1 E.	0	"	3 S. E.	1 N. W.	6 S.	1 W.	"	1 S. E.
10	"	"	"	"	"	"	0	"	"	"	2 S. E.	5 S.	1 S.	"	0
11	"	"	"	"	"	"	1 E.	"	1 S.	0	"	5 S. E.	1 S. E.	"	"
Noon	"	"	"	"	"	"	0	"	0	1 S. E.	3 S. E.	4 S. W.	"	"	1 S. E.
13	"	"	"	"	1 W.	"	"	"	"	2 S. E.	0	1 S.	0	"	0
14	"	"	"	"	"	"	"	"	"	1 S. E.	"	0	"	"	"
15	"	"	"	"	"	"	2 N. E.	"	"	"	"	"	1 S.	"	1 S. E.
16	"	"	"	"	1 S. W.	"	1 N. E.	"	"	"	"	"	0	"	0
17	"	"	"	"	1 W.	"	"	"	2 S. E.	"	1 S. E.*	2 S. W.	1 S. E.	1 S. E.	1 S. E.
18	"	"	"	"	"	"	"	"	3 S. E.	"	2 S. E.	1 S. W.	0	"	0
19	"	"	"	"	"	"	2 N. E.	"	2 S. E.	2 S. E.	"	"	"	"	"
20	"	"	"	"	"	"	"	"	"	3 S. E.	"	"	"	2 S. E.	1 S. E.
21	"	"	"	"	0	1 S. W.	3 N. W.	"	1 S. E.	0	1 S. E.	1 S. E.	"	0	"
22	"	"	"	"	"	"	"	"	"	"	2 S. E.	2 S. E.	1 S. E.	"	"
23	"	"	"	"	"	0	4 N. W.	"	3 S. E.	"	3 S. E.	3 S. E.	0	"	"
Midn't	"	"	"	"	"	"	3 N.	"	2 S. E.	1 E.	4 S. E.	4 S. E.	"	"	1 S. E.

Hour.	16th.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th.	27th.	28th.	29th.	30th.
1h.	0	0	0	0	0	2 N. E.	0	0	0	0	0	1 S.	0	0*	1 S. W.*
2	"	"	"	"	"	"	1 S. E.	"	"	"	4 N.	0	2 S.	"*	2 S. E.*
3	"	"	"	1 S.	"	"	"	"	1 S. E.	"	1 N.	1 S.	1 S.	"*	"*
4	"	"	"	0	"	0	0	"	0	"	"	2 S.	"	"*	1 S. E.*
5	"	1 S. E.	2 S.	"	"	2 S.	"	"	"	"	0	1 S. E.	0	1 S. W.*	0*
6	"	2 S. E.	1 S.	"	"	"	"	"	"	"	"	"	"	2 S. W.*	"*
7	1 S. W.	1 S. E.	"	"	"	1 S.	"	"	"	1 S. E.	2 S. E.	0	1 S. E.	1 S. W.*	1 N. W.*
8	2 S. E.	2 S.	"	"	"	"	"	"	"	2 S. E.	1 S. E.	"	0	"*	0
9	0	0	0	"	"	0	"	"	"	"	1 S.	1 S.	3 S. E.†	1 S.*‡	1 S. E.
10	"	"	"	"	"	1 S.	"	"	"	5 S. E.	"	"	"	2 N. W.*	"*
11	"	"	1 E.	"	"	0	"	"	"	6 S. E.	0	"	2 S. E.	"	0*
Noon	"	1 S. E.	0	"	"	"	"	"	"	5 S. E.	"	"	3 S. E.	1 N. W.	1 S. E.*
13	"*	0	"	"	"	"	"	"	"	4 S. E.	1 S. E.	"	"	0	"*
14	"*	"	"	"	"	"	"	"	"	3 S. E.	2 S.	"	"	"	3 S. E.*
15	"*	"	"	"	"	"	"	"	"	2 S. E.	"	2 S.	2 S. E.	"	4 S. W.*
16	"*	"	"	"	"	"	"	"	"	"	"	1 S.	1 S. E.	"	1 S. W.*
17	1 S. E.*	1 S. E.	"	"	2 S.	"	"	"	"	"	1 S. E.	1 S. E.	0	2 S.	1 S. E.*
18	3 S. E.	2 S. E.	"	"	"	"	"	"	"	1 S. E.	0	1 E.	"	1 S.	1 E.*
19	2 S. E.	1 S. E.	"	"	0	"	"	"	"	2 S. E.	"	"	"	0	2 N. W.*
20	4 S. E.	2 S. E.	"	"	1 S.	"	"	"	"	3 S. E.	1 N.	0	"	"	2 S. W.*
21	0	5 S. E.	"	"	0	"	"	"	"	6 S. W.	2 S.	"	"	"	1 N. W.
22	1 S. E.	"	"	"	3 S. E.	"	"	"	"	"	1 S.	1 S.	"*	"	"
23	0	1 S. E.	"	"	1 S. E.	"	"	"	"	5 S. W.	"	"	"*	"	0
Midn't	"	"	"	"	0	"	"	"	"	4 S. W.	0	2 S. E.	"*	1 S. W.	"

* Snowing.

† "After 8 o'clock A. M., the wind, which had been previously from the S'd, set in from due S. E. The thermometer instantly rose 2°.1, and by 6 P. M. gave us the extraordinary temperature of —5°.4. This, when compared with the record of the 24th inst., which gave a minimum of —41°.8, shows a change of 36°.4. This effect is due to the S. E. wind, and is sometimes much more excessive."

‡ "The wind is from the S'd, and the temperature continues rising; by 9 A. M. of to-day it attained its maximum of +1°.0. At this temperature, the deck house snow thawed and became very wet; snow fell freely. This S. wind is very slight, and apparently cannot satisfactorily account for this deviation of temperature, as we have had it constantly from this quarter without such effect. We all suffer much from heat.

DIRECTION AND FORCE OF THE WIND OBSERVED AT VAN RENSSELAER HARBOR,

In December, 1853, in Lat. 78° 37′, Long. 70° 53′ W. of Greenwich.

The directions are magnetic. Variation of compass 108° W.

Hour.	1st.	2d.	3d.	4th.	5th.	6th.	7th	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.
1h.	2 N. E.	2 S. W.	0	2 N. W.	3 S. E.	0	0	0	0	2 S. E.	2 S. E.*	2 S. E.	2 S. E.	0	0
2	1 N. E.	"	1 S.	1 N. W.	4 S. E.	"	"	"	"	"	1 S. E.*	3 S. E.	"	"	"
3	0	1 S. W.	"	"	2 S. E.	1 W.	"	"	"	"	"	0	3 S. E.	"	"
4	"	3 W.	"	"	1 W.	1 S.	"	"	"	1 S. E.	2 S.	"	"	"	"
5	"	1 W.	"	"*	2 W.	0	"	"	"	0	0	"	1 S. E.	"	"
6	"	0	0	2 N. W.*	1 W.	"	"	"	"	"	"	3 N. E.	"	"	"
7	"	"	"	5 N. W.*	3 S. W.	"	"	1 N.	"	1 S. E.	"	"	"	"	"
8	"	"	"	4 N. W.*	3 S.	1 N. W.	"	0	"	"	"	2 N. E.	"	1 S. E.	"
9	"	2 S. E.	2 N. W.	1 N.	1 S.	"	"	"	"	2 S. E.	"	0	0	"	"
10	1 S. E.	1 S. E.	1 N. W.	"	"	0	1 S.	"	"	1 S. E.	1 S.	2 S.	"	"	"
11	0	"	"	0	"	"	"	1 S. E.	"	2 S. E.	2 S. E.	2 S. E.	"	"	"
Noon	"	3 S. E.	"	"	0	"	"	"	"	10 S.†	"	5 E.	"	"	"
13	"	3 S.	0	2 S.	"	"	0	1 S.	2 S. E.	9 S. E.	1 S. E.	7 S. E.	"	"	"
14	"	1 S.	"	4 S. E.	"	"	1 S. E.	0	"	6 S. E.	2 S. E.	4 S. E.	"	"	"
15	"	0	"	3 S. W.	"	"	0	"	"	2 S. E.	3 N. E.	3 S. E.	"	"	"
16	"	"	"	2 S. W.	1 N.	2 S. E.	"	1 S.	1 S. E.	1 S. E.	1 N. E.	6 S. E.	"	"	"
17	1 S.	1 S. E.	"	2 S. E.	0	1 S.	"	0	"	2 S. E.	"	2 S. E.	"	"	"
18	3 S.	1 S.	2 S.	1 S. E.	"	"	"	"	"	4 N. E.	0	3 S. E.	"	"	"
19	6 S.	"	2 S. W.	"	"	0	"	1 S. W.	"	2 E.	"	2 S. E.	"	"	"
20	1 S.	0	3 S. W.	"	"	"	"	"	"	2 S. W.	2 N. E.	1 S. E.	"	"	"
21	"	"	0	"	"	"	"	0	2 S. E.	2 W.	1 N. E.	0	"	"	"
22	0	"	"	2 S. E.	"	"	"	"	1 S. E.	0	0	"	"	"	"
23	1 S. E.	"	"	2 E.	"	"	"	"	3 S. E.	"	"	1 S. E.	"	"	"
Midn't	1 S.	"	"	0	"	"	"	"	1 S. E.	4 N. E.	1 S. E.	3 S. E.	"	"	"

Hour.	16th.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th.	27th.	28th.	29th.	30th.	31st.
1h.	1 S. E.	0	2 N. E.	1 S.	0	1 S. E.	1 S. W.	1 S. W.	2 S. E.	0	0	0*	8 S. E.	2 S. E.	0	1 S. E.*
2	"	"	2 S. E.	"	"	"	"	1 S.	"	"	"	"*	"	5 S. E.	"	"*
3	"	"	1 N.	2 S.	1 S. E.	"	"	2 S.	6 S. E.	3 S. E.	"	1 W.*	10 S. E.	2 S. E.	"	2 S. E.*
4	"	"	0	1 S.	2 S. E.	0	"	1 S.	7 S.	5 S. E.	"	"*	8 S. E.	2 S.	"	1 S.*
5	0	"	"	0*	1 E.	"	"	2 S. E.	4 S. W.	4 S. E.	2 W.	"*	4 W.*	3 W.*	"	2 W.
6	"	"	"	"*	2 E.	1 N. E.	"	3 S. E.	6 S. W.	2 S.	"	"*	9 S.W.*	4 W.	2 S.	2 N.W.*
7	"	"	"	1 N. W.*	2 S.	1 N. W.	"	"	6 W.	1 S.	"*	"*	8 W.*	3 S.	1 S.	1 N.W.*
8	"	"	"	2 N. W.*	1 S.	"	2 S. E.	1 S. E.	"	"	1 W.*	2 S.*	7 W.	2 W.*	1 S.W.	"*
9	"	"	"	1 N. W.*	1 S. E.	0	1 S. E.	2 S. E.	6 S. E.	0	0*	0*	7 S. W.	1 S.	1 S.	"
10	"	"	"*	2 N. W.*	"	"	"	1 S. E.	6 E.	"	2 E.*	"*	5 S. W.	"	0	"
11	"	"	"*	1 N. W.*	"	"	0	"	"	"	1 S. E.*	"	2 S. W.	"	"	"
Noon	"	"	"*	"*	"	"	"	4 S. E.	5 E.	"	0*	"	3 S.*	"	1 S.	"
13	"	"	"*	"*	"	"	"	3 S. E.	6 E.	"	1 S.*	"	5 S.*	1 S. W.	0	2 W.
14	"	"	"*	0*	"	"	"	2 S. E.	6 S.	"	"*	"	7 S.W.*	"	"	3 N. W.
15	"	"	"	"	0	1 S. E.	"	1 S. E.	"	1 S. W.	0*	"	8 S.*	0	"	2 N. W.
16	"	"	"	1 N. W.	2 S. E.	"	"	0	"	"	"*	"	5 S. E.*	"	"*	1 N. W.
17	2 S. E.	"	1 N. W.	0	0	0	"	"	5 E.	0	"	"	8 S. E.	"	"	0
18	1 S. E.	"	2 N. W.	1 S. E.	"	"	"	"	5 S. E.	"	"	"	"	"	"	1 N. W.
19	"	"	1 N. W.	0	"	"	"	"	4 S. E.	"	"	"	"	"	"	0
20	"	"	"	"	"	"	"	1 S. E.	"	"	"	"	"	"	"	"
21	0	"	0	"	"	1 S. E.	"	0	2 S. W.	"	"*	1 W.	10 S. E.	"	"*	"*
22	"	"	"	"	"	"	"	1 W.	2 S. E.	"	"*	"	9 S. E.	1 S. E.	"*	"*
23	"	"	"	"	"	"	"	"	2 N. W.	"	"*	"	6 S. E.	0	"*	"*
Midn't	"	1 N. E.	"	"	3 S. E.	0	"	0	0	"	"*	"	5 S. E.	"	"*	"*

* Snowing. † "Temperature rising, and wind blowing heavily; very dark and cloudy."

"Temperature at noon Dec. 8th, —13°.5; wind S. E. and generally calm. Temperature at noon Dec. 9th, —31°.5; wind S. E. or calm. Temperature at noon Dec. 10th, —10°.5; wind S. E. and heavy blow. The connection of the rise of temperature with the wind is embarrassing."

Dec. 12th. Calm, with squalls at intervals.

Dec. 24. "4 to 8 A. M., overcast, and blowing heavy from S. W. and W. 12 to 4 P. M., thickly overcast, and strong breeze from the S."

Dec. 28. The twenty-four hours have been characterized by the only heavy gale of wind experienced in Smith's Strait since the closure of our winter harbor. The wind rose to No. 8, blowing in squalls from the S. E., and, after 2 A. M., blew a regular gale (No. 10). Temperature rose from —6°.4 at midnight, to +16°.5 at 5 A. M.: difference nearly 23°.

DIRECTION AND FORCE OF THE WIND OBSERVED AT VAN RENSSELAER HARBOR,

In January, 1854, in Lat. 78° 37′, Long. 70° 53′ W. of Greenwich.

The directions are magnetic. Variation of compass 108° W.

Hour.	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.
1h.	0*	0	0*	2 N.*	0	0	0	4 S.	1 S. E.	0	0	0	1 S.	0	0
2	"*	1 S.	"*	"*	"	"	3 S. E.	2 S.	"	1 S. E.	"	"	"	"	"
3	1 S. E.*	"	"*	"*	1 S. E.	"	2 S. E.	1 S.	"	"	"	1 S. E.	"	1 S. E.	"
4	"*	"	"*	"*	"	"	"	"	1 S.	"	"	3 S. E.	"	0	"
5	"*	0	"*	2 W.*	"	2 S. W.	1 S. E.*	"	0	"	"	"	2 S.	"	"
6	"*	"	"*	1 W.	"	1 S. W.	3 W.	"	"	"	"	"	1 S.	"	"
7	"*	"	"*	"	"	2 S. E.	2 W.*	"	"	"	"	"	2 N. E.	"	"
8	2 S. E.*	"	"*	2 S. E.	1 N.	1 S.	3 S.*	"	"	"	"	"	1 N. E.	"	"
9	1 S. E.	"	1 S. E.*	1 S. E.	"	1 N. E.	2 S.	0	"	0	"	"	"	"	"
10	0	"*	2 S. E.*	"	"	"	"	"	"	"	"	"	"	"	"
11	1 S. W.	4 W.	1 S. E.*	"	"	"	1 S.	"	"	"	1 S.	1 S.	2 N. W.	"	"
Noon	2 S. W.	2 W.	2 S. E.*	"	"	"	3 S.	"	"	"	"	1 S. W.	1 N. W.	"	"
13	0	4 S. W.	1 S. E.*	"	"	0	3 S. W.	"	"	"	"	"	0	"	"
14	"	"	4 S. E.	"	"	"	2 S.	"	"	"	"	"	"	"	"
15	"	2 S. W.	1 S.*	1 S.	"	"	"	"	"	"	"	"	"	"	"
16	"	3 S. W.	2 S.*	"	0	"	"	"	"	"	"	"	"	"	"
17	"	0	1 S. E.	0	"	"	0	"	"	"	"	0	"	"	"
18	"	1 S. E.	"	"	"	"	"	"	"	"	"	"	"	"	"
19	"	"	"	"	1 S. E.	"	"	"	"	"	"	"	"	"	"
20	"	0	0	"	0	"	"	"	"	"	"	"	"	"	"
21	"	1 N.	2 S.*	"	"	3 W.	1 S. E.	"	1 S.	"	"	2 S.	"	"	"
22	"	1 N. W.	0*	"	"	"	2 S. E.*	1 W.	"	"	"	"	"	"	"
23	"	1 W.	"*	"	"	2 W.	1 S. E.*	2 W.	0	"	"	2 S. E.	"	"	"
Midn't	"	0	"*	"	"	3 S. W.	4 S. E.*	0	"	"	"	1 S.	"	"	"

Hour.	16th.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th.	27th.	28th.	29th.	30th.	31st.
1h.	0	1 S.	0	0	2 S. E.	0	1 N. W.	1 E.	0	1 S.	2 N. W.	0	0	0	2 N. W.	1 S.
2	"	"	"	"	1 S. E.	"	1 S. E.	"	"	"	0	"	"	"	"	"
3	"	"	"	"	"	"	2 N. W.	2 S. E.	"	1 S. E.	"	"	1 S. E.	2 S.	1 N. W.	2 S.
4	"	"	"	"	"	"	1 E.	"	"	"	"	"	1 S. W.	"	1 S. W.	1 S.
5	"	1 N. W.	"	"	0	"	2 N. E.	0	1 S.	2 S. E.	"	3 S. W.	0	0	1 S. E.	0
6	"	"	"	"	"	"	1 E.	"	1 W.	"	"	2 S. W.	3 S. E.	"	1 N.	"
7	"	"	"	"	"	"	1 N.	"	"	1 S. W.	"	1 S. W.	1 S. W.	"	"	"
8	"	"	"	"	"	"	"	"	"	"	"	"	0	"	1 N. W.	"
9	"	0	"	"	"	2 S. E.	2 N.	1 S. W.	"	0	"	"	1 W.	"	0	1 S. E.
10	"	"	"	"	"	1 S. E.	"	"	0	"	"	"	0	1 S.	"	1 S.
11	"	"	"	"	"	0	"	1 S.	1 N.	"	"*	0	"	"	"	"
Noon	"	1 S. E.	1 S. E.	"	"	2 S. E.	1 N.	"	1 N. W.	"	2 S. W.	"	"	"	"	"
13	"	0	0	"	"	1 N. W.	"	0	1 S. E.	"	"	1 S. E.	"	"	"	0
14	"	"	"	1 N. W.	"	2 W.	"	1 S. E.	"	"	1 S.	2 S. E.	"	"	"	"
15	"	"	"	"	"	1 W.	0	"	1 N.	"	"	1 S. E.	"	0	"	"
16	"	"	"	1 S. E.	"	1 W.	1 N. E.	"	2 N. W.	"	0	"	"	"	"	"
17	"	"	"	0	1 S. E.	2 S. E.	0	"	0	"	"	0	1 E.	1 S.	"	"
18	"	"	1 S. E.	"	2 S. W.	1 S.	1 S. W.	0	"	"	"	"	0	"	"	"
19	"	"	"	"	1 S. W.	2 S.	1 S.	"	"	"	2 S. E.	"	"	0	2 S. W.	"
20	"	"	"	"	0	- - -	1 S. W.	"	"	"	1 S. E.	"	"	"	1 S.	"
21	"	"	0	2 N.	2 S. E.	1 S. E.	0	"	"	1 S. W.	0	"	"	"	0	"
22	1 S.	1 S. E.	"	1 N.	1 S. E.	- - -	"	"	1 N. W.	"	"	1 W.	2 S. W.	"	2 S. E.	"
23	1 S. W.	"	"	"	"	"	"	"	0	0	"	"	0	"	0	1 E.
Midn't	1 S.	"	"	1 N. E.	"	2 S. E.	"	"	"	"	"	"	"	"	"	0

* Snowing.

January 2d. From 8 to 12 P. M., slight snow and light variable winds.

January 7th. From 4 to 8 A. M., heavy bank of clouds to S. E.

DIRECTION AND FORCE OF THE WIND OBSERVED AT VAN RENSSELAER HARBOR,

In February, 1854, in Lat. 78° 37′, Long. 70° 53′ W. of Greenwich.

The directions are magnetic. Variation of compass 108° W.

Hour.	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.
1h.	1 S.	0	0	1 S. E.	1 W.	2 S. E.	0	1 S. E.	1 S. E.	0	2 E.	3 S. E.	2 S. E.	1 S. W.
2	"	"	"	0	"	"	"*	"	"	"	3 S.	3 S.	"	2 E.
3	0	"	"	"	0	3 S. E.	"	"	2 E.	"	3 S. E.	4 S.	1 S. E.	2 S. E.
4	"	"	"	"	"	1 S. E.	"	"	1 E.	"	2 S. E.	5 S.	2 S. E.	1 S.
5	"	"	"	1 S. W.	1 N. W.	1 N. W.	2 E.	0	0	1 S. E.	0	6 S.	0	0†
6	"	"	"	0	0	"	"	"	"	2 S. E.	"	3 S.	1 S.	1 E.
7	"	"	"	1 N. W.	"	2 N.	7 S.	1 E.	"	1 S.	"	2 S. E.	2 S.	"
8	"	"	1 N.	"	"	1 N.	8 S.	"	1 S.	2 S. W.	"	"	3 S.	"
9	"	"	0	0	"	2 S. W.	5 S.	3 S. E.	3 S. E.	3 S. W.	2 S. E.	3 S. E.	0	0
10	2 N. W.	"	"	"	"	1 S. W.	6 S.	"	1 S. E.	5 S. W.	1 S. E.	"	"	1 E.
11	"	"	"	"	"	"	8 S. E.	2 S. E.	"	"	0	1 S. E.	"	0
Noon	1 N. W.	"	"	"	1 S.	"	10 S.	3 S. E.	"	6 S. W.	2 S. E.	"	"	"
13	0	"	"	"	0	1 S.	7 S. E.	"	0	"	1 S. E.	2 S.	"	1 E.
14	"	"	"	"	"	0	5 S. E.	2 S. E.	"	"	0	4 S. W.	"	0
15	1 S.	"	"	"	"	"	5 S.	"	"	5 S. W.	"	2 S. W.	"	"
16	"	"	"	"	"	1 S.	4 S.	1 S. E.	"	3 S. W.	"	4 S. W.	"	"
17	0	"	"	"	1 S.	1 S. E.	2 S.	1 E.	1 S. E.	4 E.	2 S. E.	"	1 S. E.	1 S. W.
18	"	"	"	"	"	"	2 S. W.	"	2 S.	"	5 S. E.	5 S. W.	2 S. E.	2 S. W.
19	"	"	"	"	2 S.	"	3 S. W.	1 S. E.	1 S. W.	5 E.	6 S. E.	4 S. W.	1 S. E.	1 S. W.
20	"	"	"	1 S.	1 S.	"	3 S.	1 N.	"	1 S. E.	8 S. E.	"	2 S.	"
21	"	"	"	0	"	0	2 S. E.	0	0	"	2 S. E.	2 S. W.	"	0
22	"	"	"	"	2 S.	"	1 S. E.	"	"	"	3 S. E.	1 S. W.	3 S.	"
23	1 E.	"	"	"	1 S.	"	2 S. E.	3 S. E.	"	2 N.	1 S. E.	2 S. W.†	"	"
Midn't	0	"	"	"	1 E.	"	1 S. E.	"	"	"	"	"	1 S.	"

Hour.	15th.	16th.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th.	27th.	28th.
1h.	0	10 S. W.†	1 S. E.†	0	1 S.	0	1 W.	0	0	0	3 S. E.	3 S. E.	0	0
2	"	7 S.	"†	"	2 S.	"	0	1 S. E.	"	"	4 S. E.	1 S. E.	"	"
3	1 S. W.†	5 S.	0	1 S.	0	1 N. E.	"	"	"	"	3 S. E.	0	"	"
4	0	4 S.	"	0	"	1 S. E.	"	0	2 S.	"	"	"	"	"
5	"	2 S. W.	"	"	1 E.	"	2 E.	"	"	"	"	1 S. E.	"	2 S. W.†
6	"	1 S. W.	"	2 S. E.	0	"	2 S. E.	"	1 S.	"	"	"	1 S. W.	1 S. W.
7	"	2 S. W.	2 S.	0	1 S.	2 W.	1 S. E.	"	1 W.	"	2 S. E.	0	2 S. W.	"
8	"	"	1 S.	"	0	1 W.	4 S. E.	"	0	"	1 S. E.	1 S. E.	1 S. W.	"
9	1 E.	1 S. W.	0	"	"	2 W.	1 N. W.	"	"	1 S.	0	0	1 N. W.	0
10	2 E.	"	1 S.	"	"	"†	"	"	"	"	"	"	0	1 E.
11	1 S.	"	"	"	"	1 S.	"	"	"	"	"	"	"	1 S. E.
Noon	2 S. W.	1 S. E.	0	"	"	2 S. E.	"	"	"	0	"	"	2 S. E.	"
13	4 S. W.	0	"	"	"	1 S. E.	"	"	"	2 S.	"	"	0	0
14	3 S. W.	"	"	"	"	0	"	"	"	1 S.	"	"	"	"
15	5 S. W.	"	"	1 E.	"	1 S. E.	0	2 S.	"	2 S.	1 S. E.	"	"	"
16	"	2 S. W.	1 W.	0	"	0	"	1 S.	"	1 S.	2 W.	"	"	"
17	3 S. W.	1 S.	0	"	"	"	1 S. E.	0	2 S.	0	0	"	1 S. E.	"
18	5 S. W.	0	"	"	"	"	0	"	1 S.	"	"	1 E.	"	"
19	3 S. W.†	"	1 S. W.	"	"	"	"	"	3 S.	1 S. E.	1 S. E.	0	"	"
20	2 S. W.†	"	2 S. W.	"	"	"	"	"	2 S.	"	"	"	"	"
21	6 S. E.†	"	2 N. W.	1 W.	"	"	2 S. E.	"	0	2 S.	"	"	"	"
22	"†	1 S. E.†	1 S. W.	0	"	"	1 E.	"	1 S.	0	2 S. E.	"	0	"
23	8 E.†	3 S. E.†	0	"	"	"	0	"	2 S.	1 S.	1 S. E.	"	"	"
Midn't	9 E.†	2 S. E.†	"	"	"	"	1 N.	"	1 S. W.	1 S. W.	"	"	"	1 S.

* Between the hours of 2 and 4 A. M., the temperature was elevated 22°.5. The wind then set in from the E'd, hauled to S'd, and blew a gale (No. 10). Temperature rose as high as —20°.5 at noon. These warm changes are very trying to the health, and curious in their relation to the winds.

† Snowing.

February 15th and 16th. Strong wind between 24h. and 1h., blowing a heavy gale (No. 10).

DIRECTION AND FORCE OF THE WIND OBSERVED AT VAN RENSSELAER HARBOR,

In March, 1854, in Lat. 78° 37′, Long. 70° 53′ W. of Greenwich.

The directions are magnetic. Variation of compass 108° W.

Hour.	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.
1h.	1 N. E.	1 S.	0	0	2 S.	2 S. W.	0	1 W.	2 S. W.	0	0	0	0	0	0
2	"	"	"	"	"	0	"	"	3 E.	1 W.	"	"	"	"	"
3	0	"	"	"	"	"	"	0	3 S.	0	"	"	"	"	"
4	"	2 S.	"	"	"	"	1 W.	"	5 E.	"	1 W.	"	"	"	"
5	"	0	"	"	"	"	0	"	2 S. E.	"	0	"	"	"	1 S. E.
6	"	"	"	"	"	"	"	"	"	1 S. E.	"	"	"	"	"
7	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
8	"	"	"	"	0	"	"	"	1 S. E.	0	"	"	"	"	"
9	"	"	1 S.	"	1 S. E.	"	"	"	2 S. E.	"	"	"	"	"	3 S.
10	"	"	"	"	1 S.	"	"	"	"	"	"	"	"	"	"
11	"	"	"	"	2 S. W.	1 W.	"	"	"	"	"	"	"	"	2 S.
Noon	1 S.	1 S.	0	"	1 S. W.	"	"	"	"	"	"	"	"	"	3 S.
13	0	"	1 S.	1 S.	"	"	"	1 W.	"	"	"	"	1 S.	"	"
14	"	2 S.	0	"	0	"	"	"	1 N. W.	"	"	"	0	"	2 S.
15	"	1 S.	"	0	"	1 E.	"	0	"	"	"	"	"	"	0
16	"	"	1 W.	"	"	0	1 S. E.	"	"	"	"	"	"	"	1 W.
17	"	"	0	"	"	"	0	"	0	"	"	"	"	"	2 S. E.
18	"	2 S.	"	"	"	"	"	"	"	"	"	"	"	"	"
19	"	1 S.	"	"	"	"	"	"	"	"	"	"	"	1 S. W.	"
20	"	"	"	"	"	"	"	"	"	"	"	"	"	0	3 S. E.
21	"	"	"	"	"	"	"	"	"	"	"	"	"	"	4 S.
22	"	"	"	"	"	"	"	1 S. E.	"	"	"	"	"	"	"
23	"	"	"	1 S.	"	"	"	0	"	"	"	"	"	"	"
Midn't	"	0	"	2 S.	"	"	"	"	"	"	"	"	"	"	"

Hour.	16th.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th.	27th.	28th.	29th.	30th.	31st.
1h.	3 S.	0	0	1 N. W.	0	1 S.	1 S. E.	2 S. E.	1 W.*	0	0	1 S.	0	3 S. E.	0	0
2	2 S.	"	"	0	"	"	"	4 S. E.	1 N. W.*	2 S.	"	4 S.	"	"	"	"
3	3 S.	"	"	"	"	"	"	1 S. E.	2 N. W.*	1 S.	"	2 S. E.	"	2 S. E.	"	"
4	1 S.	"	"	"	"	"*	"	"	"*	0	"	1 S. E.	"	"	"	"
5	"	"	"	"	"	0*	0	"	0*	1 S.	"	1 S.	"	1 S. E.	"	"
6	"	"	"	"	"	"*	1 S. E.	1 S.	"*	2 S.	"	2 S. E.	"	2 S. E.	"	1 N.
7	"	"	"	"	"	"*	2 S. E.	"*	1 W.*	1 S.	"	3 S. E.	"	1 S. W.	"	"
8	"	"	"	"	1 S.	"*	3 S. E.	"*	"*	"	"	"	"	0	"	0
9	2 S.	"	"	"	1 S. E.	"	0	0	"*	"	"	1 S. E.	"	"	"	"
10	1 S.	"	"	"	0	"	1 S.*	1 N. W.	"*	"	1 N. W.	"	"	"	"	"
11	"	1 S.	"	"	1 S. E.	1 S.W.*	"*	0	"*	0	"	"	1 S.	"	"	"
Noon	"	1 S. W.	"	2 N. W.	0	"*	"	"	2 W.*	"	"	"	"	"	"	"
13	"	0	"	0	1 S. E.	0	0	1 W.*	"*	"	0	"	0	"	"	"
14	"	"	"	"	2 S. E.	"	1 S.	"*	3 W.*	"	"	"	"	"	"	"
15	"	"	"	"	1 S. E.	"	"	0*	3 N. W.*	"	"	"	1 S. E.	1 S. W.	"	"
16	0	"	"	1 S. E.	1 S. E.	"	"	"*	4 N. W.*	"	"	"	"	"	"	"
17	1 S. W.	"	"	0	0	"	0	"*	"*	"	"	2 S. E.	"	"	"	"
18	"	"	"	"	"	"	"	"*	"*	"	"	"	"	0	"	"
19	"	"	"	"	"	"	"	"*	2 N. W.	"	"	1 S. E.	1 S.	1 S.	"	"
20	"	"	"	"	"	"	2 S.	"*	4 N. W.	"	"	"	2 S.	0	"	"
21	1 N. W.	"	"	1 S.	"	"	2 S. E.	2 W.*	3 N. W.*	"	"	"	0	1 S.	"	2 S.
22	"	"	"	0	"	1 S.	2 S.	"*	2 N. W.*	"	1 S.	"	4 S.	"	1 W.	"
23	0	"	"	"	1 S.	0	0	"*	1 N. W.	"	"	0	"	"	"	3 S.
Midn't	"	"	"	"	"*	"	2 S. E.	"*	0	"	"	1 S. E.	2 S. E.	2 N. W.	"	6 S.

* Snow.

March 9th. Between the hours 1 and 2 A. M., the temperature rose 13°.5.

DIRECTION AND FORCE OF THE WIND OBSERVED AT VAN RENSSELAER HARBOR,

In April, 1854, in Lat. 78° 37′, Long. 70° 53′ W. of Greenwich.

The directions are magnetic. Variation of compass 108° W.

Hour.	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.
1h.	6 S. W.	2 S. E.	- - -	2 N.	1 S.*	1 S. W.	1 S.	1 S.	0	1 S.	3 S.	1 S.	3 S.	6 S. W.	3 S. W.
2	4 S. W.	3 S. E.	"	"	"*	3 S. W.	2 S.	"	"	"	1 S.	"	2 S.	7 S. W.	4 S. W.
3	5 S. W.	"	"	"	0*	4 S. W.	3 S.	- - -	1 S. E.	0	"	"	1 S.	6 S. W.	3 S. W.
4	3 S. E.	2 S. E.	"	"	"*	3 S.	"	"	2 S.	"	"	"	3 S.	4 S. W.	1 S. W.
5	3 S.	"	"	2 S. E.	"*	2 S. W.	2 S.	0	0	2 S. W.	0	"	0	5 S. W.	4 S. E.
6	2 S.	3 S. E.	"	1 S. E.	"	1 S. W.	1 S.	"	1 S.	1 S. W.	"	0	"	4 S. W.	2 S. E.
7	3 S.	"	"	"	"	3 S. W.	"	1 S.	0	0	"	"	"	"	3 S. E.
8	2 S.	1 S. E.	"	4 S. E.	"	"	"	1 S. E.	"	"	"	"	"	3 S. W.	4 S. E.
9	3 S.	"	"	1 S. E.	1 S.*	"	0	2 S.	"	2 S.	1 S.	1 S.	"	"	3 S. E.
10	2 S.	"	"	2 S.	"*	2 S. W.	"	1 S.	"	1 S.	"	"	1 S.	"	2 S. E.
11	"	"	"	1 S.	"	"	"	"	"	"	2 N.	1 S. W.	"	4 S. W.	1 S.
Noon	"	"	"	"	"	1 S. W.	"	0	"	1 S. E.	1 N. W.	0	0	3 S. W.	"
13	1 S.	- - -†	0	- - -	2 S. W.	1 S.	1 S.	"	1 S. E.	1 S.	1 N.	"	"	4 S. W.	2 S. E.
14	"	"	"	"	"	"	2 S.	1 S. W.	"	0	0	1 N. W.	"	"	"
15	"	"	"	"	1 S.	"	1 S.	"	"	"	"	"	"	"	1 E.
16	"	"	"	"	"	"	0	1 S.	0	"	"	"	"	"	"
17	0	"	"	2 S. W.	0	"	"	2 S. E.	"	"	1 S.	1 S.	"	3 S. W.	1 S. E.
18	"	"	"	1 S. W.	1 S. W.	0	"	1 S. W.	"	"	"	"	"	2 S. W.	0
19	"	"	"	1 S. E.*	- - -	"	"	0	"	3 S.	"	2 S.	"	1 S. W.	2 S. E.
20	"	"	"	"*	"	"	"	"	"	2 S.	"	"	"	2 S. W.	"
21	"	"	"	"*	1 W.*	"	1 S.	1 S.	1 S.	"	"	1 S. W.	"	4 S. W.	3 S.
22	"	"	"	2 S. E.*	"	"	"	"	"	"	"	1 S.	2 S.	3 S. W.	6 S. W.
23	2 S. E.	"	"	"*	"	1 S. W.	0	2 S. E.	"	3 S.	2 S.	"	"	2 S. W.	10 S. W.
Midn't	"	"	"	"*	"	"	1 S.	1 S. E.	"	"	3 S.	"	"	1 S. W.	10 S.

Hour.	16th.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th.	27th.	28th.	29th.	30th.
1h.	8 S. W.	0	1 N.	1 N.	1 S. W.	0	3 S. W.	1 N. W.	1 S. E.	2 N. W.	0	1 S.	1 S. W.	1 S. E.	3 S. E.
2	"	"	"	"	"	"	1 S. W.	0	"	1 N. W.	"	"	"	"	1 E.
3	"	"	0	"	0	"	"	1 N. W.	0	0	1 S. E.	"	"	"	0
4	"	"	1 S.	"	"	2 N. W.	0	"*	"	"	"	"	"	"	"
5	7 S. W.	"	"	0	"	1 N. W.	"	1 W.	"	"	"	"	0	0	1 S.
6	4 S. W.	1 S.	"	"	"	0	"	0	"	1 N. W.	"	"	"	"	"
7	2 S. W.	0	0	"	"	"	"	"	"	"	"	0	"	"	"
8	1 S. W.	"	"	"	(8 N. W.‡)	"	"	"	"	"	0	"	"	"	"
9	"	"	1 N.	"	0	"	"	"	"	2 N. W.	"	"	"	"	0
10	"	"	"	"	"	1 N.	"	"	"	"	"	"	"	"	"
11	0	"	"	1 N.	"	1 N. W.	"	"	"	"	"	"	"	"	"
Noon	1 S.	"	"	"	"	"	"	"	"	"	"	"	"	"	1 N. W.
13	1 S. W.	1 N. W.	"	"	"	"	1 S.	1 N. W.	"	"	"	"	"	"	0
14	"	"	"	"	1 N. W.	"	"	"	"	1 N. W.	"	"	"	"	"
15	0	"	"	"	0	"	"	"	"	"	1 S.	"	"	"	"
16	1 S. W.	"	1 N. W.	"	"	"	"	"	"	"	"	"	"	"	"
17	0	"	0	"	"	0	"	0	"	2 S. E.	"	"	"	"	"
18	"	"	"	"	"	"	0	"	"	"	"	"	"	"	"
19	1 S. E.	"	"	"	"	"	"	"	"	0	2 S.	"	"	"	"
20	"	"	"	"*	"	"	"	"	"	"	"	"	"	"	"
21	"	"	"	"*	"	"	"	"	"	- - -	1 S.	"	1 S. E.	1 S. E.	"
22	"	"	1 S.	"*	"	"	"	"	"	"	"	"	2 S. E.	"	"
23	0	"	"	"*	"	"	"	"	"	"	"	"	"	"	"
Midn't	"	"	"	1 S.W.*	"	"	"	"	"	"	"*	"	"	"	"

* Snow.

† No observations, on account of the confusion attendant upon the returning party.

‡ This entry seems to be doubtful. The temperature, beyond a great diurnal variation, is but slightly affected, and the barometer not at all. Since there is no mention made in the notes of any sudden squall, I prefer to omit the entry altogether.

April 1st. Wind continues blowing from the S'd and S. W'd, increasing to a gale.

April 15th. About 9 P. M., the wind shifted to S. W., blowing a gale, with heavy snow drift.

DIRECTION AND FORCE OF THE WIND OBSERVED AT VAN RENSSELAER HARBOR,

In May, 1854, in Lat. 78° 37′, Long. 70° 53′ W. of Greenwich.

The directions are magnetic. Variation of compass 108° W.

Hour.	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.
1h.	2 N. W.	1 N. W.*	0	4 S. E.	1 N. W.*	0	1 S. E.	1 S. W.	1 S.	2 S. W.	1 N.	1 N. W.*	1 N. W.	0	1 S. W.
2	"	"*	"	"	"*	"	"	"	2 S.	4 S. W.	"	"	"	"	"
3	"	"*	"	3 S. E.	"*	"	"	2 S. W.	"	3 S. W.	"	"	"	"	"
4	3 S. W.	"*	"	0	"*	"	3 S. E.	3 S.	1 S.	2 S. W.	"	"	"	"	"
5	1 S. E.	"*	1 N.W.*	"	"*	"	5 S. E.	5 S.	0	1 S. W.	1 W.	"	"	"	1 S.
6	0	"*	"*	1 S. E.	"*	"	"	6 S.	"	"	"	"	"	"	1 S. E.
7	1 S. E.	"*	"	"	"*	"	"	4 S.	1 S.	"	1 S. W.	"	"	"	"
8	"	"*	"	"	0*	"	1 S. E.	3 S.	3 S.	"	"*	"	"	"	0
●	2 S.	"*	"	3 S. E.	"*	"	1 S.	"	1 S.	1 S. W.	"*	2 S.	"	"	1 N. W.
10	"	2 N. W.*	"	1 S. E.	"*	"	2 S.	4 S.	1 N. W.	2 N.	"*	1 S.	"	"	"
11	1 N. W.	1 N. W.*	"	1 N. W.	"*	"	4 S.	"	"	3 N.*	1 N.*	1 N. W.	"	"	"
Noon	"	"*	"	"	"*	"	3 S.	3 S.	"	"*	"	"	"	"	"
13	"	2 N. W.*	"	2 N. W.	"*	"	6 S.	"	"	2 N.*	1 S. W.	0	"	"	"
14	"	"*	"	"	"*	"	"	2 S.	"	"*	"	"	"	"	"
15	0	3 N. W.*	"	"	"	"	"	1 S.	"	"*	2 S. W.	"	"	"	"
16	1 N. W.	"*	"	3 N. W.	"	"	7 S.	"	0	1 N.*	"	"	"	"	"
17	"	1 N. W.	"	1 N. W.	"	"	"	"	"	"*	"	"	"	"	"
18	"	"	0	1 S. E.	"	"	4 S.	"	1 N. W.	"*	1 S. W.	"	"	"	"
19	0	"	"	"	"	2 S. E.	2 S.	"	"	"*	"	"	"	"	"
20	"*	"	"	0	"	1 S. E.	4 S.	"	"	"*	2 S. W.	"	"	"	"
21	"*	"	"	"	"	0	3 S.	2 S.	2 S. W.	0*	"	"	"	1 S. W.	"
22	"*	0	"	"	"	2 S. E.*	2 S.	3 S.	4 S. W.	1 N.*	1 S. W.	"	1 W.	"	2 S.
23	"*	"	"	"	"	0	3 S.	1 S.	"	"*	"	"	"	0	1 S.
Midn't	"*	"	"	1 N. W.	"	"	5 S.	2 S.	3 S. W.	"*	"	"	"	1 S. W.	"

Hour.	16th.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th.	27th.	28th.	29th.	30th.	31st.
1h.	1 S. E.	1 S.	0*	2 S. E.	3 S. W.	1 S. W.	5 S. W.	0	0	0	1 W.*	0*	0*	0	0	0
2	2 S. E.	"	"*	4 S. E.	1 S. W.	"	4 S. W.	"	"	"*	0*	"*	"*	"	"	"
3	1 S. E.	"	"*	1 S. E.	"	"	3 S. W.	"	"	"*	"*	"*	"*	"	"	"
4	1 E.	"	"*	2 S. E.	"	2 S. W.	0	"	"	"*	"*	"*	"*	"	"	"
5	"	"	"*	"	"	3 S. W.	1 S. W.	"	"	1 N.*	1 W.*	"*	"*	1 N.W.*	"	"
6	2 E.	"	"*	1 S. E.	"	2 S. W.	2 S. W.	"	"	"*	"*	"*	"*	"*	"	"
7	1 E.	0	1 N. W.*	0	"	3 S. W.	2 S.	"	"	0*	"	"*	"*	"*	"	"
8	"	"	"*	"	"	2 S. W.	1 S. E.	"	"	"	0	"*	"*	0*	"	"
9	"	1 N. W.	0*	1 S. W.	"	3 S. W.	1 S.	1 N.	"	"	1 N.	"*	"	"	"	"
10	0	"	1 N.*	0	1 N. W.	4 S. W.	"	"	1 N.	"	"	"*	"	"*	"	"
11	"	2 N. W.	"*	"	"	"	0	"	"	"	"	"*	"	"*	2 N.	"
Noon	"	"	"*	"	"	3 S. W.	1 N.	"	"	"*	2 N.	"*	"	"	1 N.	1 N.
13	"	"	"*	"	0	"	"	"	"	"*	1 N.	"*	"	"	"	"
14	2 N. W.	"	"*	"	"	"	2 N.	"	"	"	1 N. W.	"*	"	"	"	0
15	"	"	"*	1 S. W.	"	4 S. W.	3 N.	"	0	"*	"	"*	"*	"	"	"
16	"	"	"*	"	"	"	"	1 N. W.	"	1 N.	"	"*	"	"	0	"
17	1 N. W.	1 N. W.	"*	"	"	"	"	"	1 N.	"	"*	"*	"	"	"	"
18	0	"	"*	3 S. W.	"	"	2 N.	2 N. W.	"	"	"*	"*	"	"	"	"
19	"	"	"*	"	"	"	"	"	"	"	"*	"*	"	"	"	"
20	"	"	"	2 S. W.	1 S. W.	3 S. W.	"	"	0	1 S. W.	"*	"*	"	"	"	"
21	"	0	1 S. W.	"	3 S. W.	4 S. W.	0	0	"	"	"*	"*	"	"	"	"
22	"	"	3 S. W.	"	2 S. W.	"	1 N.	"	"	"	"	"*	"	"	"	"
23	"	"	2 S. W.	3 S. W.	1 S. W.	"	0	"	"	"	"*	"	"	"	"	"
Midn't	"	"	"	"	2 S. W.	3 S. W.	"	"	"	"*	"*	"	"	"	"	"

* Snowing.

May 7th and 8th. Strong breeze and gale from the S'd; ceased at noon of the 8th.

DIRECTION AND FORCE OF THE WIND OBSERVED AT VAN RENSSELAER HARBOR,

In June, 1854, in Lat. 78° 37′, Long. 70° 53′ W. of Greenwich.

The directions are magnetic. Variation of compass 108° W.

Hour.	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.
1h.	0	0	1 S. W.	6 N. E.	0	0	4 N. W.	0	0	0	0	0	1 N. W.	2 N. W.	0
2	"	"	"	5 N. E.	"	"	0	"	1 N. W.	"	"	"	"	3 W.	"
3	"	"	"	"	"	"	3 N. W.	"	"	"	3 N. W.	"	0	4 W.	"
4	"	"	0	"	"	"	"	"	0	"	3 N.	"	"	"	"
5	1 W.	1 S. W.	- - -	- - -	"	1 N. W.	"	"	2 N. W.	"	1 N. W.	1 N. W.	1 N. W.	0	"
6	0	2 S. W.	"	"	1 N. W.	"	"	"	"	"	"	"	1 W.	"	"
7	1 W.	1 S. W.	"	"	"	"	"	"	"	"	"	"	1 N. W.	"	"
8	"	2 N. W.	"	"	"	"	"	"	1 N. W.	"	"	"	1 W.	"	"
9	"	"	1 N.	3 N. W.	"	0*	2 N. W.	"	"	"	2 N. W.	2 N. W.	1 N. W.	"	"
10	"	"	"	"	2 N.	"*	0	"	0	"	"	"	2 W.	"	"
11	"	1 N. W.	"	"	2 N. W.	"	"	"	"	"	0	0	2 N. W.	"	"
Noon	0	2 N. W.	"	"	3 N. W.	"	"	"	3 W.	"	"	1 N. W.	0	"	1 N. W.
13	"	1 N. W.	2 N. W.	5 N.	1 N. W.	"	"	"	0	"	"	"	1 N. W.	"	"
14	"	"	3 N. W.	"	0	"	1 N. W.	"	2 N. W.	"	"	"	6 N. W.	"	0
15	"	"	4 N. W.	"	2 N. W.	3 N. W.	"	3 N. W.	0	"	1 N. W.	"	"	1 N. W.	"
16	"	"	"	"	"	2 N.	3 N. W.	"	4 N. W.	"	"	0	"	0	"
17	"	"	"	3 N. W.	3 N.	0	0	"	"	"	"	2 N. W.	"	"	"
18	"	"	"	"	4 N.	1 N. W.*	2 N. W.	"	2 N. W.	"	"	"	5 N. W.	"	"
19	"	"	3 N. W.	"	2 N. W.	2 W.	1 N. W.	2 N. W.	3 N. W.	1 S. W.	2 W.	"	2 N.	"	"
20	"	"	"	2 N. W.	"	2 N. W.	0	"	"	0	1 N. W.	1 N. W.	1 N. W.	"	"
21	"	0	2 N. W.	2 N.	"	"	"	1 N. W.	2 N. W.	1 S. W.	1 W.	2 W.	1 N.	"	"
22	"	"	"	1 W.	"	1 N. W.	"	"	1 N. W.	- - -	0	4 N. W.	1 N. W.	"	"
23	"	"	"	0	1 N. W.	3 N. W.	"	"	0	"	"	3 N. W.	0	"	"
Midn't	"	"	"	"	2 N. W.	2 N. W.	4 S. W.	"	"	"	"	2 N. W.	1 W.	"	"

Hour.	16th.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th.	27th.	28th.	29th.	30th.
1h.	0	7 S. W.	0	0	0	1 S. W.*	1 S. W.*	4 N. W.*	0	0	0	0	0	- - -	0
2	"	8 S. W.	"	"	"	2 S. W.*	2 S. W.*	1 N. W.	"	"	"	2 N. E.	"	"	"
3	"	7 S. W.	"	"	"	3 S. W.*	1 S. W.*	0	"	"	"	3 N. E.	"	"	"
4	"	5 S. W.	"	"	"	0	"*	2 N. W.	"	"	"	2 N. E.	"	"	1 S. W.
5	"	3 S. W.	"	"	"	"	0*	4 N. W.*	"	"	"	0	"	0	"
6	"	3 S. W.	"	"	"	"	"*	"*	"	"	"	"	"	"	0
7	"	"	"	"	"	"	"*	"*	"	"	"	"	"	"	"
8	"	1 S. W.	"	"	"	"	"*	"*	"	"	"	"	"	"	"
9	"	"	"	"	"	"	"*	1 N. W.	"	"	"	"	"	"	"
10	"	"	"	"	2 N. W.	"	"	"*	"	"	"	"	"	"	"
11	"	2 S. W.	"	"	2 W.	"	"	"*	"	1 N. W.	"	"	"	"	"
Noon	"	"	"	"	0	"	"	"*	"	2 N. W.	"	"	"	"	"
13	"	0	"	"	"	"	"	0*	"	0	"	"	"	"	"
14	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
15	"	"	"	"	"	"	"	"	- - -	"	"	"	"	"	"
16	"	"	"	"	"	"	1 S. W.	"	"	"	"	"	"	"	"
17	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
18	"*	"	"	"	"	"	0	"	"	"	"	"	"	"	"
19	1 S. W.*	1 S. W.	"	"	"	"*	2 N. W.	1 W.	1 N. W.	3 N.	"	"	"	"	"
20	0*	"	"	"	"	"	"*	"	1 W.	"	"	"	"	"	1 N.
21	"	0	"	"	"	"	3 N. W.*	"	0	2 N.	"	"	"	"	1 N. W.
22	"	1 W.	"	"	"	"	"*	0	"	1 N. W.	1 N. W.	"	"	"	0
23	"	0	"	"	"	"*	4 N. W.*	"	"	"	0	"	"	"	1 N. W.
Midn't	"	"	"	"	"	"*	- - -*	"	1 N. W.	0	"	"	"	"	0

* Snow.

DIRECTION AND FORCE OF THE WIND OBSERVED AT VAN RENSSELAER HARBOR,

In July, 1854, in Lat. 78° 37′, Long. 70° 53′ W. of Greenwich.

The directions are magnetic. Variation of compass 108° W.

Hour.	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.
1h.	0	- - -	0*	0	0	0	0	0	0	1 N. W.	1 N. W.	0	0	2 S. E.*	0
2	"	"	"*	"	"	"	"	"	"	"	0	1 W.	"	1 S. E.*	"*
3	"	"*	"	"	2 N. W.	1 N. E.	"	"	"	0	"	"	"	0*	"
4	"	"*	"	3 S. W.	0	0	"	"	"	"	"	0	"	"*	"
5	"	S. E.*	"	1 S. W.	"	1 N. W.	"*	"	2 W.	1 N. W.	1 W.	"	"	"*	"
6	"	"*	"	"	"	"	"	"	1 W.	2 N. W.	"	"	"	"	"
7	"	"*	"	1 N.	"	"	"	"	"	1 N. W.	0	"	"	"	"
8	"	S.*	"	0	"	2 N. W.	"	"†	0	"	1 W.	"	"	"	"
9	"	S. E.	1 N.	"	"	"	"	"†	"	0	0	"	"	"	"
10	"	E.	"	"	"	"	"	"†	"	"	"	"	"	"	"
11	"	"	"	"	"	"	"*	"†	"	"	"	"	"	"	"
Noon	"	S. E.	"	"	"	"	"*	"†	"	"	1 N.	"	"	"	"
13	"	S.	0	"	"	"	"*	"	"	"	"	"	"	"	"†
14	"	"	"	"	"	1 N. W.	"*	"	"	"	"	"	"	"	2 N.
15	"	S. W.	"	"	"	2 N. W.	"*	"	"	1 S. W.	1 N. E.	"	"	"	1 N.†
16	"	"	"	"	"	3 N. W.	"*	"	"	1 W.	"	"	"	"	"†
17	"	"	"	"	1 S. W.	2 W.*	"*	"	"	"	1 N. W.	"	- - -	"	0
18	"	"	"	"	"	1 W.*	"*	"	"	"	"	"	"	"	"
19	"	N. W.	"	"	"	"*	"*	"	"	"	2 S. E.	"	0	"	"
20	"	"	"	"	"	1 N. W.	"*	"	"	"	1 E.	"	"	"	"
21	"	- - -	"	"	0	"	"	"	1 W.	0	1 N.	"	- - -	"	"
22	"	"	"	"	"	"	"	"	0	"	"	"	"	"	3 S. W.
23	1 N. W.*	"	"	"	"	"	"	"	"	"	0	"	"	"	"
Midn't	"*	"	"	"	"	"	"	"	"	"	"	"	"	"	"

Hour.	16th.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th.	27th.	28th.	29th.	30th.	31st.
1h.	- - -	- - -	- - -	- - -	0	0	0	0	0	0	0*	1 N.	0	5 S. W.	0	0
2	"	"	"	"	"	"	"	"	"	"	"*	2 N.†	"	6 S. W.	"	"
3	"	"	"	"	"	"	"	"	"	"	"*	4 N. W.	1 N. W.	4 S. W.	"	"
4	"	"	"	"	"	"	"	"	"	"	"*	3 N. W.	2 S. E.	"	"	"
5	1 N.	0	0	0	1 W.	"*	"	"	"	"	"*	0	2 S. W.	4 W.	1 W.	- - -
6	"	"	"	"	0	"*	"	"	"	"	"	"	3 S. W.*	3 W.	"	"
7	"	1 S.	"	"	"	"*	"	"	"	"	"	"	5 S. W.	0	2 W.	"
8	"	"	"	"	2 N. W.	1 N.*	"	"	"	"	1 S. E.	"	"	"	"	"
9	"	0	"	"	0	"*	"	"	"	"*	1 S.	"	"	"	0	0
10	"	"	"	"	"	1 S.*	"	"	"	"*	1 N.	"	"	"	"	"
11	0	"	"	"	"	"*	"	"	"	"*	1 N. E.	"	6 S. W.	"	"	"
Noon	"	"	"	"	"	"*	"	"	"	"*	"	2 N. W.	6 S.	"	2 N. W.	"
13	"	"	1 E.	"	"	0*	"	"	"	"	2 N.	1 N. W.	6 S. W.	3 N.	3 W.	"†
14	1 N.	1 N.	0	"	2 N. W.	"*	"	"	"	"	3 N. E.	1 W.	6 S.	0	3 N. W.	"
15	5 S.	"	"	"	1 N. W.	"*	"	"	"	"	0	0	8 S. W.	"	2 N. W.	"
16	6 S.	0	1 S.	"	"	"*	"	"	"	"	"	"	"	"	"	"
17	"	"	0	"*	"	"	"	1 W.	"	"	"	"	"	3 N. W.	"	"
18	"	"	"	"*	"	"	"	"	"	"	"	"	"	"	3 N. W.	"
19	"	"	"	"*	"	"	"	"	"	"	"	"	7 S. W.	"	4 N. W.	"
20	"	"	"	"*	"	"	"	"	"	"	"	"	"	0	3 N. W.	"
21	4 S.	- - -	"	"	"	"	"	1 N. W.	"	"	"	"	6 S. W.	"	1 N. W.	"
22	3 S.	"	"	"	"	"	"	"	"	"	"	"	2 S. W.	"	"	"
23	2 S.	"	"	"	0	"	"	"	"	"	"	"	"	"	"	"*
Midn't	0	"	"	"	"	"	"	0	"	"	"*	"	2 S. E.	"	0	"*

* Rain. † Snow.

July 2d. The force of the wind was not noted on this day; estimated force 2.

July 28th. The bergs outside are now in motion.

DIRECTION AND FORCE OF THE WIND OBSERVED AT VAN RENSSELAER HARBOR,

In August, 1854, in Lat. 78° 37′, Long. 70° 53′ W. of Greenwich.

The directions are magnetic. Variation of compass 108° W.

Hour.	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.
1h.	0	0	0	1 S. E.	0	0	0	1 N.	0	0	0	0	1 S. E.	0	3 N. W.
2	"	"	1 N. W.	0	"	"	"	1 S. E.	"	"	"	"	"	"	3 W.
3	"	"	1 N.	"	"	"	"	3 N. W.	"	"	"	"	"	"	2 N. W.
4	"	"	1 N. W.	"	"	"	"	1 N. W.	"	"	"	1 S. W.	0	"	0
5	1 W.	"	0	"	1 S. E.	"	"	0	"	"	"	"	1 N. E.	"	"*
6	"	"	"	2 N. E.	1 N.	"	"	"	"	"	"	"	0	1 S. E.	"*
7	1 N. W.	"	1 S. E.	1 N.	"	"	"	"	"	"	"	"	2 N.	"	"*
8	"	"	0	1 S.	0	"	"	"	"	"	"	"	3 N.	0	"*
9	0	"	"	0	"	"	"	"	"	"	"	"	2 N.*	"	"*
10	"	"	"	"	"	"	"	"	"	"	"	"	1 N.	1 N.	"*
11	"	"	"	"	"	"	"	"	"	"	"	0	2 N.	2 S. E.	"*
Noon	"	"	"	"	"	"	"	"	"	"	"	"	1 N.	3 N. W.	"*
13	"	"	"	"	"	"	"	"	"	"	"	"	"	4 W.	"*
14	"	"	"	"	"	"	"	2 S.	"	"	1 W.	"	2 N. W.	2 W.	1 N. W.
15	"	"	"	"	"	"	"	1 S.	"	"	"	"	"	3 W.	0
16	"	"	"	"	"	"	"	"	"	1 S.	"	"	1 N. W.	4 W.	"
17	"	"	"	"	"	"	"	0	"	"	0	"	2 N.	3 N. W.	"
18	"	"	"	"	"	"	"	"	"	"	1 S.	"	1 N.	4 N. W.	"
19	"	"	"	"	"	"	"	"	1 S.	"	"	"	0	3 N. W.	"
20	"	"	"	"	"	"	"	"	"	"	"	"	"	2 N. W.	"
21	"	"	"	"	"	"	"	"	"	0	"	"	"	4 N. W.	"
22	"	"	"	"	"	"	"	"	"	"	"	1 S. E.	"	3 N. W.	"
23	"	"	"	"	"	"	"	"	"	"	"	"	"	4 N. W.	"
Midn't	"	"	"	"	"	"	"	"	"	"	"	"	"*	0	"

Hour.	16th.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th.	27th.	28th.	29th.	30th.	31st.
1h.	0	0	0	1 N. W.	0	0	0	2 S. E.	0	0	0*	- - -	- - -	2 S. E.	7 S.	5 S.
2	"	"	2 N.	0	"	"	"	1 S. E.	"	"	"	"	"	3 S. E.	"	"
3	"	"	4 N.	"	"*	"	"	0	"	"	"	"	"	"	"	"
4	"	"	2 N.	"	"*	"	"	"	"	"	"	"	"	"	"	"
5	"	"	2 N. W.	1 N.	"*	"	"	1 S. E.	"	"	"	1 S. E.	"	3 E.	1 S.	4 S.
6	"	"	2 W.	"	1 N. W.*	"	"	0	"	"	"	"	"	5 S. E.	"	3 S.
7	"	"	"	0	"*	"	"	"	1 S.	"	"	"	"	6 S. E.	1 E.	"
8	"	"	"	1 E.	"*	1 W.	"	"	"	"	"	"	"	2 S. E.	"	2 S.
9	- - -	2 N.	1 N. W.	1 S. E.	"*	0	"	"	0	"	"	1 S.	"	4 S. E.	1 S. E.	2 S. E.
10	"	"	"	0	3 N. W.*	"	"	"	"	"	"	"	"	3 S. E.	2 S. E.	"
11	"	"	"	1 E.	1 N. W.	"	"	"	"	"	"	"	"	4 S. E.	5 S. E.	2 S.
Noon	"	"	"	"	2 W.	"	"	"	"	"	"	"	"	"	"	"
13	0	3 N. W.	2 N. W.	1 S. E.	"	"	"	"	"	"	"	"	"	5 S. E.	- - -	"
14	"	2 N. W.	2 N. E.	0	"	"	"	"	"	"	"	"	"	6 S.	"	0
15	"	"	0	"	2 N. W.	"	"	"	1 S.	"	1 S. E.	"	"	"	"	"
16	"	3 N. W.	"	"	3 N. W.	"	"	"	"	"	"	0	"	"	"	"
17	"	1 N. W.	2 N. W.	"	1 N. W.	"	"	"	"	"	"	"	"	"	"	"
18	"	0	3 N. W.	"	"	"	"	"	1 S. E.*	"	"	"	"	"	"	- - -
19	"	1 S. E.	"	1 E.	"	1 S.	"	"	2 S. E.	"	"	"	"	"	"	"
20	"	"	4 N. W.	"	"	"	"	"	"	"	- - -	"	"	"	"	"
21	"	"	3 N. W.	2 E.*	"	"	"	"	1 S. E.	2 S. W.	"	"	"	6 S. E.	3 S. E.	0
22	"	0	"	"*	0	"	"*	"	3 N. W.	1 S. W.	"	"	"	"	"	"
23	"	1 S. E.	4 N. W.	1 N.*	"	0	"	"	1 N. W.	2 S. W.	"	"	"	"	4 S. E.	"
Midn't	"	0	"	0	"	"	"	"	1 S. E.	0	"	"	"	6 S.	4 S.	"

* Snow.

DIRECTION AND FORCE OF THE WIND OBSERVED AT VAN RENSSELAER HARBOR,

In September, 1854, in Lat. 78° 37′, Long. 70° 53′ W. of Greenwich.

The directions are magnetic. Variation of compass 108° W.

Hour.	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.
1h.	0	- - -	0*	0	0	0	0	0	0	0	0	0	0	1 S. W.	0*
2	"	"	"*	"	"	"	"	"	"	"	"	"	"	"	"*
3	"	0	"*	"	"	"	"	"	"	"	"	"	"	0	"*
4	"	"*	"*	"	"	"	"	"	"	"	"	"	"	"	"*
5	"	"*	"	"	1 S.	"	"	"	"	"	"	"	1 N. W.	"	"*
6	"	"*	"	"	2 S.	"	"	"	"	"	"	"	0	"	"*
7	"	"*	"	"	0	"	"	"	"	"	"	"	"	"	- - -
8	"	"*	"	"	"	"	"	"	"	"	"	"	"	"	"
9	"	"*	"	"	"	"	"	"	"	"	"	"	"	"	0*
10	"	"*	"	"	"	"	"	"	"	"	"	"	"	"	2 N. E.*
11	"	"*	"	"	"	"	"	"	"	- - -	"	"	"	2 S. W.	1 N. E.*
Noon	"	"*	"	"	"	"	"	"	"	"	"	"	"	"	2 N.*
13	"	"*	"	"	"	"	"	"	- - -	0	"	"	"	3 S. W.	0
14	"	"	"	"	"	"	"	"	"	"	"	"	"	2 S. W.	"
15	"	"	"	"	"	"	"	"	"	"	"	"	"	1 S. W.	"
16	"	"	1 S.	"	"	"	"	"	"	"	"	"	"	"	"
17	"	"	1 S. E.	"	"	"	- - -	"	0	- - -	"	"	"	"	1 S.
18	"	"	1 N.	"	"	"	"	"	"	0	"	"	"	"	"
19	"	"	0	"	"	"	"	"	"	"	"	"	"	0	"
20	"	"	"	"	"	"	"	"	"	"	"	"	3 S.	"	"
21	"	"	"	"	1 S.	"	0	"	"	"	"	"	5 S.	1 S. W.	"
22	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
23	"	"	"	"	"	"	"	"	"	"	"	"	2 S.	1 S.	"
Midn't	"	"	"	"	"	"	"	"	1 S. W.	"	"	"	1 S.	"	"

Hour.	16th.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th.	27th.	28th.	29th.	30th.
1h.	0	0	0	0	0	2 W.	2 N. W.	1 S.	0	0*	0	0	3 S.	3 S.	10 S. W.
2	"	"	2 S. E.	"	"	1 W.	3 N. W.	0	2 S. E.	"*	1 S. W.	"	1 S.	4 S.	9 S.
3	"	"	"	"	"	0	0	"	1 W.	"*	2 S. W.	"	"	5 S.	8 S. W.
4	"	"	3 E.	"	"	"	1 N. W.	"	0	"*	"	2 S.	"	"	9 S. W.
5	"	"	3 S. E.	"	"	"	3 S. E.	"	1 W.	"*	"	1 S.	2 S. W.	3 S.	7 S. W.
6	"	"	5 E.	"	"	"	"	"	0	"*	4 S. W.	1 S. W.	3 S. W.	2 S.	"
7	"	1 S. W.	4 S. E.	"	"	"	2 E.	"	2 S. W.	"*	3 S. W.	3 S. W.	"	5 S.	"
8	"	0	3 S. E.	1 S. E.	"	"	2 S. E.	"	1 S. W.	"*	4 S.*	4 S. W.	2 S. W.	"	5 S. W.
9	"	"	2 S. E.	2 S. E.	"	"	1 S. E.	"	"	"	3 S.	"	3 S. W.	4 S. W.*	7 S. W.
10	"	"	0	1 S. E.	"	"	"	"	1 E.	"	"*	5 S. W.	4 S. W.	5 S. W.*	"
11	"	"	"	"	"	1 W.	2 S. E.	"	0	"	2 S.W.*	3 S. W.	"	"*	"
Noon	"	"	"	"	- - -	0	4 S. E.	"	"	"	1 S.W.*	4 S. W.	2 S. W.	3 S. W.*	7 S.
13	"	"	"	"	"	"	3 S. E.	"	"	"	1 S.	5 S. W.	"	2 S. W.*	6 S. W.
14	"	"	"	"	"	"	2 S. E.	"	"	"	0	4 S. W.	"	"	5 S. W.
15	"	"	"	0	0	"	0	"	2 S. E.	"	"	4 S.	3 S. W.	2 S.	7 S. W.
16	"	"	"	"	"	"	"	"	1 S. E.*	1 W.	"	5 S.	2 S. W.	"	"
17	"	"	"	"	"	"	"	"	1 E.*	0	"	4 S. W.	3 S. W.	"	5 S. W.
18	"	"	"	2 S. E.	"	"	"	"	0*	"*	"	5 S. W.	2 S. W.	3 S.	"
19	"	1 N. E.	"	"	"	"	"	"	"*	"*	"	"	"	"	3 S. W.
20	"	"	"	0	"	"	"	1 S. W.	"	2 S.*	"	"	1 S. W.	4 S.	5 S.
21	"	"	2 S. E.	"	"	"	"	- - -	"*	3 S.*	"	"	4 S. E.	"	3 S. E.
22	"	"	"	"	"	"	"	"	"*	4 S.*	"*	"	5 S.	5 S.	"
23	"	"	"	"	"	"	"	"	"*	3 S.*	2 S. E.*	3 S.	6 S.	5 S. E.	"
Midn't	"	"	"	"	"	2 N. W.	"	"	"*	2 S.*	"*	"	5 S.	5 S.	"

* Snow.

Sept. 30th. From 12 to 2 A. M., heavy drift and wind squall.

DIRECTION AND FORCE OF THE WIND OBSERVED AT VAN RENSSELAER HARBOR,

In October, 1854, in Lat. 78° 37′, Long. 70° 53′ W. of Greenwich.

The directions are magnetic. Variation of compass 108° W.

Hour.	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.
1h.	2 S.	2 S. W.	6 S. W.	3 N. E.	0	2 N. E.	2 N. W.	0*	3 S. W.	0	1 W.	0	2 W.	4 W.	9 S. E.
2	"	5 S. W.	1 S.	2 N. E.	"	"	"	"*	"	"	2 S. W.	"	"	"	8 S.
3	0	6 S. W.	0	3 S. W.	"	2 N. W.*	2 N.	"	"	"	1 S. W.	"	0	3 N. W.	"
4	"	1 S. W.	"	"	"	"*	1 N.	"	"	"	"	"	"	"	6 S.
5	2 S. W.	4 S. W.	"	"	2 S.	2 W.*	0	"	2 W.	"	0	"	2 S. W.*	2 N. W.	4 S. W.
6	1 S. W.	3 S. W.	1 S. W.	"	1 S. W.	2 N. W.*	"	"	3 S. W.	"	"	"	"*	"	4 S.
7	1 S.	1 N.	0	"	1 S.	"*	3 S. W.	2 S.*	1 S.	"	"	1 S. W.	3 S. W.	1 N. W.*	4 S. W.
8	"	"	"	4 S. W.	0	"*	"	1 S.*	7 S.	"	"	"	2 S. W.	"*	4 S.
9	"	3 W.	"	3 S. W.	"	0*	4 S. W.	"	3 S. W.	"	"	"	3 S. W.	2 W.*	3 S. W.
10	"	4 S. W.	2 S. W.	0	"	"*	5 S. W.	"	1 S. W.	"	"	"	4 S. W.	"*	3 S.
11	"	5 S.	"	1 S. W.	"	"	"	"	0	"	"	1 S. E.	"	3 N. W.	1 S.
Noon	0	"	2 S.	2 S. W.	"	"	5 S.	"	"	"	"	"	"	"	0
13	"	2 S.	0	"	1 S.	"	4 S.	1 S. W.	"	"	"	0	"	"	2 S. W.
14	"	3 S. W.	2 S. W.	"	0	"	4 S. W.	"	"	"	"	"	"	2 N. W.	2 S.
15	"	3 S.	3 S. W.	0	"	"	3 S. W.	"	"*	"	"	"	3 S. W.	2 S.	3 S. W.
16	"	"	"*	"	"	"	1 S. W.	"	"	"	"	"	2 S. W.	1 S.	2 S. W.
17	"	2 S. W.	1 S. W.	1 N. W.	"	"	"	2 S.	"	"	"	"	3 S. W.	"	"
18	"	3 S. W.	"	0	"	"	"	1 S.	"	"	"	1 S. W.	1 S. W.	"	"
19	"	1 S. W.	0	1 N. W.	"	"	2 S. W.	"	"	"	1 W.	"	0	"	3 S. W.
20	"	"	"	"	"	"	2 S.	2 S.*	"	"	"	"*	"	"	"
21	"	5 S. W.	3 S. W.	2 N. W.	"	2 N. W.	3 S. W.*	"	"	"	2 W.	0*	2 N. W.	"	5 S. W.
22	"	6 S. W.	"	0	"	"	1 S. W.*	1 S.	"	"	"	"*	2 W.	"	"
23	4 S. W.	6 S.	4 S. W.	2 S. W.	3 N. W.*	3 N. W.*	"*	"	"	"	3 W.	"	"	3 S.	6 S.
Midn't	3 S. W.	"	"	"	3 W.*	"*	0*	"	"	"	2 S. W.	"	"	5 S.	"

Hour.	16th.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th.	27th.	28th.	29th.	30th.	31st.
1h.	5 W.	0	0	1 S. E.	0	0	- - -	- - -	1 N.	1 S.	- - -	0	1 S.	0	1 S. W.	- - -
2	6 S. W.	"	"	0	"	"	"	"	"	"	"	1 S. E.	"	"	1 S.	"
3	4 W.	"	"	"	"	"	0	0	0	0	1 S. W.	0	"	"	3 S. W.	"
4	6 W.	"	"	"	"	"	"	"	"	"	"	"	"	1 S.	"	"
5	4 W.	"	"	"*	"	"	1 S. E.	"	"	"	- - -	"	0	"	2 S. W.	1 S. W.*
6	"	"	"	"	"	"	"	"	"	"	"	"	1 S.	"	"	0*
7	0	1 S.	"	"	"	"	0	"	"	1 S. W.	0	"	0	0	0	"*
8	1 E.	"	"	"	"	"	"	"	"	2 S. W.	"	"	"	"	"	"*
9	1 S.	"	"	"*	"	"	"	"	"	1 S. W.	"	"	"	"	"	"
10	2 S.	0	"	"	"	"	"	"	1 S. E.	"	"	"	"	1 S. E.	1 S. W.	"
11	2 S. W.	"	"	"	"	"	"	"	"	0	"	"	2 S.	"	"	- - -
Noon	0	"	"	"	"	"	"	"	"	"	1 N. E.	"	"	"	"	"
13	"	"	"	"	"	"	"	"	0	"	1 S. E.	"	1 S. E.	1 S.	"	"
14	"	"	"	"	"	"	"	"	"	"	"	"	1 S.	"	"	"
15	"	"	"	"	"	"	1 S. E.	"	"	"	0	"	1 S. E.	- - -	"	1 S.
16	"	"	"	"	"	"	"	"	"	"	"	"	1 E.	"	"	"
17	"	"	"	"	"	"	0	"	"	1 S. E.	"	"	"	"	"	0
18	"	"	"	"	"	"	"	"	1 S. E.	"	"	"	"	"	"	"
19	"	"	"	"	"	"	"	"	"	"	"	1 S. W.	0	"	0	"
20	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
21	"	"	"	"*	"	"	"	"	"	2 S. E.	"	"	"	"	"	"
22	"	"	"	"*	"	"	"	"	0	"	"	"	"	"	"	"
23	"	1 S. W.	"	2 S. W.	"	"	"	"	"	"	"	1 S.	"	0	"	"
Midn't	"	2 S. W.	"	1 S. W.	"	"	"	"	"	1 S. E.	"	"	"	"	"	"

* Snow.

October 15th. From 12 to 2 A. M., the wind blowing a heavy gale (9) from the S. S. E.

DIRECTION AND FORCE OF THE WIND OBSERVED AT VAN RENSSELAER HARBOR,

In November, 1854, in Lat. 78° 37′, Long. 70° 53′ W. of Greenwich.

The directions are magnetic. Variation of compass 108° W.

Hour.	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.
1h.	0	0	0	- - -	- - -	- - -	- - -	- - -	- - -	- - -	0	0	0	0	0
2	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
3	"	"	"	"	"	"	"	"	"	"	"	1 N.	"	"	"
4	1 S.	"	"	"	"	"	"	"	"	"	"	0	"	"	"
5	0	"	"	"	"	"	"	"	"	"	3 N.	"	"	1 S. W.	"
6	"	"	1 W.	"	"	"	"	"	"	"	2 N.	"	"	"	"
7	1 S.	"	"	"	"	"	"	"	"	"	1 N.	"	"	2 S. W.	"
8	2 S.	"	0	"	"	"	"	"	"	"	"	"	"	1 S. W.	"
9	4 S.	"	"	"	"	"	"	"	"	"	0	"	"	0	"
10	3 S.	"	"	"	"	"	"	"	"	"	"	"	"	"	"
11	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
Noon	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
13	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
14	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
15	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
16	0	"	"	"	"	"	"	"	"	"	"	"	"	"	"
17	"	"	"	"	"	"	"	"	"	"	- - -	1 N.	"	"	"
18	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
19	"	"	"	"	"	"	"	"	"	"	0	0	"	"	"
20	1 S.	"	"	"	"	"	"	"	"	"	"	"	"	"	"
21	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
22	0	"	"	"	"	"	"	"	"	"	"	"	"	"	"
23	1 W.	"	"	"	"	"	"	"	"	"	"	"	"	"	"
Midn't	0	"	"	"	"	"	"	"	"	"	"	"	"	"	"

Hour.	16th.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th.	27th.	28th.	29th.	30th.
1h.	0	0	2 S. E.	0*	7 S. W.	0	0	0	0	0	2 N. E.	1 S.	0	1 N. W.	0
2	"	"	0	"*	8 S. W.	"	"	"	"	"	"	"	1 S. E.	0	"
3	1 N.	"	1 S. E.	3 S. W.*	7 S. W.	"	"	"	"*	"	2 S.	"	1 N. E.	3 S. W.	"
4	"	"	1 W.	2 S. W.*	8 S. W.	"	"	"	"*	"	3 S. E.	1 S. W.	2 N. W.	2 S. W.	"
5	0	"	- - -	1 S. W.*	"	1 S. W.	"*	"	"*	"	3 S.	0	"	1 E.	"
6	"	"	"	1 S. W.*	9 S. W.	0	"*	"	"*	1 S.	4 S.	"	2 S. W.	2 E.	"
7	"	"	0	0*	"	"	"*	"	1 W.	"	5 S.	"	0	0	"
8	"	"	"	"*	8 S. W.	"	"*	"	3 W.	2 S.	3 S.	"	"	"	1 N. W.
9	"	"	1 S. E.	"	9 S. W.	"	1 W.*	"	2 S.	3 S. W.	0	1 W.	1 S. E.	"	0
10	"	"	3 S. E.	"	"	"	"*	"	1 S.	4 S. W.	"	"	"	"	"
11	"	"	0	"	0	1 S.	0*	1 N. E.	2 S.	5 S.	"	0*	0	"	"
Noon	"	"	1 E.	"	"	0	"*	0	0	4 S.	"	"*	"	"	"
13	"	"	5 S. E.	2 S. E.	1 S.	1 S. E.	"*	2 N. E.	"	3 E.	"	1 S.	2 S. W.	"	"
14	"	"	1 S. E.	3 S.	2 S.	0	"*	"	"	"	"	0	0	"	1 N. W.
15	"	"	1 S.	1 N. W.	0	"	"*	2 S. W.	"	0	"	"	"	"	0
16	"	"	3 S.	2 N. W.	"	1 N.	"*	3 S. W.	"	"	"*	"	"	"	"
17	1 N. W.	"	0	1 S. W.	"	0	"	2 S. W.	"	"	"	"	"	"	"
18	"	"	"	3 S. W.	"	"	"	"	1 N.	"	"	"	"	"	"
19	0	"	"	2 S. W.	"	"	"	"*	0*	"	"	"	"	"	"
20	"	"	"	3 S. W.	"	"	"	"*	"	"*	1 S.	"	"	"	"
21	"	"	"	2 S. E.	3 S.	"	"	0*	"	"	2 S.	"	"	"	"
22	"	"	1 E.	0	"	"	"	"	"	"	"	"	"	"	"
23	"	"	"	4 S.	"	1 W.	1 N.	2 S. W.*	1 S. W.*	2 S. W.	3 S.	"	"	1 S.	"
Midn't	"	"	"	5 S.	2 S.	"	"	1 S. W.	"*	"	"	"	1 E.	"	"

* Snowing.

DIRECTION AND FORCE OF THE WIND OBSERVED AT VAN RENSSELAER HARBOR,

In December, 1854, in Lat. 78° 37′, Long. 70° 53′ W. of Greenwich.

The directions are magnetic. Variation of compass 108° W.

Hour.	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.
1h.	0	0	0	0	0	0	- - -	- - -	- - -	- - -	- - -	- - -	- - -	0	0
2	"	"	"	"	"	"	"	"	"	"	"	"	0	1 W.	"
3	"	"	1 S. W.	"	"	"	0	"	0	"	3 S. W.	0	"	0	"
4	"	1 S. E.	2 S. W.	"	"	"	"	"	"	"	2 S. W.	"	1 W.	"	"
5	"	"	"	1 W.	3 S. E.	"	"	0	- - -	"	0	1 S. W.	0	1 E.	"
6	2 W.*	"	3 S. W.	"	1 S. W.	"	"	"	"	"	"	1 W.	"	0	"
7	"	"	5 S. W.	0	0	"	1 S.	"	0	1 N.	"	"	"	"	"
8	1 W.	"	1 S. W.	"	"	"	"	"	"	"	"	1 S. W.	"	"	"
9	0	"	"	"	"	"	3 S. W.	1 W.	1 W.	2 N.	2 S. E.	"	"	"	"
10	"	1 N.	"	"	"	"	4 S. W.	0	1 S.	"	3 S. E.	1 S.	"	"	"
11	"	0	3 S.	"	"	"	0	"	"	"	0	3 S.	"	"	"
Noon	"	"	1 S.	"	"	"	"	"	2 S.	"	"	5 S. W.	"	"	"
13	"	"	2 S. W.	"	"	"	"	"	0	0	"	0	"	"	"
14	"	1 N.	3 S. W.	"	"	"	"	"	"	"	"	"	"	"	"
15	"	0	2 S. W.	"	"	"	1 W.	"	"	"	1 S. E.	2 S.	"	"	"
16	"	"	4 S. W.	"	"	"	1 S.	"	"	"	0	0	"	"	"
17	"	"	6 S. W.	"	"	"	0	"	"	"	"	"	"	"	"
18	"	"	4 S. W.	"	"	"	"	"	"	3 S. E.	"	"	"	"	1 W.
19	"	"	3 S. W.	"	"	"	"	"	"	1 S.	"	"	"	"	0
20	"	"	0	"	"	"	"	"	1 S.	"	"	"	"	"	"
21	"	"	"	"	"	"	- - -	"	0	4 S.	"	4 W.	"	"	- - -
22	2 N. W.	"	"	"*	"	"	"	"	"	5 S.	"	0	"	"	"
23	4 N. W.	1 S.	1 S. W.	"	"	"	"	"	- - -	- - -	- - -	- - -	"	"	"
Midn't	0	0	"	"	"	"	"	"	"	"	"	"	"	"	"

Hour.	16th.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th.	27th.	28th.	29th.	30th.	31st.
1h.	0	0	0	6 S. E.	5 S. W.	1 S.	0	0	- - -	0	0	0	0	0	3 S.	0
2	"	"	"	1 N.	4 S.	2 S.	"	"	0	- - -	"	"	1 W.	"	2 S. W.	"
3	"	"	"	0	2 S. W.	0	"	- - -	"	0	3 E.	"	0	2 S. E.	0	"
4	"	1 W.	"	"	1 S.	"*	"	0	"	"	1 N. E.	"	"	0	"	"
5	"	0	"	2 S. E.	2 S. E.	"*	"	"	"	"	0	"	"	"	"	"
6	"	1 E.	"	1 S. E.	0	"*	"	"	"	"	"	"	"	"	"	"
7	"	"	"	"	"	"*	"	"	"	"	"	"	"	"	"	5 S. W.
8	"	"	"	"	"	"*	"	"	"	2 S. W.	"	"	"	"	"	4 S.
9	"	"	"	0	"	"*	"	"	"	3 S. W.	"	"	"	3 E.	"	5 S. W.
10	"	"	1 S.	"	"	"	"	"	"	4 S. W.	"	"	"	4 E.	"	7 S.
11	"	"	0	1 N.	"	2 S.	"	"	"	3 S. W.	"	"	"	"	"	4 S. W.
Noon	"	1 S.	"	"	"	3 S. W.	"	"	"	0	"	"	"	5 S. E.	"	7 S.
13	"	0	"	"	"	0	"	"	"	"	"	"	"	4 S. E.	"	0
14	"	"	"	"	"	3 S. E.	"	"	"	2 S.	"	"	"	2 S. E.	"	"
15	"	"	9 S. E.	"	"	5 S. E.	"	"	2 S. W.	1 S.	"	"	3 S.	"	"	"
16	"	"	"	"	"	3 S. E.	"	1 S. E.	"	1 S. W.	"	"	5 S. W.	3 S.	"	"
17	"	"	8 S. E.	"	1 E.	2 S. E.	"	"	1 W.	"	"	"	6 S.	1 S.	"	4 S.
18	"	"	"	"	"	"	"	"	1 N.	2 S. W.	"	"	3 S. W.	0	"	3 S.
19	"	"	7 S. E.	"	0	3 S. E.	"	0	0	1 S. W.	"	"	2 S.	"	"	1 S.
20	"	"	5 S. E.	"	"	0	"	"	"	0	"	"	4 S. W.	"	"	0
21	"	"	3 S. E.	- - -	"	- - -	"	- - -	"	"	"	"	0	3 S.	"	2 S.
22	1 E.	"	1 S. E.	"	"	5 S. E.	"	0	"	"	"	"	"	4 S. W.	"	1 S. W.
23	0	"	0	"	"	4 S. E.	"	"	"	"	"	"	"	5 S.	"	2 S.
Midn't	"	"	"	"	"	0	"	"	"	"	"	"	"	2 S. W.	"	0

* Snow.

DIRECTION AND FORCE OF THE WIND OBSERVED AT VAN RENSSELAER HARBOR,

In January, 1855, in Lat. 78° 37′, Long. 70° 53′ W. of Greenwich.

The directions are magnetic. Variation of compass 108° W.

Hour.	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.
1h.	2 W.	0	0	0	---	---	---	0	1 S. E.	1 S.	0	0	0*	1 S. W.	0
2	1 W.	"	"	"	0	"	"	"	"	---	"	"	"*	"	"
3	"	"	"	"	"	2 S. E.	1 S. W.	"	0	0	"	"	"*	2 S. W.	"
4	0	"	1 W.	"	"	"	"	"	"	"	"	"	"*	"	"
5	"	"	0	"	"	1 S. E.	"	"	"	"	"	"	"*	1 S. W.	"
6	"	"	"	"	"	0	"	"	"	"	"	"	"*	0	"
7	"	"	"	"	"	"	"	"	"	"	"	"	"*	"	"
8	"	"	"	"	"	"	"	"	"	"	1 S. W.	"	2 S. W.*	"	2 W.
9	"	"	"	"	"	2 N. W.	"	"	"	"	1 S.	1 S. E.	"*	1 S. W.	1 W.
10	"	"	"	"	"	1 N. W.	"	"	"	"	2 S. W.	2 S. E.	4 S. W.*	"	2 S. W.
11	"	"	"	"	"	2 N. W.	"	"	"	"	2 S.	"	7 S. W.*	"	"
Noon	"	"	"	"	"	3 N. W.	"	"	"	"	4 S. W.	1 S. E.	6 S. W.	"	3 S. W.
13	"	"	"	"	1 W.	2 N. W.	"	"	"	"	3 S.	0	5 S. W.	"	4 S. W.
14	"	"	"	"	"	"	"	1 W.	"	"	1 S. W.	"	"	0	3 S. W.
15	"	"	1 N.	"	1 N. W.	0	"	0	"	1 E.	0	"	2 S. W.	"	0
16	"	"	2 N. W.	"	0	"	"	"	"	0	"	"	0	"	2 S.
17	"	"	0	1 S.	"	"	"	"	"	"	"	"	"	"	3 S. W.
18	"	"	"	2 S. W.	"	"	"	"	"	"	"	"	"	"	3 S.
19	"	"	"	0	"	"	"	"	"	"	"	"	2 S. E.	"	2 S. W.
20	"	"	"	"	1 S.	"	"	"	1 S.	"	"	"	1 S. E.	"	0
21	"	"	"	"	1 S. E.	1 var.	"	"	0	"	"	"	3 S. E.	---	---
22	"	"	"	"	3 S. E.	---	"	"	"	1 var.	"	"	9 S. E.	"	"
23	"	"	"	"	2 S. E.	1 S. W.	"	"	2 S.	"	"	1 var.	10 S. E.	"	"
Midn't	"	"	"	1 S. W.	1 S. E.	"	"	1 N.	1 W.	"	"	2 N. W.*	9 S. E.	"	"

Hour.	16th.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th.	27th.	28th.	29th.	30th.	31st.
1h.	0	0	0	8 S. W.	2 S. W.	1 W.	2 S. W.	0	0*							
2	"	"	1 W.	7 S. W.	1 W.	0	"	"	"*							
3	"	"	2 S. W.	6 S.	1 S. E.	"	0	1 S. E.	"*							
4	"	"	1 S. W	6 S. W.	"	1 S.	"	"	"*							
5	"	"	---	---	---	---	---	---	"*							
6	"	1 S. W.	"	"	"	"	"	"	"*							
7	2 N. W.	0	3 S. E.	5 S. W.	"	"	"	"	"*							
8	1 N. W.	"	2 S. E.	6 S. W.	"	"	"	"	"*							
9	1 N.	1 W.	"	3 S.	1 S. E.	2 S.	0	1 S. E.	1 S. E.*							
10	"	2 W.	"	2 S.	"	3 S.	"	"	"*							
11	"	4 S. W.	1 S. E.	"	"	"	"	"	"*							
Noon	"	5 S. W.	"	1 S.	"	"	"	"	"*							
13	---	---	---	---	---	---	---	"	0*							
14	"	"	"	"	"	"	"	"	"*							
15	"	"	"	"	"	"	"	"	"*							
16	"	"	"	"	"	"	"	"	"*							
17	"	"	7 S. W.	1 S. W.	2 S. W.	2 S. W.	0	"	---							
18	"	"	8 S. W.	"	"	2 W.	"	"	"							
19	1 N.	"	5 S. W.	---	---	---	---	---	"							
20	"	"	2 S. W.	"	"	"	"	"	"							
21	0*	0	---	"	"	"	"	1 S. E.	"							
22	"	"*	"	1 S. E.	"	"	"	"	"							
23	"	"	"	"	"	"	"	"*	"							
Midn't	---	"	"	5 S. E.	"	"	"	"	"							

* Snow.

January 17th. From 10h. to 12h., blowing hard from S. W., with thick snow drift.

The immediate bearing of the wind on the temperature, the weight and moisture of the atmosphere, and upon the climate in general, as well as its practical relation to navigation, renders this meteorological element of equal importance with any of the others, though it has, perhaps, received comparatively less attention.

Method of Reduction.—In the following discussion, we have to consider the average direction and force, as well as the quantity of air blown over the place of observation.

In regard to the mean direction and velocity of the wind for any given period—a day, month, or year—the customary formula of Lambert has been so far modified as to include the velocity, and not to depend on the relative frequency of the winds alone.

Let $\theta_1\ \theta_2\ \theta_3 \ldots\ldots$ be the angles which the directions of the wind make with the meridian, reckoned round the compass, according to astronomical usage, from the south, westwards to 360°, or in a direction indicated by the law of rotation; and $v_1\ v_2\ v_3 \ldots\ldots$ its respective velocities, which may be supposed expressed in miles per hour; and let the observations be made at equal intervals of time, say hourly. By adding up all velocity-numbers referring to the same wind during a given period, and representing these quantities, or the number of miles of air transferred bodily over the place in each direction, by $s_1\ s_2\ s_3 \ldots\ldots$, then the quantity of air passed over the place of observation by winds *from* the southward is expressed by

$$R_s = s_1 \cos \theta_1 + s_2 \cos \theta_2 + s_3 \cos \theta_3 + \ldots\ldots$$

And for winds *from* the westward

$$R_w = s_1 \sin \theta_1 + s_2 \sin \theta_2 + s_3 \sin \theta_3 + \ldots\ldots$$

The resulting quantity R, and the angle ϕ it forms with the meridian, is found by the expressions

$$R = \sqrt{R_s^2 + R_w^2}, \text{ and } \tan \phi = \frac{R_w}{R_s}.$$

The general formulæ, in the case of eight principal directions θ, assume the convenient form

$$R_s = (S—N) + (SW—NE)\sqrt{\tfrac{1}{2}} — (NW—SE)\sqrt{\tfrac{1}{2}}$$
$$R_w = (W—E) + (SW—NE)\sqrt{\tfrac{1}{2}} + (NW—SE)\sqrt{\tfrac{1}{2}}$$

Where the letters S, SW, W, etc., stand for the sum of all velocities during the given period, or for the quantity of air moved in the directions S, SW, W, etc., respectively; R_s stands for the total quantity of air transported *to* the northward, and R_w for the same transferred *to* the eastward. These formulæ, for practical working, may be put in the following shape:—

Put $S—N = a$ $\qquad$ $SW—NE = c$
$\qquad\quad W—E = b$ $\qquad$ $NW—SE = d$

Then

$$R_s = R \cos \phi = a + 0.707\ (c—d)$$
$$R_w = R \sin \phi = b + 0.707\ (c+d).$$

Since R_s, R_w, R, represents the quantity of air passed over during the given period in the direction 0, 90°, ϕ, respectively, we must, in order to find the mean

velocity in any resulting direction, divide by n, or the number of observations during that period; we then have

$$V_s = \frac{R_s}{n}, \quad V_w = \frac{R_w}{n}, \quad \text{and } V = \frac{R}{n}.$$

A particle of air which has left the place of observation at the commencement of the period—of a day, for instance—will be found at its close in a direction $180 + \phi$, and at a distance of R miles, equal to a movement with an average velocity of $\frac{R}{n}$; the length of the path described by the particle can be found by the summation of all the v's (for each hour) during the period.

The above development supposes that all particles of the air surrounding the station equally participate in the general motion, or that all particles describe equal and parallel paths.

To admit nothing arbitrary in the reduction, no attempt has been made to interpolate values in those instances where occasional omissions occur in the hourly abstract.

The great variability in the direction and force of the aerial motion renders the taking of mean values for short intervals unnecessary, and we can at once proceed to the mean monthly values.

For the convenience of reference, and in illustration of the method of reduction, one of the monthly abstracts of the sum of the velocity numbers of each wind is here inserted. Similar abstracts were made for each of the seventeen months during which the observations continued.

ABSTRACT OF THE QUANTITY OF WIND IN EACH OF THE EIGHT PRINCIPAL DIRECTIONS, OBSERVED AT VAN RENSSELAER HARBOR,

In September, 1858.

Magnetic Direction.	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.	
S.	0	0	0	- - -	0	0	0	0	13	0	0	0	0	1	0	...
N.	92	102	0	- - -	0	0	0	0	36	0	0	36	0	2	13	...
W.	92	0	0	- - -	0	0	0	0	17	40	9	16	0	0	0	...
E.	0	0	0	- - -	0	0	22	0	0	0	0	0	0	3	66	...
S. W.	0	0	0	- - -	0	413	214	0	4	0	0	0	0	0	0	...
N. E.	0	0	0	- - -	0	0	0	15	0	0	0	0	0	3	0	...
N. W.	199	217	19	- - -	5	0	1	13	46	0	0	0	0	0	0	...
S. E.	0	0	0	- - -	0	0	0	0	0	0	0	4	0	2	0	...
Sum & check	383	319	19	- - -	5	413	237	28	116	40	9	56	0	11	79	...

Magnetic Direction.	16th.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th.	27th.	28th.	29th.	30th.	Sums.
S.	0	0	4	0	0	4	40	53	0	11	0	13	2	0	2	143
N.	2	0	0	0	5	0	0	0	0	0	0	0	112	49	0	449
W.	0	5	0	1	0	0	0	0	0	0	0	31	4	0	5	220
E.	0	0	0	8	0	0	0	0	0	0	0	4	0	0	1	104
S. W.	0	0	0	0	0	105	14	50	7	52	4	0	5	0	7	875
N. E.	5	0	0	5	0	0	0	0	0	0	0	6	0	0	2	36
N. W.	0	5	1	0	23	0	0	0	0	0	0	0	6	25	0	560
S. E.	0	0	0	0	0	0	34	0	13	0	41	20	25	0	4	143
Sum & check	7	10	5	14	28	109	88	103	20	63	45	74	154	74	21	2530

Resulting Monthly Direction of the Wind.—The resulting monthly direction ϕ of the wind is obtained by adding up the velocity-numbers for each wind separately, from the hourly observations taken during the month, irrespective of omissions. The numbers thus obtained are then treated in accordance with the preceding formulæ. For the month of September, 1853, for instance, we would have—

Σ S.	$= 143$	Hence $c = + 839$	$R_s = - 11$
Σ N.	$= 449$	$d = + 417$	$R_{vr} = + 995$
Σ W.	$= 220$	$c - d = + 422$	$R = 995$
Σ E.	$= 104$	$c + d = + 1256$	$\phi = 89° 22'$
Σ S. W.	$= 875$	$0.7\ (c - d) = + 295$	equivalent to a
Σ N. E.	$= 36$	$0.7\ (c + d) = + 879$	west wind.
Σ N. W.	$= 560$	$a = - 306$	
Σ S. E.	$= 143$	$C = + 116$	

To convert the resulting ϕ from the magnetic into the true direction, apply the magnetic declination, viz: 108° 12′ west.[1]

In like manner, the mean direction of the wind for each month has been made out. The following table exhibits the sum of the velocity-numbers for each wind, as well as the resulting direction of the winds for each month of observation:—

Direction.	1853.				1854.				
	September.	October.	November.	December.	January.	February.	March.	April.	May.
S.	143	1069	197	532	176	735	464	463	668
N.	449	47	39	5	52	16	2	48	164
W.	220	18	12	290	100	23	61	5	9
E.	104	47	35	233	6	254	46	3	9
S. W.	875	413	219	348	158	733	26	1187	730
N. E.	36	1	54	107	17	1	2	0	0
N. W.	560	408	90	132	38	25	154	68	251
S. E.	143	1102	763	1718	326	838	243	300	249
Magnetic ϕ	89°	353°	333°	334°	359°	351°	357°	25°	27°
True ϕ	341	245	225	226	251	243	249	277	279

Direction.	1854.							1855.
	June.	July.	August.	September.	October.	November.	December.	January.
S.	0	381	776	897	726	436	437	123
N.	229	50	89	5	9	28	27	8
W.	108	88	106	9	273	24	45	28
E.	0	10	28	51	4	36	82	1
S. W.	308	832	16	1505	1297	888	572	792
N. E.	157	18	9	11	26	18	1	0
N. W.	1163	261	397	23	165	18	27	44
S. E.	0	38	527	296	109	77	661	365
Magnetic ϕ	132°	47°	359°	21°	37°	27°	356°	22°
True ϕ	24	299	251	273	289	279	248	274

To obtain the resulting direction of the wind in each month, each season, and for the whole year, we first take the mean of the values R_s and R_{vr} respectively, for the same months in the different years and find—

[1] See my discussion of Dr. Kane's magnetical observations, in Vol. X of the Smithsonian Contributions to Knowledge, 1858, p. 25.

Month.	R_s.	R_w.	Mag. ☡.	True ☡.	Month.	R_s.	R_w.	Mag. ☡.	True ☡.
September	+1059	+904	40°	292°	March	+ 541	— 30	357°	249°
October	+1682	+486	17	269	April	+1408	+ 670	25	277
November	+ 901	+ 89	6	258	May	+1014	+ 512	27	279
December	+1530	—482	342	234	June	— 937	+1027	132	24
January	+ 659	+174	15	267	July	+ 745	+ 805	47	299
February	+1800	—288	351	243	August	+ 783	— 8	359	251

By means of ΣR_s and ΣR_w for the respective periods, we find the following mean directions:—

	Magnetic ☡.	True ☡.	True direction.
Winter (December, January, February)	351°	243°	E. 27° N.
Spring (March, April, May)	21	273	E. 3 S.
Summer (June, July, August)	72	324	E. 54 S.
Autumn (September, October, November)	22	274	E. 4 S.
Year	19	271	E. 1 S.

From the above results we see that, in general, the mean *true* direction of the wind is from the eastward, varying in the several months to the northward and southward of it. There is but one exception, namely: in the month of June, the wind veers round to the westward of south. In spring and autumn, the resulting *true* direction is almost exactly east, as well as for the whole year; in winter it is E. N. E., and in summer S. E. by S.

Average Velocity in the Mean Direction of the Wind.—The average velocity in the mean direction of the wind—or, in other words, the mean velocity of the resulting wind—which is necessarily smaller than the mean velocity of the several winds on account of the neutralization by opposing winds, is found by dividing the quantity R by the actual number of observations (exclusive of calms). Thus, for September, 1853, we found $R = 995$, n the number of hours of observations $= 348$, hence $V = 2.9$ miles per hour. In similar manner, V has been found for each month of the year. In the table below, the quantities opposite the months from September to January inclusive, are mean values derived from the years 1853 and 1854, and 1854 and 1855.

Table of the Mean Velocity of the Resulting Wind.

Month.	R	n	V	Month.	R	n	V
September . . .	1637	278	5.9	March	541	262	2.1
October	1892	377	5.0	April	1559	385	4.0
November . . .	1016	213	4.8	May	1136	441	2.6
December . . .	1633	213	7.7	June	1390	257	5.4
January	694	256	2.7	July	1097	200	5.5
February . . .	1823	332	5.5	August	783	244	3.2

Average V for the whole year . . . . . 4.5 miles per hour.

Having found the resulting direction of the wind and its mean velocity in this direction, we proceed to determine the mean velocity of each wind.

Mean Velocity of the Winds.—The average velocity with which each of the eight winds passes over the place of observation in each month and for the whole year, is found by dividing the sum of their velocity-numbers in the period by their respective number of entries in the table; thus, for the month of September, 1853, we have:—

Direction (Magnetic).	Sum of velocities.	Number of entries.	Mean velocity.	Direction (Magnetic).	Sum of velocities.	Number of entries.	Mean velocity.
S.	143	40	3.6	N. E.	36	15	2.4
S. W.	875	88	10.0	E.	104	25	4.2
W.	220	35	6.3	S. E.	143	38	3.8
N. W.	560	55	10.2				
N.	449	52	8.6	Sums and mean	2530	348	7.3

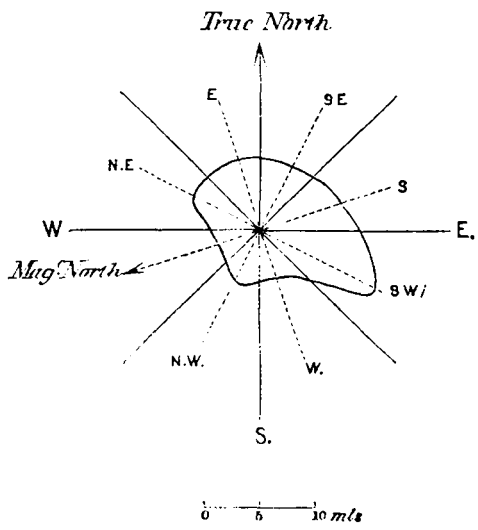
In the following table of the mean velocity of the winds, the values for September, October, November, December, and January are mean values. As in the above example, the weighted means are given in the table.

Magnetic Direction.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.
S.	2.9	9.4	4.3	3.3	10.9	- - -	18.1	12.1	10.1	8.2	6.3	9.1
S. W.	8.2	11.3	1.5	14.6	7.1	8.7	23.1	1.6	14.2	9.2	15.6	11.5
W.	3.2	2.1	2.0	1.0	1.0	4.3	2.9	6.3	5.6	10.4	1.5	7.0
N. W.	2.7	1.5	6.4	1.5	1.6	6.8	4.1	7.2	9.7	10.4	4.2	3.6
N.	1.7	2.3	1.0	1.3	2.2	11.4	1.7	3.6	8.4	3.3	2.6	2.0
N. E.	1.6	1.0	1.0	- - -	- - -	22.4	4.5	3.0	2.0	4.5	4.8	7.2
E.	1.0	8.5	11.5	1.0	1.5	- - -	2.5	2.8	5.1	2.1	3.5	13.1
S. E.	4.3	6.7	3.3	4.1	6.9	- - -	2.9	8.8	5.7	5.5	5.8	11.1
Weighted mean	4.4	7.9	3.8	5.4	4.7	7.6	8.4	8.0	9.6	7.6	6.9	9.5

The winds, therefore, blow with their greatest strength in the months of September and December, and with their least strength in the months of March and May; in the former the mean velocity is 9.6, and in the latter case 4.2 miles per hour. In the following table is exhibited the mean velocity of each wind separately:—

Magnetic direction.	Mean velocity in miles per hour.
S.	7.4
S. W.	11.2
W.	4.1
N. W.	4.8
N.	3.5
N. E.	6.2
E.	6.0
S. E.	6.3

Of all winds, the S. W. (magnetic) blows with the greatest force, and the north wind with the least. The relation of the velocity of the wind to its direction is further illustrated by the annexed diagram.



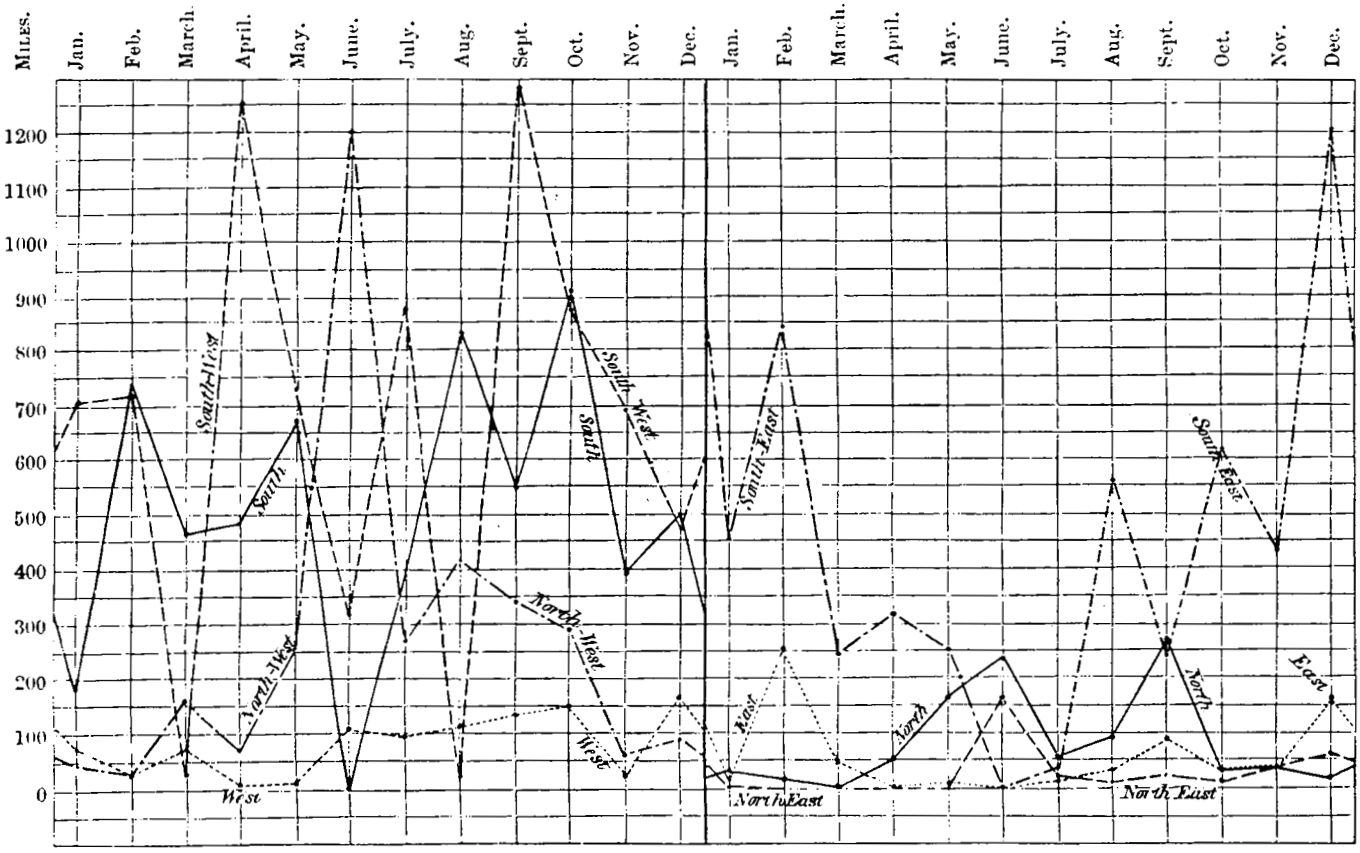
Quantity and Relative Frequency of the Winds.—The sum of the velocity-numbers, or the number of miles travelled over by the air in any direction for any given period, may be called the quantity (q) of the wind which has been transferred over the place of observation during that time. It will not be necessary to take into account the variations in the density of the air, and the number given below refers, therefore, to an average density. The velocity-numbers for each wind and month have been given in a preceding table; they require, however, a correction, in order to find q, for the occasional omissions in the observations. Thus, in September, 1853, no observations were recorded during 109 hours, and we may assume that during this time the several winds (inclusive of calms) occurred, or would have occurred in quantity and with a frequency directly proportional to their numbers found from the 720 — 109 remaining hours of the month. After adding this proportional number for each wind and month, and after taking mean values for the same months, the following table of the quantity of wind (q) has been made out.

Magnetic Direction.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Yr. mls.
S.	187	735	464	488	668	0	402	830	545	918	385	497	6119
S. W.	713	733	26	1250	730	317	877	17	1291	880	693	477	8004
W.	72	23	61	5	9	111	93	113	134	150	22	169	962
N. W.	54	25	154	71	251	1197	275	425	342	293	57	81	3225
N.	33	16	2	51	164	236	53	95	267	28	38	17	1000
N. E.	9	1	2	0	0	162	19	10	27	14	39	54	337
E.	4	254	46	3	9	0	11	30	88	26	41	160	672
S. E.	455	838	243	316	249	0	40	564	236	616	433	1210	5200
Sums	1527	2625	998	2184	2080	2023	1770	2084	2930	2925	1708	2665	25519

The following table gives the number of hours during which each wind blew, or the relative frequency of each wind for every month.

Magnetic Direction.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Yr. hrs.
S.	58	78	108	146	61	0	22	68	56	112	57	55	821
S. W.	81	65	17	85	103	36	38	11	93	95	42	42	708
W.	24	11	31	5	9	26	32	18	24	15	14	24	233
N. W.	19	16	24	50	152	175	67	59	34	28	14	22	660
N.	20	7	2	40	74	21	31	27	32	8	16	9	287
N. E.	5	1	2	0	6	7	4	3	12	3	9	7	53
E.	3	30	4	3	6	0	4	11	16	12	12	12	113
S. E.	97	124	74	76	36	0	14	64	43	111	75	108	822
Calm	437	340	482	315	303	455	532	483	410	360	481	465	5063
Check sum . .	744	672	744	720	744	720	744	744	720	744	720	744	8760

The preceding tabular results have been laid down graphically on the accompanying diagrams. The two rectangular diagrams show the quantity of each wind for each month; the first for the directions S., S. W., W., and N. W., the second for the directions N., N. E., E., and S. E. The circular diagram exhibits the quantity of each wind for the whole year, as indicated by a full line according to the scale at the foot of the diagram. It likewise shows, by a dotted line, the relative frequency of each wind during the year (on a ten times larger scale).


Miles.
Jan.
Feb.
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900
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700
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500
400
300
200
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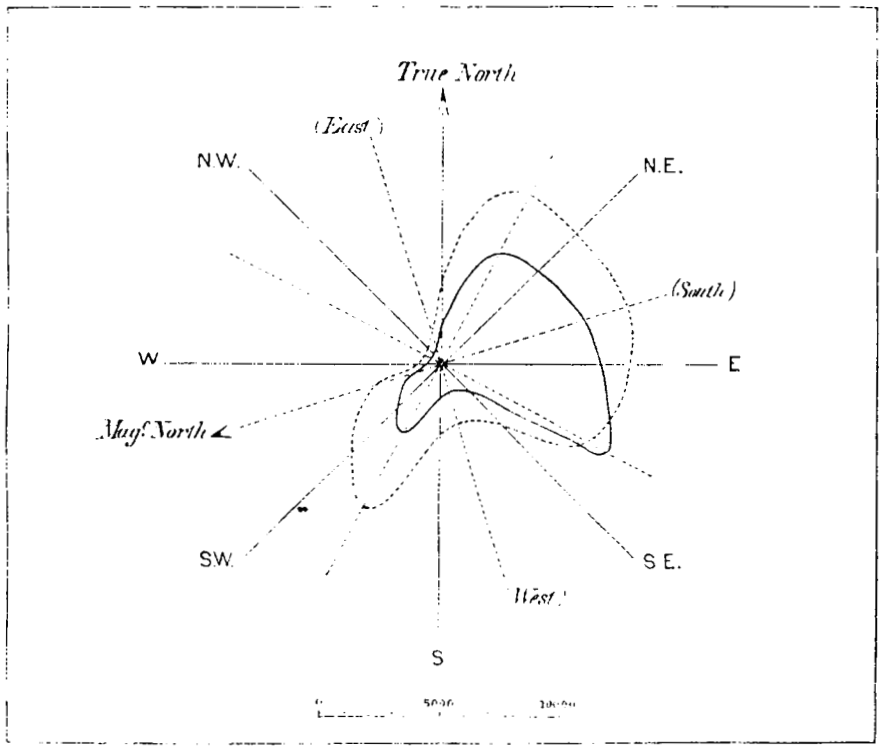

True North
(East)
N.W.
N.E.
(South)
W
E
Mag.f North
S.W.
S.E.
(West)
S

The greatest quantity of air moved over the place during the year comes from a quarter bounded by the true directions S. E. by E. and N. N. E.; the prevailing wind also comes from this quarter. With the exception of true S. W. by S. winds, there is comparatively hardly any wind from the remaining directions; the quadrant between (true) west and north is particularly defective in this respect.

The calms greatly predominate, there being during the year more hours of calm (5063) than hours of wind from any direction (3697)—a circumstance quite characteristic of the locality.

Average Duration of the Winds.—The number of consecutive hours during which any one wind blew is given in the table below. It contains average values made out from all observations during the seventeen months. The number of consecutive hours during which, on the average, calms lasted, is likewise given.

Magnetic direction.	Mean duration.	Magnetic direction.	Mean duration.
S.	$2^{h}.8$	N. E.	$2^{h}.1$
S. W.	3.4	E.	2.1
W.	2.0	S. E.	3.3
N. W.	3.4		
N.	2.7	Calm	7.8

Rotation of Winds.—Owing to the great number of calms, and partly, also, to the generally small quantity and velocity of the winds between the (true) S. and (true) N. W. directions, Dove's laws of rotation cannot well be verified in this locality. There is, however, a tendency of the magnetic S., S. E., and E. (E. N. E., N. N. E., and N. N. W., true) winds to shift, in accordance with the law, in the proportion of three cases for to one case against it, or with a relative probability of three-fourths in favor of the law.

Note on the Occurrence of Gales.—Between September 1st, 1853, and January 24th, 1855, there were recorded thirteen gales (with a force of 7 and above, and a duration of not less than two hours). The date, direction, and duration of these gales is shown in the following table.

Date.		General (mag.) direction.	Duration.	Date.		General (mag.) direction.	Duration.
1853	Dec. 10	S. E.	2^{h}.	1854	Sept. 30	S. W.	16^{h}.
	Dec. 28	S. E.	22		Oct. 15	S. E.	3
1854	Feb. 7	S. E.	3		Nov. 20	S. W.	10
	Feb. 15–16	S.	4		Dec. 18	S. E.	5
	April 15–16	S. W.	7	1855	Jan. 13	S. E.	3
	June 17	S. W.	3		Jan. 18–19	S. W.	4
	July 28	S. W.	6				

These gales do not appear to be confined to any particular season of the year. On the average they last seven hours, and in summer they have a tendency to blow from the S. W. (true E. S. E.), and in winter from the S. E. (true N. N. E.). These two directions are the only ones from which gales were observed.

Thermometric and Barometric Wind Rose.—The investigation of the connection of the temperature and weight of the atmosphere with the direction of the wind, will be found in the discussion of the observations for temperature and barometric pressure, parts I and III of this paper.

Relation of the Direction of the Wind to the Amount of Snow (or Rain).—The dependence of the fall of snow (or rain) on the direction of the wind, is shown in the following table, which contains the aggregate number of hours during which snow (or rain) fell for any direction of the wind and during calms.

Direction (mag.)	Hours.	Direction (mag.)	Hours.
S.	52	N. E.	6
S. W.	71	E.	10
W.	43	S. E.	75
N. W.	110	Calm	328
N.	45	Total	740 in 17 months.

The snowy (or rainy) quarter is between N. N. E. (true) and E. S. E. (true), or from the direction of the Spitzbergen Sea, and also from the direction S. S. W. (true), or from the upper Baffin Bay. During almost half the time, it snowed during calms. From the directions W. N. W. (true) and N. N. W. (true), there was hardly any precipitation.

PART III.

ATMOSPHERIC PRESSURE.

RECORD AND DISCUSSION OF THE ATMOSPHERIC PRESSURE.

THE barometric observations at Van Rensselaer Harbor, North Greenland, were made hourly, and commence June 8th, 1853. The record now available, however, commences with June 27th, 1853, and extends to January 24th, 1855. The mean daily values subsequent to this date, up to April 22d, 1855, inclusive, together with the corresponding mean temperature, are to be found in Appendix No. XII. second volume of the Narrative of the Expedition. It is proposed to discuss here the observations taken between September 1st, 1853, when the brig entered her winter quarters in Van Rensselaer Bay, and January 24th, 1855, at which date the log-book on hand terminates.

Instruments.—The expedition was provided with a mercurial barometer and two aneroids. The mercurial marine barometer was made for Dr. Kane by Mr. Tagliabue, of New York. Its length was thirty-three and a half inches; it had a brass scale seven inches in length, and a glass cistern with an adjusting point for the surface of the mercury. In its adjustment, the correction for capillarity was included.[1] The readings are expressed in English inches. The aneroids have the numbers 4796 and 1400. Of these, the first one was read daily (and hourly) from the commencement of the record (June 27th, 1853) till its conclusion (January 24th, 1855). That aneroid 4796 (and not 1400) was thus used, I infer from a note in Mr. Sonntag's report dated Godhavn, September 12th, 1855, and in which he refers to the comparisons between this aneroid and the mercurial barometer, for the purpose of deducing the corrections to the former. These comparisons, as found recorded in the volume containing meteorological constants, commence with September 30th, 1853, and end on January 9th, 1854—65 in number.

The readings of the mercurial barometer commence October 24th, 1853, and terminate with January 24th, 1855. The preference has been given to these readings. The indications of the aneroid were only used for the time between September 1st and October 24th, 1853; its readings are also valuable as corroborating those of the mercurial barometer.

The aneroid was kept on deck till September 19th, 1853, 9 A. M., when the temperature was so low that the attached thermometer failed to record. The instrument was then taken into the cabin; its position there was six feet lower than on deck.

In his reduction of a part of the above 65 comparisons between the mercurial

[1] The above information of the construction of the instrument was received from the maker. Scale and cistern were connected by brass.

and aneroid barometers, the reduction of the former to the temperature 32° is applied by Mr. Sonntag, astronomer to the expedition, for the case of a brass connection between the cistern and scale. Table No. XVII. Series C, p. 63, in Guyot's Meteorological and Physical Tables, edition of 1858, prepared for the Smithsonian Institution, answers this case, and has been adopted by me for the temperature reductions. This reduction, in general, is not very great, as may be seen on p. 425, Appendix No. XII. of the second volume of the Narrative, where the mean readings of the attached thermometer, for the year 1854, is given as +40°.3.

Reduction of the Aneroid to the Mercurial Barometer.—A number of comparisons of the two instruments, for the purpose of reducing the readings of the first to their equivalent values by the second instrument, were made, as stated above. The differences in the indications of the mercurial and aneroid barometers, or $M - A$, may be supposed to be proportional to the variations in pressure and temperature, and may be represented by the equation

$$B = A + c + m\,(A - \text{mean pressure}) + n\,(T - \text{mean temperature}),$$

c being an index error. The quantities c, m, n, are to be determined from the following comparisons. In the absence of any better information, the attached thermometers were supposed free of index error. The comparisons were made by Mr. Sonntag.

TABLE OF COMPARISONS OF ANEROID BAROMETER No. 4796 WITH TAGLIABUE'S MERCURIAL BAROMETER.

No.	Date.		Hour.	Mercurial barometer.	Att'd ther.	Aneroid barometer.	Att'd ther.	Mer'l bar. referred to same temp.	No.	Date.		Hour.	Mercurial barometer.	Att'd ther.	Aneroid barometer.	Att'd ther.	Mer'l bar. referred to same temp.
	1853			Inch.	°	Inch.	°	Inch.		1853			Inch.	°	Inch.	°	Inch.
1	Sept.	30	21	29.962	21.3	30.00	65	30.080	35	Nov.	30	21	29.730	39.0	29.67	77	29.832
2	Oct.	1	2	29.925	23.8	29.93	72	30.055	36	Dec.	3	21.5	29.833	35.0	29.76	80	29.952
3	"	1	12	29.790	11.0	29.84	62	29.927	37	"	4	21.5	29.640	37.0	29.58	75	29.740
4	"	1	23	29.653	21.7	29.66	70	29.780	38	"	5	21.5	29.448	36.5	29.39	80	29.562
5	"	2	12	29.440	15.9	29.46	70	29.582	39	"	6	21.5	29.660	32.0	29.625	76	29.776
6	"	2	22	29.165	22.0	29.19	76	29.305	40	"	7	21.5	29.725	31.4	29.68	76	29.843
7	"	3	3	29.122	34.2	29.18	64	29.199	41	"	8	21.5	29.686	27.0	29.66	74	29.811
8	"	3	12	29.140	26.8	29.22	65	29.240	42	"	9	21.5	29.850	36.2	29.78	75	29.953
9	"	3	23	29.308	29.0	29.35	64	29.400	43	"	10	21.5	29.870	41.5	29.80	74	29.956
10	"	24	20.5	29.765	49.2	29.70	77	29.839	44	"	11	21.5	29.952	37.0	29.90	77	30.059
11	"	25	20.5	30.165	48.9	30.05	78	30.244	45	"	13	21.5	30.022	37.0	29.93	81	30.140
12	"	26	21	29.960	41.4	29.87	76	30.051	46	"	14	21.5	29.898	33.2	29.81	83	30.030
13	"	27	21	29.800	33.0	29.74	75	29.911	47	"	15	21.5	29.860	34.7	29.79	82	29.985
14	Nov.	4	21	29.732	36.0	29.67	75	29.835	48	"	16	21.5	29.802	37.2	29.73	79	29.912
15	"	5	21	29.610	34.6	29.53	78	29.723	49	"	18	21.5	30.000	40.2	29.89	80	30.106
16	"	6	21	29.825	42.3	29.73	78	29.922	50	"	20	21.5	30.105	39.2	30.00	79	30.211
17	"	7	21	29.966	37.2	29.87	78	30.075	51	"	21	21.5	29.475	40.0	29.43	75	29.567
18	"	8	21	29.916	34.2	29.84	76	30.026	52	"	22	21.5	29.760	42.0	29.70	79	29.858
19	"	9	21	29.230	32.9	29.20	77	29.345	53	"	23	21.5	30.188	40.5	30.07	82	30.301
20	"	10	21	29.330	38.5	29.26	79	29.436	54	"	24	21.5	30.230	35.2	30.135	80	30.350
21	"	11	21	29.555	41.6	29.475	76	29.645	55	"	25	21.5	30.270	40.0	30.175	77	30.369
22	"	12	21	30.130	39.2	30.05	76	30.228	56	"	26	21.5	29.425	46.0	29.35	78	29.508
23	"	13	21	30.213	34.8	30.14	72	30.309	57	"	31	21.5	29.610	41.0	29.56	78	29.707
24	"	15	21	29.895	29.0	29.82	74	30.016		1854							
25	"	17	21	29.750	30.2	29.70	76	29.872	58	Jan.	1	21.5	29.600	43.0	29.55	79	29.695
26	"	18	21	29.735	32.8	29.675	77	29.853	59	"	3	21.5	29.300	37.0	29.27	76	29.400
27	"	20	21	29.720	29.2	29.67	74	29.838	60	"	4	22.5	29.510	36.5	29.47	77	29.617
28	"	21	22	29.777	24.8	29.73	76	29.912	61	"	5	21.5	29.515	45.0	29.46	75	29.593
29	"	22	21	29.922	34.5	29.84	80	30.044	62	"	6	21.5	29.790	42.6	29.70	78	29.882
30	"	24	22	29.616	33.7	29.57	77	29.730	63	"	7	21.5	29.760	47.3	29.68	74	29.831
31	"	25	21	29.605	35.2	29.55	75	29.709	64	"	8	21.5	29.925	37.0	29.90	70	30.013
32	"	27	21	29.210	41.0	29.175	84	29.321	65	"	9	21.5	29.700	43.0	29.65	74	29.781
33	"	28	21	29.375	42.4	29.32	79	29.470									
34	"	29	22	29.665	41.3	29.59	75	29.753		Means		...	...	...	29.672	75.78	29.831

The constant c is, therefore, + 0.159 inches, at a mean temperature 75°.78 and a mean barometric pressure 29.831. To deduce the coefficients m and n, the correction c has first been applied to the aneroid readings. The following differences were then formed: $B-(A+c)$, $(A+c)-29.831$, and $T-75°.8$. We then have the 65 conditional equations:—

$$
\begin{array}{ll}
1. & -0.079 = +0.328\,m - 10.8\,n \\
2. & -0.034 = +0.258\,m - 3.8\,n \\
3. & -0.072 = +0.168\,m - 13.8\,n \\
4. & -0.039 = -0.012\,m - 5.8\,n \\
 & \text{etc. etc.}
\end{array}
$$

Their solution furnishes m and n. Making first the coefficient of n as great as possible, by addition and change of sign of the equation when necessary, we find

$$203.4\,n + 0.846\,m = +1.374$$
$$\text{or,}\quad n = +0.00675 - 0.004\,m,$$

and, in like manner, m results from the equation—

$$12.56\,m + 40\,n = +1.190$$
$$m = +0.072, \qquad \text{and } n = +0.0065$$

Hence the formula for reduction—

$$B = A + \overset{\text{Inch.}}{0.159} + 0.072\,(A - \overset{\text{Inch.}}{29.672}) + 0.0065\,(T - 75°.8).$$

To show the result by the formula in extreme cases, the following eight comparisons are here inserted.

			Inch.		Inch.	Difference.
No. 3)	Lowest temp.	Computed reading B =	29.92,	same observed (M) =	29.93	—0.01
" 9)		"	29.41,	"	29.40	+0.01
" 32)	Highest temp.	"	29.35,	"	29.32	+0.03
" 46)		"	30.03,	"	30.03	0.00
" 23)	Greatest pressure	"	30.31,	"	30.31	0.00
" 54)		"	30.35,	"	30.35	0.00
" 6)	Least pressure	"	29.33,	"	29.31	+0.02
" 7)		"	29.23,	"	29.20	+0.03

These differences prove a sufficient approximation in the terms of the above expression, and likewise leave no doubt that the indications of the aneroid may generally be relied on to nearly within one-hundredth of an inch.

To facilitate the reduction, the following table of corrections has been calculated according to the above formula:—

	Temperature.									
Barometer.	15°	20°	25°	30°	40°	45°	50°	52°.5	55°.0	57°.5
29.0	—0.28	—0.25	—0.22	—0.19	—0.12	—0.09	—0.06	—0.04	—0.02	—0.01
29.5	—0.25	—0.22	—0.18	—0.15	—0.09	—0.05	—0.02	0.00	+0.01	+0.03
30.0	—0.21	—0.18	—0.15	—0.12	—0.05	—0.02	+0.01	+0.03	+0.05	+0.07

Barometer.	60°.0	62°.5	65°.0	67°.5	70°.0	72°.5	75°.0	77°.5	80°.0	
29.0	+0.01	+0.03	+0.04	+0.05	+0.07	+0.09	+0.11	+0.13	+0.14	...
29.5	+0.04	+0.06	+0.08	+0.09	+0.11	+0.13	+0.14	+0.16	+0.17	...
30.0	+0.08	+0.09	+0.11	+0.13	+0.15	+0.16	+0.18	+0.19	+0.21	...

The hourly record of the barometer and attached thermometer readings is given for mean local time, English inches and degrees of Fahrenheit, and for an average elevation of the cistern of the barometer above the mean level of the sea of five feet.

For the months of September and October, 1853, the barometric and thermometric means are not directly comparable with the corresponding figures in Appendix No. XI. of the Narrative (2d vol.) for this reason: In the Appendix the uncorrected aneroid readings are given, while the present abstract contains the corrected or referred readings according to the preceding investigation. After October 23d, the readings of the mercurial barometer take the place of the aneroid readings.

A star (*) attached to any date in the following record indicates that a corresponding remark will be found in the notes appended to the abstract.

Occasional omissions in the hourly record of either barometer or thermometer readings, as seen by the blanks in the table, have in all cases been supplied by simple interpolations before the means (hourly or daily) were taken, in order to give the result independent of these omissions.

HOURLY ABSTRACT OF THE READINGS OF THE BAROMETER AND ATTACHED THERMOMETER AT VAN RENSSELAER HARBOR,

In September, 1853, in Lat. 78° 37′, Long. 70° 53′ W. of Greenwich.

Aneroid Barometer in cabin. 29 inches +. Readings in English inches and degrees of Fahrenheit.

Day.	1h.		2h.		3h.		4h.		5h.		6h.		7h.		8h.		9h.		10h.		11h.		Noon.		13h.	
	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°
1st	.80	68	.79	64	.80	68	.81	69	.78	63	.76	63	.76	74	.74	74	.73	73	.71	70	.72	72	.70	71	.69	66
2d	.67	67	.69	69	.69	69	.68	68	.70	75	.70	73	.69	72	.67	68	.68	70	.66	68	.66	68	.67	67	.69	66
3d	.71	68	.72	68	.72	68	.74	70	.71	66	.71	64	.72	64	.72	64	.74	65	.74	64	.75	66	.77	72	.76	70
4th	.83	68	.81	66	.83	68	.80	64	.81	66	.80	64	.84	68	.86	73	.84	72	.83	70	.82	67	.81	60	.87	71
5th	.89	66	.90	66	.88	63	.93	70	.87	72	.84	65	.86	65	.85	64	.85	64	.85	68	.83	70	.83	70	.78	65
6th	.81	65	.86	66	.88	68	.86	66	.83	62	.86	64	.86	64	.86	62	.86	66	.85	65	.85	63	.85	63	.85	66
7th	.55	68	.53	69	.57	71	.46	71	.38	67	.39	70	.34	69	.31	66	.28	65	.30	68	.35	72	.34	72	.26	75
8th	.25	70	.23	71	.24	68	.22	65	.23	63	.25	71	.24	69	.25	68	.27	67	.27	68	.27	68	.27	68	.25	64
9th	.32	66	.22	60	.30	52	.32	52	.33	54	.33	54	.33	52	.35	59	.36	62	.38	64	.37	64	.36	64	.37	66
10th	.38	60	.38	60	.41	62	.40	61	.43	65	.43	65	.43	62	.46	64	.47	68	.46	67	.45	66	.45	66	.50	66
*11th	.49	62	.49	63	.49	63	.49	63	.47	54	.48	62	.50	64	.50	65	.52	67	.53	68	.53	66	.50	65	.50	65
12th	.57	63	.59	62	.59	63	.64	63	.67	60	.67	63	.65	61	.68	64	.68	63	.70	66	.70	65	.71	68	.71	68
13th	.49	65	.53	67	.49	66	.52	63	.52	66	.54	67	.53	63	.57	62	.57	62	.56	61	.57	62	.57	62	.54	64
*14th	.52	60	.53	62	.51	60	.55	68	.55	69	.54	67	.55	68	.52	67	.49	63	.54	67	.53	66	.53	69	.51	66
15th	.35	20	.41	21	.42	22	.40	22	.36	17	.37	18	.38	18	.38	18	.43	24	.41	23	.42	24	.41	24	.41	26
16th	.40	13	.43	13	.43	13	.44	13	.42	13	.45	14	.47	15	.49	16	.51	18	.52	18	.52	19	.50	19	.50	19
17th	.67	26	.67	26	.67	26	.70	29	.71	23	.63	18	.66	24	.65	21	.70	29	...	...	...	...	...	...	.73	29
18th	.72	13	.73	14	.73	13	.74	14	.72	11	.72	12	.74	14	.75	18	.79	22	.81	26	.81	27	.83	34	.81	29
*19th	.73	22	.73	22	.74	23	.73	22	.65	10	.65	11	.64	(9)	.64	(9)	.66	12	.86	60	.88	62	.89	65	.89	65
20th	.94	69	...	...	.94	69	.90	58	.91	61	.91	61	.92	62	.93	60	.91	60	.91	59	.89	60	.88	60	.80	42
21st	.83	61	.83	59	.85	56	.83	54	.84	55	.84	54	.84	54	.87	62	.87	62	.89	64	.86	60	.85	56	.83	54
22d	.86	55	.85	54	.87	58	.87	57	.87	56	.90	56	.90	56	.90	56	.90	54	.88	51	.86	48	.87	50	.88	50
23d	.88	48	.89	48	.90	50	.91	52	.93	55	.90	50	.87	44	.86	42	.86	43	.87	45	.88	46	.88	46	.87	43
24th	.92	61	.90	56	.89	54	.88	52	.89	58	.88	58	.88	58	.87	58	.89	62	.87	60	.87	58	.87	61	.85	60
25th	0.91	(59)	0.93	58	0.96	57	0.99	56	1.01	54	1.05	52	1.05	52	1.05	52	1.07	54	1.10	58	1.10	58	1.11	64	1.12	64
26th	1.13	63	1.11	61	1.09	57	1.12	58	1.13	54	1.13	53	1.13	55	1.15	60	1.10	56	1.12	57	1.08	56	1.08	60	1.06	57
27th	0.99	62	0.99	62	1.02	64	0.98	60	0.97	58	0.91	55	0.91	58	0.89	58	0.99	57	1.00	58	0.99	58	0.99	58	0.96	56
28th	1.02	58	1.02	58	1.01	57	1.02	60	1.04	58	1.03	58	1.04	60	1.02	58	...	...	1.07	70	1.05	67	1.07	68	1.01	60
29th	1.01	66	1.01	66	1.04	70	1.06	74	1.03	70	1.05	70	1.04	68	1.01	65	0.99	64	0.99	64	0.99	62	0.98	60	0.98	(59)
30th	1.07	65	1.02	60	1.02	60	1.03	61	1.05	62	1.07	60	1.04	54	...	...	1.06	56	1.06	56	1.04	54	1.03	53	1.05	55
Means	.724	55.9	.724	54.8	.733	55.3	.734	56.5	.727	53.9	.726	53.7	.727	53.9	.728	54.4	.737	55.2	.748	58.7	.745	58.4	.744	59.1	.734	56.9
B. at 32°	29.651		29.654		29.663		29.660		29.660		29.659		29.660		29.660		29.667		29.669		29.667		29.663		29.659	

Day.	14h.		15h.		16h.		17h.		18h.		19h.		20h.		21h.		22h.		23h.		Midn't.		Means.		B. 32°.
	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.
1st	.70	68	.74	73	.65	68	.67	67	.66	66	.65	64	.66	66	.66	66	.64	65	.66	67	.67	68	.715	68.0	.610
2d	.63	60	.63	60	.67	65	.67	66	.67	65	.66	64	.66	64	.67	63	.69	69	.70	66	.68	64	.674	66.9	.571
3d	.75	69	.76	70	.79	73	.79	73	.79	71	.81	70	.82	70	.82	70	.82	70	.81	68	.82	68	.762	68.4	.656
4th	.87	74	.88	75	.86	70	.86	68	.88	67	.87	65	.88	66	.87	63	.87	66	.88	66	.90	68	.849	67.7	.745
5th	.78	63	.78	61	.79	60	.86	70	.83	67	.86	69	.85	68	.82	67	.79	63	.81	65	.80	64	.839	66.0	.739
6th	.79	65	.81	62	.79	61	.72	62	.83	76	...	...	.72	70	.67	72	.63	74	.59	70	.55	68	.791	66.4	.690
7th	.25	70	.24	68	.17	68	.23	68	.28	69	.24	66	.29	64	.27	67	.26	67	.25	68	.30	74	.327	68.8	.221
8th	.25	68	.25	64	.27	66	.28	64	.35	66	.27	67	.29	65	.30	66	.31	64	.29	62	.29	62	.266	66.4	.167
9th	.38	68	.39	70	.38	68	.41	68	.43	68	.42	67	.42	67	.43	66	.41	64	.41	64	.41	64	.368	63.5	.278
10th	.50	66	.51	70	.51	70	.50	64	.53	66	.53	66	.51	68	.49	66	.49	65	.49	64	.50	63	.467	65.0	.371
*11th	.49	67	.49	65	.49	68	.50	70	.50	70	.51	72	...	...	.53	68	.53	66	.53	63	.57	64	.505	65.3	.409
12th	.71	68	.71	68	.70	66	.67	64	.67	65	.65	66	.65	66	.63	65	.61	65	.58	67	.56	65	.654	64.8	.558
13th	.58	64	.59	68	.57	64	.57	62	.54	61	.54	61	.54	61	.57	65	.58	67	.55	66	.54	66	.549	64.0	.455
*14th	.51	64	.35	25	.36	26	.40	28	.38	26	.37	25	.37	26	.34	19	.31	16	.31	16	.33	18	.454	47.5	.404
15th	.42	27	.43	29	.41	26	.40	25	.38	22	.38	21	.37	20	.39	20	.40	18	.44	18	.38	17	.398	21.7	.416
16th	.54	26	.59	29	.59	29	.62	30	.62	27	.63	30	.63	30	.63	31	.60	25	.64	24	.66	23	.503	21.1	.523
17th	.73	29	.73	29	.73	29	.71	22	.71	22	.73	23	.71	21	.72	20	.71	19	.73	19	.70	17	.700	24.6	.710
18th	.81	32	.79	27	.79	27	.76	23	.74	21	.73	20	.74	21	.71	18	.68	14	.68	14	.68	14	.750	19.9	.773
*19th	.88	63	.91	69	.91	68	.91	66	.92	67	.87	63	.87	61	.86	58	.86	59	.86	59	.86	60	.808	45.4	.763
20th	.80	42	.84	42	.78	38	.78	38	.79	39	.82	51	.81	53	.90	60	.93	68	.84	61	.84	61	.871	56.2	.797
21st	.82	53	.89	65	.87	63	.88	63	.85	59	.85	59	.83	56	.84	56	.84	56	.84	54	.84	56	.849	58.0	.771
22d	.88	48	.88	48	.98	60	.92	50	.92	50	.91	50	.90	50	.90	53	.91	56	.91	56	.89	48	.892	52.9	.826
23d	.88	46	.89	47	.92	53	.92	53	.94	56	.97	61	.98	62	.97	62	.99	66	.99	68	.95	66	.913	52.2	.850
24th	.85	62	.84	60	.85	60	.89	60	.89	60	.89	60	.89	59	.90	60	.94	65	.94	65	.90	60	.885	59.5	.802
25th	1.14	66	1.14	66	1.12	64	1.10	60	1.11	58	1.12	58	1.12	59	1.13	60	1.15	64	1.15	66	1.14	64	1.077	59.3	.994
26th	1.05	53	1.06	54	1.10	58	1.10	58	1.07	58	1.06	56	...	62	1.03	60	1.04	64	1.00	64	1.01	66	1.082	58.3	1.002
27th	0.96	54	0.97	56	0.99	57	0.99	56	0.99	54	0.97	52	0.99	55	1.01	58	1.01	58	1.02	58	1.03	60	.980	57.6	.903
28th	1.02	60	1.01	60	1.02	60	1.00	56	1.01	58	0.99	58	1.00	58	0.98	58	0.99	60	0.98	60	0.97	60	1.017	60.9	.930
29th	0.97	(58)	0.97	(57)	0.97	(56)	0.97	55	0.96	56	0.98	55	1.01	58	1.03	58	1.03	60	1.09	68	1.09	68	1.010	62.8	.919
30th	1.05	55	1.05	55	1.03	53	...	...	1.11	54	1.12	56	1.11	56	1.09	54	1.13	58	1.13	58	1.13	58	1.067	56.8	.992
Means	.733	56.9	.732	56.4	.735	56.4	.738	55.5	.745	55.5	.739	55.0	.739	55.2	.738	55.6	.738	56.4	.737	56.1	.733	55.8	.735	55.9	
B. at 32°	29.658		29.658		29.661		29.666		29.674		29.669		29.668		29.667		29.665		29.664		29.660		29.662		

HOURLY ABSTRACT OF THE READINGS OF THE BAROMETER AND ATTACHED THERMOMETER AT VAN RENSSELAER HARBOR,

In October, 1853, in Lat. 78° 37′, Long. 70° 53′ W. of Greenwich.

Aneroid in cabin, Mercurial Barometer in house on deck. 29 inches +. Readings in English inches and degrees of Fahr.

Day.	1h.		2h.		3h.		4h.		5h.		6h.		7h.		8h.		9h.		10h.		11h.		Noon.		13h.	
	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°
1st	1.12	58	1.13	60	1.14	62	1.17	66	1.08	56	1.09	56	1.10	60	1.13	66	1.11	65	1.10	64	1.10	70	1.11	74	...	...
2d	.93	62	.93	62	.93	62	.90	64	.88	(64)	.88	(64)	.87	(64)	.87	(64)	.81	65	.82	72	.78	70	.78	70	.78	70
3d	.56	80	.55	78	.52	73	.49	68	.34	60	.35	60	.32	60	.32	(60)	.32	60	.34	62	.40	64	.37	64	.36	65
4th	.29	68	.29	68	.31	70	.36	64	.36	(64)	.40	(64)	.45	(64)	.45	(64)	.41	64	.39	62	.39	62	.40	64	.45	69
5th	.51	64	.52	66	.53	67	.53	67	.53	68	.53	68	.53	68	.53	69	.53	69	.54	70	.53	69	.54	69	.53	64
6th	.52	62	.52	63	.52	62	.55	68	.54	64	.57	66	.54	66	.54	66	.58	75	.58	75	.61	78	.62	81	.62	78
7th	.75	76	.76	74	.79	74	.81	74	.75	65	.79	73	.83	70	.85	75	.81	68	.86	70	.88	70	.91	74	.93	70
8th	.89	74	.86	74	.82	75	.83	77	.79	(70)	.73	63	.74	64	.73	64	.84	75	.83	73	.82	69	.81	68	.86	60
9th	1.23	68	1.25	68	1.25	65	1.25	63	1.26	64	1.30	68	1.34	69	1.39	78	1.36	71	1.36	72	1.37	74	1.37	74	1.37	74
10th	1.35	78	1.29	74	1.26	72	1.23	70	1.24	70	1.28	74	1.30	76	1.32	78	1.25	70	1.27	73	1.29	74	1.29	74	1.30	72
11th	1.57	70	1.58	70	1.58	69	1.58	69	1.59	70	1.61	72	1.61	71	1.57	70	1.59	71	1.57	70	1.57	68	1.54	65	1.52	67
12th	1.39	70	1.38	73	1.38	78	1.39	80	1.38	76	1.37	76	1.38	74	1.37	70	1.35	68	1.33	64	1.36	63	1.37	64	...	...
13th	1.21	70	1.20	70	1.18	67	1.10	64	1.07	64	1.07	64	1.08	68	1.03	64	1.03	64	1.02	64	.99	60	.99	70	.99	70
14th	.85	65	.93	80	.93	80	.86	78	.87	76	.87	76	.85	71	.89	74	.86	72	.87	72	.86	70	.87	70	.86	70
15th	.81	70	.78	70	.75	64	.77	72	.79	74	.78	72	.77	72	.77	72	.75	72	.75	74	.74	72	.74	72	.75	76
16th	.90	70	.91	70	.93	74	.96	75	.97	76	.97	74	.96	72	.96	68	.96	68	.97	66	.97	63	.98	62	.98	64
17th	.97	67	.97	67	.98	68	1.00	68	1.01	70	.99	68	.97	64	.99	66	.97	65	.97	65	.96	64	.96	64	.98	66
18th	1.01	68	1.01	71	1.01	73	1.02	74	.98	70	.98	70	.98	70	.98	70	.95	66	...	...	...	...	...	...	...	...
19th	.94	72	.94	72	.93	71	.92	70	.92	70	.89	68	.89	68	.90	68	.90	68	.92	70	.92	70	.91	70	.90	71
20th	.87	69	.88	68	.89	70	.88	69	.88	68	.90	(69)	.89	(69)	.89	(70)	.90	71	.88	69	.89	73	.86	74	.87	74
21st	.85	76	.86	73	.89	72	.89	72	.90	(72)	.91	(72)	.91	(72)	.91	(72)	.91	73	.88	70	.97	66	.99	69	1.00	70
22d	1.07	73	1.06	72	1.08	68	1.11	82	1.09	76	1.09	74	1.16	72	1.17	72	1.18	72	1.16	68	1.18	68	1.17	69	1.20	72
23d	1.20	72	1.20	73	1.20	73	1.19	71	1.18	70	1.19	76	1.19	76	1.12	72	1.09	72	1.09	72	1.07	74	1.08	76	1.03	69
24th	.70	39	.70	44	.60	39	.60	35	.60	40	.61	41	.64	43	.64	45	.77	43	.76	44	.76	42	.76	41	.76	41
25th	.73	47	.73	44	.72	45	.70	46	.65	47	.65	47	.70	43	.75	44	.76	47	.74	43	.74	45	.74	45	.91	78
26th	1.10	47	1.10	50	1.10	49	1.10	45	1.10	45	1.12	45	1.12	47	1.12	47	1.20	45	1.15	45	1.16	45	1.16	45	1.17	49
27th	1.05	40	1.05	40	1.05	35	1.05	33	1.00	37	1.00	38	1.00	39	1.00	40	.96	41	.95	42	.94	41	.94	40	.95	48
28th	.80	33	.80	34	.80	31	.80	27	.80	28	.78	34	.75	36	.72	37	.80	37	.84	36	.84	35	.84	38	.83	47
29th	.84	35	.84	34	.84	25	.82	31	.78	36	.78	35	.76	37	.76	37	.76	34	.78	32	.78	32	.78	33	.76	36
30th	.67	32	.66	32	.60	34	.65	29	.68	35	.63	31	.63	33	.63	33	.60	34	.60	33	.60	33	.60	33	.60	32
31st	.64	35	.65	35	.64	34	.64	33	.65	35	.64	34	.65	32	.66	33	.63	32	.64	33	.65	34	.65	38	.70	30
Means	.914	62.2	.914	62.2	.908	61.3	.908	61.4	.892	60.6	.895	61.0	.900	61.0	.902	61.5	.901	61.1	.901	61.0	.906	60.8	.906	61.9	.916	63.1
B. at 32°	29.823		29.823		29.820		29.820		29.807		29.809		29.813		29.814		29.814		29.814		29.820		29.816		29.823	

Day.	14h.		15h.		16h.		17h.		18h.		19h.		20h.		21h.		22h.		23h.		Midn't.		Means.		B. 32°.
	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.
1st	1.09	(72)	1.08	(72)	1.06	(72)	1.07	72	1.02	68	1.01	65	.98	60	.97	60	.93	60	.90	60	.90	60	1.062	64.6	.965
2d	.77	70	.74	(68)	.73	(66)	.70	64	.70	64	.70	61	.67	62	.62	60	.62	(65)	.57	(65)	.50	70	.770	65.3	.674
3d	.24	65	.23	66	.20	(65)	.21	64	.22	62	.23	64	.24	64	.24	64	.26	66	.26	66	.26	66	.326	65.3	.231
4th	.44	69	.42	68	.42	69	.44	66	.46	62	.46	61	.48	61	.51	66	.51	66	.51	65	.51	66	.421	65.2	.326
5th	.55	65	.55	64	.55	64	.57	64	.51	63	.53	63	.53	63	.53	64	.54	66	.54	66	.55	67	.535	66.1	.436
6th	.56	70	.62	70	.61	68	.61	68	.61	68	.62	68	.62	68	.62	(67)	.65	(66)	.66	64	.68	63	.590	68.5	.484
7th	.94	70	.94	70	.92	71	.94	73	.96	75	.94	73	.94	73	.90	66	.91	72	.88	70	.86	70	.869	71.5	.756
8th	.87	62	.89	66	.86	61	.94	65	1.02	69	1.09	73	1.18	75	1.12	64	1.12	63	1.14	62	1.15	61	.914	67.8	.809
9th	1.35	70	1.34	74	1.33	73	1.32	72	1.31	72	1.30	70	1.26	64	1.29	(66)	1.30	(69)	1.31	(72)	1.33	(75)	1.314	70.2	1.202
10th	1.31	70	1.36	71	1.39	68	1.39	(68)	1.40	(69)	1.42	(69)	1.43	(70)	1.43	70	1.40	68	1.38	64	1.39	66	1.332	71.2	1.217
11th	1.51	66	1.50	64	1.48	62	1.48	64	1.43	66	1.42	64	1.42	64	1.40	66	1.39	64	1.39	65	1.40	66	1.512	67.2	1.406
12th	1.34	64	1.33	64	1.34	66	1.33	66	1.32	68	1.32	70	1.30	69	1.23	64	1.26	72	1.25	72	1.22	70	1.335	69.4	1.224
13th	.98	70	.95	68	.95	70	.94	69	.92	67	.93	68	.93	68	.90	70	.85	73	.86	70	.86	68	1.001	67.5	.896
14th	.86	70	.84	70	.84	68	.83	68	.82	67	.79	65	.78	64	.78	64	.77	64	.74	66	.80	76	.842	70.7	.730
15th	.76	70	.77	70	.77	70	.79	72	.80	71	.80	70	.81	70	.81	70	.81	70	.87	70	...	(70)	.784	71.0	.671
16th	.99	66	.98	64	1.00	67	1.02	68	1.02	68	1.01	67	1.01	72	1.03	74	1.05	76	1.01	72	1.01	74	.981	69.6	.871
17th	.96	64	.96	64	.98	64	.98	64	.98	64	.98	63	.99	64	1.01	66	1.02	68	1.02	68	1.00	66	.983	65.7	.883
18th	.99	70	.93	70	.93	70	.93	70	.91	67	.89	64	.91	66	.89	64	.91	66	.89	71	.88	70	.952	68.9	.843
19th	.86	70	.87	71	.86	70	...	...	.89	76	.87	74	.89	72	.88	70	.88	70	.86	70	.85	70	.895	70.5	.784
20th	.87	70	.86	70	.86	76	.84	71	.86	74	.86	73	.86	74	.86	74	.84	70	.83	70	.83	70	.869	71.0	.756
21st	1.00	70	1.01	71	1.00	70	1.00	69	.93	70	.95	68	.98	69	1.04	70	1.06	70	1.06	70	1.06	70	.957	70.7	.845
22d	1.20	72	1.19	71	1.19	71	1.22	72	1.23	72	1.22	69	1.22	69	1.22	70	1.22	72	1.21	(72)	1.20	(72)	1.168	71.7	1.051
23d	.99	68	.99	69	1.01	69	1.02	72	1.01	69	1.00	68	1.02	72	.99	76	.97	74	.95	72	.94	72	1.072	72.0	.955
24th	.76	46	.75	46	.74	43	.72	45	.75	47	.75	45	.75	46	.74	47	.74	43	.75	45	.73	45	.712	43.1	.674
25th	.91	78	.91	76	.98	82	.91	43	.92	44	.97	51	1.00	52	1.02	54	1.03	51	1.05	58	1.06	54	.845	52.6	.780
26th	1.16	49	1.15	47	1.10	44	1.10	41	1.11	42	1.09	41	1.09	40	1.12	(40)	1.10	(40)	1.09	(40)	1.08	(40)	1.120	44.5	1.077
27th	.95	48	.94	44	.94	49	.95	48	.90	47	.93	40	.93	38	.81	33	.79	34	.76	35	.76	35	.942	40.2	.911
28th	.85	47	.84	47	.85	36	.82	36	.82	37	.82	40	.82	37	.81	37	.81	38	.81	36	.81	38	.811	36.7	.789
29th	.75	33	.75	36	.76	31	.76	35	.75	36	.76	35	.72	36	.72	36	.72	37	.71	38	.70	37	.766	34.5	.751
30th	.60	34	.61	34	.61	36	.62	34	.62	35	.61	35	.61	35	.61	38	.62	37	.62	37	.62	36	.621	34.0	.606
31st	.72	32	.72	29	.73	29	.73	37	.74	32	.74	32	.74	33	.74	33	.75	33	.76	32	.76	33	.690	33.0	.678
Means	.907	62.6	.904	62.3	.903	62.2	.905	61.0	.901	61.0	.904	61.1	.907	60.3	.898	60.0	.898	60.7	.892	60.7	.890	61.1	.903	61.3	
B. at 32°	29.816		29.813		29.813		29.819		29.815		29.817		29.822		29.814		29.814		29.806		29.803		29.815		

HOURLY ABSTRACT OF THE READINGS OF THE BAROMETER AND ATTACHED THERMOMETER AT VAN RENSSELAER HARBOR, In November, 1853, in Lat. 78° 37′, Long. 70° 53′ W. of Greenwich.

Mercurial Barometer in house on deck. 29 inches +. Readings in English inches and degrees of Fahrenheit.

Day.	1h.		2h.		3h.		4h.		5h.		6h.		7h.		8h.		9h.		10h.		11h.		Noon.		13h.	
	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°
1st	.75	25	.75	23	.75	24	.75	26	.73	30	.74	30	.74	31	.74	32	.78	33	.78	34	.79	35	.79	34	.78	25
2d	.85	29	.85	28	.85	29	.85	29	.85	28	.85	31	.85	36	.85	37	.85	35	.85	32	.85	32	.85	29	.85	35
3d	.81	34	.82	30	.81	29	.81	28	.70	25	.80	25	.78	26	.78	25	.75	33	.75	24	.73	19	.72	23	.73	31
4th	.70	35	.71	32	.75	30	.75	28	.73	30	.72	28	.70	25	.70	26	.72	30	.74	34	.73	33	.75	36	.74	32
5th	.78	37	.78	35	.76	31	.76	32	.75	33	.75	30	.74	32	.78	35	.75	37	.74	37	.74	38	.74	40	.74	40
6th	.70	35	.69	35	.68	35	.68	35	.67	34	.65	33	.63	34	.62	33	.62	34	.62	34	.62	36	.57	34	.58	32
7th	.72	37	.75	37	.77	39	.77	39	.79	38	.79	40	.80	40	.82	41	.85	40	.78	39	.79	33	.75	35	.84	37
8th	.87	35	.87	35	.88	33	.88	34	.88	39	.90	39	.93	39	.90	37	.95	37	.95	37	1.00	39	1.02	37	1.02	38
9th	1.08	39	1.06	32	1.05	33	1.04	31	1.05	33	1.05	33	1.02	35	1.01	35	.92	34	.88	35	.84	34	.82	35	.75	35
10th	.24	35	.23	34	.20	33	.20	30	.15	32	.16	32	.20	31	.20	32	.23	34	.25	33	.30	34	.35	35	.40	34
11th	.59	34	.60	33	.55	32	.55	34	.50	34	.48	35	.44	34	.38	35	.35	30	.35	35	.35	38	.29	32	.22	38
12th	.23	28	.25	25	.30	24	.35	25	.41	32	.45	34	.47	34	.48	(36)	.54	38	.54	41	.52	38	.55	39	.60	38
13th	1.03	33	1.03	29	1.07	30	1.07	30	1.09	34	1.09	32	1.10	35	1.12	37	1.15	38	1.14	38	1.14	40	1.15	37	1.20	35
14th	1.22	29	1.22	31	1.22	32	1.22	32	1.22	33	1.22	32	1.20	33	1.20	33	1.21	35	1.20	35	1.23	34	1.22	35	1.23	33
15th	1.17	31	1.17	29	1.17	27	1.17	22	1.12	23	1.12	24	1.13	24	1.10	24	1.10	38	1.12	37	1.11	37	1.10	31	1.10	30
16th	1.00	24	1.00	24	1.00	25	1.01	26	.96	26	.93	23	.90	23	.85	23	.87	30	.86	27	.85	28	.85	29	.85	31
17th	.75	24	.75	28	.78	29	.78	26	.80	33	.82	31	.84	32	.84	32	.84	31	.86	30	.85	31	.87	32	.88	35
18th	.85	34	.85	36	.85	27	.85	27	.80	27	.80	27	.81	26	.76	27	.79	30	.75	30	.75	32	.75	31	.75	34
19th	.75	33	.74	34	.74	33	.74	33	.72	32	.74	34	.74	31	.73	34	.70	32	.77	33	.77	33	.77	32	.75	39
20th	.68	34	.68	33	.68	39	.68	37	.68	32	.69	31	.68	30	.65	30	.65	31	.62	31	.62	31	.64	30	.64	39
21st	.73	30	.73	28	.72	29	.72	30	.71	29	.71	27	.72	27	.72	28	.71	30	.71	32	.71	36	.71	32	.75	39
22d	.75	33	.75	30	.75	29	.75	26	.75	21	.75	20	.75	18	.75	22	.75	27	.77	30	.78	29	.80	32	.83	24
23d	.90	33	.90	33	.90	35	.90	34	.90	31	.90	31	.90	29	.90	31	.90	34	.92	34	.93	31	.93	31	.93	30
24th	.95	30	.95	29	.95	29	.95	32	.95	29	.95	30	.95	30	.95	30	.95	33	.95	34	.95	32	.95	33	.99	35
25th	.97	35	.90	34	.85	35	.78	32	.77	31	.75	32	.72	35	.69	35	.65	30	.60	32	.57	34	.56	37	.54	37
26th	.58	33	.59	33	.61	35	.61	36	.60	36	.60	32	.60	33	.60	32	.60	35	.60	35	.60	39	.60	40	.60	40
27th	.46	35	.44	35	.43	34	.41	33	.39	32	.35	32	.33	34	.29	37	.26	37	.26	37	.26	36	.25	37	.20	35
28th	.20	38	.20	37	.20	35	.20	36	.21	38	.24	37	.24	36	.22	38	.22	42	.22	41	.21	41	.20	40	.20	40
29th	.18	39	.20	38	.23	38	.25	39	.25	41	.20	39	.25	39	.30	40	.36	43	.41	41	.41	41	.42	41	.45	43
30th	.55	37	.60	35	.61	35	.61	35	.62	37	.62	37	.64	38	.65	45	.65	46	.65	37	.65	38	.65	40	.65	40
Means	.735	32.9	.735	31.8	.737	31.6	.736	31.2	.725	31.8	.727	31.4	.727	32.0	.719	32.7	.722	34.6	.721	34.3	.722	34.3	.721	34.3	.726	35.1
B. at 32°	29.713		29.726		29.729		29.728		29.717		29.719		29.718		29.708		29.706		29.705		29.706		29.705		29.709	

Day.	14h.		15h.		16h.		17h.		18h.		19h.		20h.		21h.		22h.		23h.		Midn't.		Means.		B. 32°.
	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.
1st	.80	23	.80	24	.80	26	.82	34	.84	34	.84	35	.85	33	.85	33	.84	33	.84	34	.84	34	.791	30.2	.787
2d	.85	27	.85	35	.86	33	.85	33	.86	32	.84	33	.85	32	.85	34	.89	34	.83	32	.82	33	.850	32.0	.841
3d	.68	30	.69	32	.70	38	.72	41	.72	37	.72	35	.72	35	.72	34	.72	34	.74	34	.70	29	.742	30.4	.737
4th	.74	30	.75	31	.75	30	.75	34	.75	36	.79	36	.78	36	.78	32	.78	37	.78	38	.79	37	.745	32.3	.735
5th	.72	41	.74	40	.74	39	.75	37	.75	39	.75	42	.75	40	.75	38	.75	37	.73	37	.70	37	.747	36.8	.725
6th	.59	33	.61	42	.68	40	.64	35	.63	36	.63	33	.64	37	.68	36	.69	38	.70	38	.72	38	.648	35.4	.630
7th	.84	37	.85	40	.85	38	.68	40	.69	37	.70	43	.72	35	.87	35	.87	37	.86	33	.86	36	.792	37.7	.767
8th	1.01	37	1.02	38	1.05	38	1.05	40	1.06	43	1.07	43	1.07	45	1.07	35	1.07	35	1.07	35	1.07	33	.986	37.5	.961
9th	.70	35	.65	38	.59	38	.50	37	.44	35	.40	40	.32	39	.30	36	.30	36	.26	34	.22	30	.719	35.1	.702
10th	.43	33	.43	34	.50	37	.59	30	.51	36	.58	36	.56	40	.58	37	.60	38	.60	36	.60	38	.379	34.3	.364
11th	.19	37	.15	36	.12	35	.11	39	.08	35	.07	35	.07	36	.10	35	.19	29	.12	38	.17	29	.292	34.5	.278
12th	.65	37	.70	40	.81	43	.83	42	.84	40	.88	41	.90	34	.95	32	.95	37	.96	39	.99	37	.631	35.6	.613
13th	1.22	36	1.22	36	1.22	34	1.22	38	1.23	39	1.22	37	1.22	37	1.20	36	1.19	34	1.21	37	1.20	35	1.155	35.3	1.137
14th	1.23	34	1.23	34	1.28	36	1.23	34	1.23	33	1.22	36	1.21	35	1.20	30	1.16	30	1.15	33	1.16	32	1.213	33.1	1.201
15th	1.10	32	1.10	35	1.10	31	1.11	36	1.09	30	1.07	28	1.06	29	1.05	28	1.05	29	1.02	26	1.03	25	1.102	29.4	1.100
16th	.85	34	.84	36	.83	41	.82	37	.80	36	.78	34	.78	33	.75	28	.75	31	.75	31	.75	27	.860	29.4	.857
17th	.88	30	.89	32	.89	33	.90	33	.90	32	.90	30	.90	29	.88	27	.85	31	.87	31	.85	28	.849	30.4	.845
18th	.75	34	.75	31	.75	33	.75	34	.75	35	.74	35	.73	35	.75	34	.75	33	.80	34	.76	33	.777	31.6	.768
19th	.75	36	.75	37	.75	36	.75	35	.73	36	.74	37	.73	38	.70	37	.70	37	.70	37	.71	39	.736	34.9	.718
20th	.65	39	.65	36	.65	37	.69	36	.70	36	.70	38	.70	39	.70	37	.70	37	.70	32	.70	33	.672	34.5	.656
21st	.75	38	.75	39	.75	31	.75	33	.75	36	.75	33	.75	33	.75	34	.75	30	.75	30	.75	31	.733	31.9	.724
22d	.84	23	.85	29	.85	32	.85	35	.85	35	.85	35	.85	39	.88	38	.90	34	.92	35	.92	37	.812	29.7	.809
23d	.93	29	.93	30	.93	33	.93	36	.93	33	.93	33	.93	36	.95	33	.95	34	.95	39	.95	29	.922	32.6	.912
24th	1.00	36	1.00	37	1.00	37	1.00	34	1.00	38	.99	39	.99	32	.99	31	.99	32	.98	32	.97	34	.971	32.8	.960
25th	.53	37	.53	40	.53	33	.51	35	.52	31	.55	32	.55	40	.56	30	.56	34	.57	35	.59	36	.640	34.2	.625
26th	.62	40	.60	38	.59	38	.59	37	.56	34	.52	31	.50	35	.50	37	.47	35	.47	36	.47	36	.570	35.7	.550
27th	.20	36	.20	35	.20	34	.20	40	.20	39	.20	34	.20	40	.20	43	.20	39	.20	37	.20	37	.272	36.2	.261
28th	.18	40	.16	40	.16	41	.14	39	.11	40	.10	43	.10	43	.12	41	.12	42	.15	42	.17	41	.178	39.6	.158
29th	.46	43	.49	41	.51	44	.52	41	.52	41	.55	41	.57	43	.57	40	.58	36	.58	36	.58	36	.410	40.2	.380
30th	.65	38	.65	38	.65	42	.70	40	.72	40	.74	43	.73	41	.72	42	.72	42	.72	41	.72	40	.661	39.5	.631
Means	.726	34.5	.728	35.8	.736	36.0	.732	36.5	.725	36.1	.727	36.4	.724	36.6	.732	34.8	.735	34.8	.733	35.1	.732	34.0	.728	34.1	
B. at 32°	29.710		29.709		29.716		29.711		29.705		29.706		29.703		29.715		29.718		29.716		29.717		29.713		

Hourly Abstract of the Readings of the Barometer and Attached Thermometer at Van Rensselaer Harbor,

In December, 1853, in Lat. 78° 37′, Long. 70° 53′ W. of Greenwich.

Mercurial Barometer in house on deck. 29 inches +. Readings in English inches and degrees of Fahrenheit.

Day.	1h.		2h.		3h.		4h.		5h.		6h.		7h.		8h.		9h.		10h.		11h.		Noon.		13h.	
	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°
1st	.73	37	.73	37	.73	35	.73	36	.75	35	.75	35	.75	36	.74	37	.74	40	.71	39	.70	37	.66	37	.65	39
2d	.47	35	.47	34	.47	35	.47	33	.48	31	.48	33	.49	33	.49	34	.50	35	.50	33	.50	40	.52	43	.53	43
3d	.60	35	.60	37	.60	37	.60	37	.59	38	.60	39	.60	35	.60	34	.61	37	.63	35	.63	36	.64	37	.64	39
4th	.70	35	.71	37	.71	35	.72	32	.75	40	.75	43	.75	38	.75	38	.75	33	.75	35	.77	35	.80	37	.84	38
5th	.83	37	.80	34	.80	34	.80	34	.80	30	.80	35	.71	35	.78	33	.65	37	.64	37	.60	37	.59	38	.57	35
6th	.48	38	.48	38	.48	36	.46	34	.46	35	.45	35	.45	35	.45	39	.45	34	.45	36	.45	34	.42	35	.43	34
7th	.57	34	.57	35	.57	35	.60	35	.59	30	.59	27	.60	28	.62	25	.66	31	.68	31	.69	25	.69	26	.68	28
8th	.75	29	.75	33	.75	32	.75	32	.75	34	.72	27	.72	24	.71	29	.72	31	.72	32	.72	30	.72	32	.73	33
9th	.65	28	.65	25	.65	24	.65	23	.67	27	.67	22	.67	25	.65	25	.70	29	.69	25	.69	24	.70	27	.69	25
10th	.76	37	.80	36	.81	37	.82	36	.80	35	.80	36	.82	37	.82	37	.83	36	.83	37	.85	35	.85	36	.85	34
11th	.95	40	.95	38	.95	40	.95	35	.94	34	.90	32	.90	32	.85	36	.85	36	.87	40	.85	35	.84	37	.82	37
12th	.88	36	.88	34	.87	33	.87	31	.90	36	.94	32	.94	29	.95	32	.95	35	.97	39	1.00	35	1.00	32	1.00	34
13th	1.03	34	1.03	31	1.03	31	1.03	33	1.04	31	1.03	33	1.03	32	1.03	33	1.03	34	1.03	34	1.02	33	1.02	34	1.01	36
14th	1.03	37	1.03	37	1.03	37	1.03	37	1.02	32	1.02	38	1.02	36	1.02	45	1.02	36	1.02	35	1.02	35	1.02	36	1.02	36
15th	1.03	36	1.03	36	1.03	32	1.03	33	.97	28	.97	32	.95	32	.93	32	.91	34	.90	35	.87	34	.86	31	.86	29
16th	.86	31	.86	24	.86	22	.86	25	.85	23	.85	24	.85	27	.85	41	.85	34	.85	33	.85	32	.85	33	.86	33
17th	.80	38	.80	37	.80	38	.80	37	.80	35	.80	32	.81	32	.80	36	.80	39	.80	35	.80	36	.80	35	.81	37
18th	.86	33	.86	31	.87	31	.91	32	.93	33	.94	34	.97	36	1.00	36	1.00	35	1.00	35	1.02	35	1.04	36	1.03	36
19th	1.12	33	1.12	35	1.12	33	1.12	35	1.12	36	1.12	36	1.10	38	1.08	39	1.00	43	.97	39	.95	39	.94	40	.92	42
20th	.55	35	.50	35	.50	38	.50	38	.46	38	.46	39	.44	39	.42	43	.45	32	.43	32	.40	37	.47	33	.41	40
21st	.80	35	.83	34	.87	33	.90	34	.96	37	1.02	40	1.04	37	1.09	38	1.10	39	1.10	38	1.10	36	1.10	36	1.10	40
22d	.80	36	.75	35	.73	34	.70	34	.65	34	.57	34	.57	33	.50	36	.50	40	.49	38	.47	39	.43	44	.39	45
23d	.55	38	.60	42	.60	38	.60	40	.65	39	.67	40	.70	40	.74	44	.74	41	.76	41	.76	39	.76	37	.77	40
24th	.85	42	.90	42	.95	41	.97	43	.97	42	1.03	41	1.07	41	1.11	42	1.11	41	1.20	40	1.20	35	1.20	36	1.23	37
25th	1.40	39	1.40	39	1.40	39	1.40	41	1.37	41	1.32	42	1.28	36	1.25	36	1.25	36	1.24	36	1.23	39	1.23	31	1.17	41
26th	1.25	35	1.25	37	1.25	36	1.25	35	1.27	35	1.27	36	1.27	36	1.27	37	1.27	41	1.27	43	1.27	40	1.27	41	1.19	39
27th	.86	39	.84	36	.80	37	.75	38	.65	39	.60	37	.55	40	.50	40	.49	44	.40	46	.40	45	.40	40	.25	40
28th	.15	45	.20	42	.25	42	.28	39	.30	37	.32	31	.40	33	.45	37	.45	43	.45	37	.54	39	.56	39	.57	26
29th	1.30	45	1.33	43	1.35	44	1.35	45	1.37	44	1.39	44	1.40	43	1.44	43	1.45	40	1.45	40	1.45	41	1.45	40	1.48	41
30th	1.45	36	1.40	35	1.40	35	1.40	33	1.40	35	1.40	36	1.36	36	1.34	37	1.34	35	1.34	35	1.34	33	1.34	31	1.26	35
31st	1.15	39	1.15	40	1.15	40	1.15	41	1.10	41	1.10	40	1.08	40	1.07	43	1.07	39	1.05	40	1.00	42	.97	41	.90	41
Means	.845	36.4	.847	35.8	.851	35.3	.853	35.2	.850	35.0	.849	35.0	.848	34.6	.848	36.7	.846	36.8	.845	36.5	.843	35.9	.843	35.8	.828	36.5
B. at 32°	29.824		29.827		29.832		29.835		29.833		29.832		29.832		29.826		29.824		29.824		29.823		29.824		29.807	

Day.	14h.		15h.		16h.		17h.		18h.		19h.		20h.		21h.		22h.		23h.		Midn't.		Means.		B. 32°.
	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.
1st	.65	39	.60	41	.60	43	.60	40	.60	40	.58	43	.58	39	.58	37	.56	36	.50	34	.50	36	.655	37.8	.631
2d	.52	38	.52	38	.55	42	.60	40	.60	40	.60	42	.61	42	.60	45	.61	41	.59	39	.59	40	.532	37.9	.508
3d	.64	38	.64	37	.64	39	.70	40	.73	43	.73	48	.73	48	.70	37	.70	35	.70	35	.71	35	.648	38.0	.623
4th	.84	38	.85	40	.85	41	.90	37	.90	37	.90	41	.90	36	.89	35	.88	35	.85	36	.85	36	.807	37.0	.785
5th	.55	37	.55	40	.55	40	.55	35	.53	35	.53	36	.53	37	.52	38	.52	38	.53	37	.54	38	.636	36.1	.616
6th	.43	34	.43	34	.43	37	.42	34	.45	34	.46	35	.46	31	.48	31	.49	38	.52	29	.52	30	.458	34.6	.442
7th	.70	30	.70	35	.72	34	.75	33	.75	33	.75	33	.75	33	.78	34	.75	33	.75	32	.75	30	.677	31.2	.670
8th	.74	34	.74	33	.75	34	.70	32	.70	32	.68	31	.68	31	.67	31	.66	31	.66	36	.66	31	.715	31.4	.707
9th	.70	25	.70	26	.70	28	.75	33	.75	34	.75	38	.75	36	.75	34	.75	32	.75	34	.75	36	.700	28.6	.700
10th	.85	36	.87	40	.87	41	.92	40	.92	39	.92	39	.92	41	.94	40	.94	40	.94	42	.94	41	.861	37.8	.837
11th	.82	36	.82	37	.82	36	.83	38	.82	34	.82	36	.82	37	.83	37	.84	35	.85	36	.85	35	.864	36.2	.844
12th	1.00	35	1.00	34	1.00	36	1.03	36	1.04	35	1.04	35	1.04	32	1.04	33	1.04	25	1.04	26	1.04	34	.978	33.3	.965
13th	1.01	36	1.01	38	1.00	40	1.00	36	1.00	32	1.00	37	1.00	37	1.00	35	1.00	36	1.01	35	1.01	37	1.017	34.5	1.001
14th	1.02	36	1.03	33	1.03	35	1.03	37	1.02	34	1.02	38	1.00	30	.99	27	.98	28	.97	30	.97	32	1.015	33.9	1.000
15th	.86	26	.86	37	.85	32	.85	36	.85	34	.85	29	.85	30	.86	37	.86	36	.85	34	.85	35	.905	32.9	.893
16th	.87	35	.87	30	.86	39	.84	39	.84	31	.84	34	.82	32	.80	33	.80	33	.80	36	.80	37	.843	31.7	.834
17th	.81	38	.82	31	.82	27	.83	29	.83	30	.83	31	.83	32	.83	30	.83	23	.84	30	.84	32	.814	33.3	.802
18th	1.03	35	1.03	38	1.05	38	1.10	31	1.10	39	1.10	39	1.10	41	1.12	37	1.12	36	1.12	34	1.12	33	1.017	35.2	.999
19th	.90	46	.90	45	.88	42	.85	38	.82	39	.80	44	.74	35	.62	41	.62	39	.62	42	.62	49	.919	39.5	.889
20th	.41	39	.45	38	.46	40	.55	43	.57	45	.60	42	.65	37	.75	35	.80	32	.80	34	.82	34	.535	37.4	.512
21st	1.05	39	1.10	39	1.10	41	1.06	37	1.04	36	1.02	43	1.00	40	.95	40	.90	35	.80	34	.75	33	.991	37.2	.968
22d	.36	42	.36	44	.36	44	.35	41	.36	37	.40	42	.41	35	.42	43	.45	36	.47	38	.50	40	.500	38.5	.473
23d	.80	38	.80	39	.80	44	.82	41	.82	40	.82	42	.82	42	.85	41	.86	40	.86	41	.87	44	.751	40.4	.720
24th	1.25	34	1.27	27	1.31	39	1.34	35	1.35	35	1.35	36	1.35	34	1.33	39	1.33	35	1.35	35	1.35	37	1.182	37.8	1.156
25th	1.17	37	1.19	36	1.17	42	1.19	39	1.19	37	1.18	35	1.18	34	1.20	35	1.20	40	1.23	34	1.25	35	1.254	37.5	1.229
26th	1.14	38	1.13	40	1.12	43	1.06	40	1.05	42	1.02	43	1.00	41	.95	40	.95	39	.90	37	.87	34	1.148	38.7	1.120
27th	.21	42	.20	43	.17	44	.14	43	.09	40	.08	40	.06	47	.05	45	.10	49	.15	47	.15	46	.370	42.0	.334
28th	.67	40	.74	27	.81	32	.90	31	.94	35	1.00	40	1.05	30	1.12	37	1.15	36	1.20	40	1.27	40	.657	36.6	.636
29th	1.48	36	1.49	38	1.51	35	1.50	31	1.50	30	1.50	35	1.49	37	1.50	36	1.50	38	1.48	38	1.45	36	1.442	39.3	1.413
30th	1.25	35	1.25	36	1.25	39	1.22	38	1.21	40	1.20	42	1.17	40	1.17	38	1.17	39	1.15	41	1.15	39	1.290	36.6	1.268
31st	.85	39	.84	39	.82	40	.77	39	.73	41	.75	36	.75	36	.72	(37)	.72	(39)	.67	(39)	.65	(41)	.925	39.7	.894
Means	.825	36.5	.831	36.5	.834	38.3	.844	36.8	.842	36.5	.843	38.2	.840	36.5	.839	36.7	.841	35.7	.837	36.0	.838	36.6	.842	36.2	
B. at 32°	29.804		29.810		29.808		29.822		29.821		29.817		29.819		29.818		29.822		29.817		29.817		29.821		

HOURLY ABSTRACT OF THE READINGS OF THE BAROMETER AND ATTACHED THERMOMETER AT VAN RENSSELAER HARBOR, In January, 1854, in Lat. 78° 37′, Long. 70° 53′ W. of Greenwich.

Mercurial Barometer in house on deck. 29 inches +. Readings in English inches and degrees of Fahrenheit.

Day.	1h.		2h.		3h.		4h.		5h.		6h.		7h.		8h.		9h.		10h.		11h.		Noon.		13h.	
	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°
1st	.65	42	.65	43	.65	43	.65	42	.64	42	.64	40	.64	40	.64	40	.63	39	.61	41	.61	42	.61	43	.60	40
2d	.56	40	.55	42	.55	43	.55	42	.55	41	.55	41	.55	44	.55	43	.61	43	.60	42	.60	41	.60	40	.64	37
3d	.70	38	.70	40	.68	39	.65	40	.62	43	.60	43	.56	45	.56	52	.56	48	.52	42	.50	39	.48	35	.43	37
4th	.35	36	.35	38	.35	39	.35	39	.35	40	.35	40	.34	40	.30	42	.30	39	.30	38	.30	35	.30	35	.30	39
5th	.40	36	.40	36	.42	37	.42	37	.44	37	.44	37	.46	37	.47	37	.48	37	.51	36	.52	34	.52	35	.50	36
6th	.45	42	.45	43	.45	43	.45	44	.41	40	.45	41	.47	39	.48	46	.49	42	.51	43	.52	46	.55	46	.57	36
7th	.74	43	.74	43	.74	43	.74	43	.74	43	.74	43	.74	44	.76	44	.76	42	.79	41	.79	37	.80	33	.73	39
8th	.80	40	.80	43	.80	43	.80	43	.80	45	.81	44	.81	48	.81	47	.77	46	.77	43	.75	42	.75	41	.75	42
9th	.90	40	.90	39	.90	40	.90	40	.90	39	.90	39	.92	39	.92	39	.94	36	.94	43	.93	42	.93	47	.95	50
10th	.75	39	.72	41	.72	40	.72	39	.72	36	.72	43	.72	50	.72	47	.70	41	.70	43	.70	37	.70	45	.70	65
11th	.63	39	.63	39	.62	37	.61	38	.60	35	.61	34	.55	40	.50	40	.56	37	.56	41	.55	41	.55	46	.55	35
12th	.45	50	.45	38	.47	37	.50	34	.50	32	.50	26	.50	25	.50	29	.50	37	.50	36	.50	36	.50	31	.51	37
13th	.69	39	.68	32	.68	36	.68	37	.70	35	.70	28	.70	30	.70	35	.70	39	.70	39	.70	40	.67	38	.69	35
14th	.53	26	.52	26	.52	28	.52	26	.55	28	.55	26	.53	24	.53	26	.53	28	.53	28	.53	29	.53	29	.51	29
15th	.40	23	.40	21	.40	21	.35	17	.35	22	.35	17	.34	10	.34	13	.28	13	.28	20	.26	14	.33	17	.37	15
16th	.50	13	.50	12	.50	9	.50	9	.50	17	.53	14	.53	14	.55	16	.55	12	.55	4	.55	12	.55	16	.55	13
17th	.60	10	.60	7	.60	19	.60	14	.60	20	.61	16	.60	11	.51	14	.57	9	.56	6	.56	11	.55	17	.55	15
18th	.56	19	.58	14	.56	15	.58	24	.56	14	.58	10	.58	11	.60	13	.60	21	.60	18	.60	21	.60	13	.62	13
19th	.57	12	.57	9	.57	10	.58	(9)	.57	9	.57	7	.57	8	.57	7	.57	15	.57	15	.57	19	.57	20	.57	18
20th	.70	8	.70	9	.70	8	.70	10	.69	17	.69	13	.69	9	.69	10	.69	18	.67	13	.65	12	.64	14	.64	10
21st	.45	12	.45	11	.45	12	.45	19	.34	13	.34	15	.34	21	.34	26	.34	27	.34	26	.34	27	.27	29	.26	22
22d	.25	27	.27	27	.27	29	.27	27	.27	21	.27	28	.27	21	.27	25	.27	28	.27	29	.27	30	.27	30	.28	29
*23d	.10	16	.10	15	.08	14	.05	19	.05	15	.05	14	.05	19	.05	25	*.97	26	*.92	24	*.87	22	*.86	22	*.86	24
*24th	*.95	30	*.95	25	*.95	28	*.95	30	*.95	31	*.97	29	*.97	29	*.97	27	*.97	28	*.97	29	*.95	23	*.95	27	.00	26
*25th	*.98	26	*.97	19	*.95	22	*.95	28	*.95	28	*.95	29	*.95	30	*.95	34	*.95	39	*.95	30	*.95	26	*.95	24	*.92	25
26th	.00	33	.00	32	.00	31	.00	31	.09	30	.06	30	.06	28	.08	27	.08	27	.08	20	.10	23	.10	27	.15	30
27th	.21	32	.21	31	.21	31	.21	34	.21	30	.21	29	.21	30	.20	31	.18	32	.18	26	.18	27	.18	30	.19	30
28th	.21	24	.21	22	.21	24	.21	26	.22	27	.22	25	.22	22	.22	28	.25	27	.25	26	.25	22	.25	19	.25	22
29th	.30	23	.30	19	.30	19	.30	17	.32	18	.32	20	.32	20	.32	23	.40	23	.35	17	.35	21	.37	22	.38	22
30th	.50	25	.49	23	.49	23	.49	22	.49	16	.50	14	.50	15	.50	16	.50	21	.50	20	.50	21	.50	19	.50	21
31st	.50	27	.50	22	.50	20	.50	19	.50	21	.50	24	.50	20	.50	21	.57	27	.57	26	.55	24	.57	25	.57	24
Means	.464	29.4	.463	27.8	.461	28.5	.459	29.1	.459	28.5	.460	27.7	.458	27.8	.455	29.8	.460	30.5	.456	29.2	.452	28.9	.452	29.5	.452	29.5
B. at 32°	29.461		29.465		29.461		29.457		29.459		29.462		29.460		29.452		29.454		29.454		29.451		29.450		29.450	

Day.	14h.		15h.		16h.		17h.		18h.		19h.		20h.		21h.		22h.		23h.		Midn't.		Means.		B. 32°.
	Inch	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch	°	Inch.	°	Inch	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.
1st	.60	39	.60	39	.60	42	.60	40	.60	41	.60	42	.60	39	.60	39	.60	40	.57	40	.55	39	.614	40.7	.582
2d	.70	39	.70	42	.72	40	.71	35	.74	39	.74	42	.74	42	.72	38	.70	39	.68	39	.69	39	.637	40.5	.605
3d	.43	34	.42	41	.42	37	.41	37	.41	42	.40	41	.40	39	.40	41	.41	38	.32	39	.35	39	.497	40.4	.465
4th	.30	40	.30	37	.30	37	.31	38	.32	38	.33	41	.34	39	.38	37	.39	36	.39	35	.39	36	.333	38.1	.307
5th	.50	39	.50	46	.50	49	.49	45	.49	45	.49	45	.46	44	.49	42	.49	42	.49	42	.44	42	.472	39.7	.443
6th	.57	46	.62	44	.62	47	.62	44	.63	43	.65	48	.66	46	.67	45	.68	45	.70	42	.75	43	.561	43.5	.521
7th	.73	39	.73	39	.73	39	.73	40	.75	40	.77	43	.80	45	.80	44	.80	41	.80	44	.80	43	.760	41.5	.726
8th	.75	46	.75	46	.75	40	.76	39	.77	41	.80	41	.82	40	.82	36	.82	37	.83	36	.85	37	.789	41.9	.753
9th	.95	50	.93	50	.90	46	.90	44	.90	41	.92	42	.90	40	.80	36	.77	36	.77	39	.77	40	.893	41.5	.858
10th	.72	68	.72	69	.73	68	.74	43	.74	44	.74	44	.74	45	.69	39	.69	39	.69	39	.69	39	.716	46.0	.670
11th	.55	35	.55	36	.55	41	.51	40	.51	43	.50	36	.46	37	.48	38	.50	37	.50	37	.50	38	.547	38.3	.521
12th	.55	38	.56	36	.56	33	.56	34	.60	33	.60	34	.63	36	.65	38	.65	38	.65	39	.65	39	.543	35.2	.525
13th	.70	36	.69	37	.70	40	.68	36	.65	30	.60	30	.56	28	.56	28	.56	27	.56	28	.57	26	.659	33.7	.645
14th	.51	21	.51	17	.51	21	.50	21	.48	23	.48	19	.45	21	.45	19	.45	15	.45	15	.43	20	.504	23.7	.517
15th	.37	20	.37	17	.37	16	.35	15	.35	15	.40	9	.40	12	.45	20	.45	13	.45	15	.49	14	.371	16.2	.403
16th	.55	19	.54	16	.54	12	.60	19	.60	18	.60	20	.60	18	.61	18	.62	22	.62	20	.62	11	.557	14.7	.594
17th	.55	18	.55	17	.55	16	.55	19	.55	13	.55	26	.55	25	.59	27	.59	26	.56	19	.56	24	.569	16.5	.601
18th	.62	21	.62	18	.62	19	.64	20	.65	21	.65	20	.62	19	.60	14	.60	14	.59	11	.59	11	.601	16.4	.633
19th	.56	20	.60	19	.60	19	.65	20	.65	21	.65	21	.65	22	.69	24	.69	15	.69	13	.69	12	.606	15.2	.641
20th	.64	18	.64	17	.64	21	.55	19	.55	25	.53	20	.49	16	.50	22	.50	18	.50	15	.50	13	.620	14.8	.657
21st	.22	24	.19	25	.19	29	.20	26	.20	25	.20	25	.20	23	.20	26	.20	27	.19	27	.19	20	.287	22.4	.303
22d	.28	34	.28	31	.26	28	.26	34	.26	32	.26	30	.26	25	.25	29	.25	26	.25	28	.25	22	.265	27.9	.267
*23d	*.86	31	*.86	30	*.86	28	*.86	27	*.86	29	*.86	30	*.86	26	*.89	30	*.92	33	*.94	30	*.94	26	*.947	23.9	*.959
*24th	.00	32	.00	29	.00	24	.00	30	.00	30	.00	32	.00	30	.00	29	.00	30	.00	30	.00	24	*.979	28.4	*.979
*25th	*.94	25	*.94	31	*.95	32	*.94	31	*.93	32	*.95	33	*.95	33	*.95	30	.00	28	.00	30	.00	30	*.955	28.9	*.954
26th	.16	29	.17	32	.17	30	.20	37	.21	31	.20	32	.20	30	.20	30	.20	37	.20	31	.20	31	.121	30.0	.117
27th	.19	30	.19	32	.19	33	.20	27	.20	31	.20	31	.20	32	.21	31	.21	31	.22	31	.22	31	.200	30.5	.194
28th	.25	23	.25	23	.25	21	.25	23	.25	24	.25	29	.25	23	.30	25	.30	24	.31	24	.31	21	.247	23.9	.259
29th	.38	24	.40	30	.44	30	.45	24	.45	30	.45	28	.50	27	.50	29	.50	27	.50	26	.50	32	.392	23.8	.404
30th	.50	21	.50	21	.50	21	.50	24	.50	23	.51	25	.51	23	.51	24	.50	26	.50	27	.50	26	.500	21.5	.518
31st	.60	25	.60	27	.60	25	.60	26	.60	31	.60	31	.60	31	.58	31	.55	25	.55	27	.55	27	.553	25.2	.561
Means	.459	31.7	.461	32.1	.462	31.7	.462	30.9	.465	31.4	.467	31.9	.465	30.8	.469	30.9	.471	30.1	.467	29.6	.469	28.9	.461	29.8	
B. at 32°	29.451		29.451		29.454		29.455		29.457		29.459		29.459		29.462		29.467		29.464		29.468		29.458		

HOURLY ABSTRACT OF THE READINGS OF THE BAROMETER AND ATTACHED THERMOMETER AT VAN RENSSELAER HARBOR,

In February, 1854, in Lat. 78° 37′, Long. 70° 53′ W. of Greenwich.

Mercurial Barometer in house on deck. 29 inches +. Readings in English inches and degrees of Fahrenheit.

Day.	1h.		2h.		3h.		4h.		5h.		6h.		7h.		8h.		9h.		10h.		11h.		Noon.		13h.	
	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°
1st	.55	27	.55	22	.50	21	.50	20	.50	21	.50	20	.50	20	.50	22	.51	26	.51	17	.49	18	.45	25	.50	25
2d	.62	28	.62	29	.62	23	.62	21	.65	20	.65	17	.65	20	.65	22	.72	25	.72	24	.72	26	.72	25	.70	24
3d	.52	26	.48	26	.46	21	.43	20	.43	21	.41	21	.39	20	.38	24	.38	25	.40	19	.40	18	.40	18	.40	23
4th	.60	25	.60	25	.62	24	.62	24	.67	16	.67	15	.67	21	.69	21	.70	27	.70	20	.70	15	.68	16	.68	20
5th	.52	16	.50	16	.50	15	.47	11	.40	6	.38	5	.35	5	.33	15	.34	16	.30	16	.30	14	.25	17	.25	15
6th	.30	15	.30	17	.30	16	.30	10	.40	9	.43	8	.43	4	.50	19	.50	18	.50	18	.51	12	.52	15	.55	20
7th	.65	18	.66	17	.66	16	.66	14	.66	18	.67	19	.67	21	.68	20	.80	21	.80	22	.80	22	.80	15	.90	17
8th	1.22	26	1.22	25	1.22	24	1.22	24	1.40	17	1.40	25	1.40	24	1.40	26	1.40	20	1.40	9	1.35	9	1.30	13	1.22	14
9th	.60	24	.60	24	.60	27	.60	26	.67	16	.65	8	.60	6	.60	16	.60	18	.60	18	.60	20	.60	25	.60	16
10th	.45	17	.45	14	.43	16	.47	18	.60	24	.55	16	.60	15	.65	15	.65	12	.68	4	.75	10	.78	12	.79	16
11th	.88	21	.88	20	.86	20	.86	17	.85	16	.83	18	.80	18	.80	23	.80	24	.80	22	.80	20	.80	22	.77	24
12th	1.03	22	1.04	20	1.07	19	1.08	21	1.10	19	1.15	20	1.20	24	1.20	24	1.20	23	1.20	23	1.25	27	1.25	29	1.23	26
13th	1.15	22	1.15	21	1.10	20	1.10	18	1.05	22	1.03	23	1.00	23	.96	21	.90	21	.90	21	.90	21	.88	26	.90	35
14th	.94	21	.94	18	.94	17	.95	16	.93	24	.95	20	.97	20	.97	24	.95	20	.95	23	.90	24	.85	24	.85	27
15th	.40	27	.40	28	.35	27	.35	26	.40	25	.46	21	.46	23	.46	24	.35	24	.35	24	.40	25	.40	26	.46	28
16th	.86	22	.88	22	.88	19	.88	19	.90	20	.90	31	.94	29	.95	30	.99	29	.99	29	.99	29	.99	27	.99	33
17th	1.01	35	1.02	33	1.04	32	1.04	33	1.00	31	1.02	33	1.02	31	1.04	32	1.03	32	1.02	36	1.02	36	1.00	35	.85	31
*18th	.39	32	.30	29	.25	30	.20	27	.15	26	.13	27	.10	28	.05	29	.02	33	.00	31	*.95	30	*.93	31	*.93	37
*19th	*.90	34	*.90	35	*.91	33	*.91	33	*.91	32	*.91	31	*.91	31	*.92	35	*.88	35	*.86	33	*.84	30	*.90	28	*.90	29
20th	.14	34	.14	30	.14	31	.17	33	.20	34	.22	33	.25	33	.27	30	.25	30	.27	30	.27	29	.30	29	.30	29
21st	.25	30	.23	28	.21	29	.18	30	.15	29	.12	27	.10	28	.10	30	.11	31	.15	33	.16	33	.25	31	.25	31
22d	.32	31	.35	33	.35	35	.35	32	.35	31	.35	30	.40	30	.40	31	.41	32	.44	25	.45	28	.48	28	.48	31
23d	.62	32	.63	30	.63	28	.63	27	.63	25	.63	23	.64	23	.66	24	.62	23	.65	25	.65	26	.68	31	.68	32
24th	.82	27	.83	27	.85	28	.86	28	.86	27	.86	28	.90	28	.95	30	1.05	33	1.05	33	1.05	27	1.06	28	1.10	29
25th	1.23	23	1.21	21	1.21	21	1.21	23	1.15	24	1.16	25	1.17	26	1.15	29	1.08	26	1.08	28	1.06	28	1.05	33	1.00	31
26th	.50	17	.49	19	.45	18	.45	18	.44	18	.42	20	.42	20	.38	20	.40	20	.40	20	.35	24	.35	22	.34	23
27th	.50	23	.50	23	.55	24	.55	25	.57	25	.57	26	.60	23	.60	28	.60	28	.62	21	.60	18	.60	23	.60	23
28th	.60	18	.60	18	.60	16	.60	20	.60	19	.60	18	.60	20	.60	23	.60	27	.60	25	.60	22	.58	24	.60	25
Means	.627	24.7	.624	24.0	.618	23.2	.616	22.6	.629	22.0	.629	21.7	.634	21.9	.637	24.5	.637	25.0	.641	23.2	.638	22.9	.637	24.2	.636	25.5
B. at 32°	29.637		29.636		29.632		29.632		29.646		29.647		29.651		29.647		29.646		29.655		29.653		29.648		29.644	

Day.	14h.		15h.		16h.		17h.		18h.		19h.		20h.		21h.		22h.		23h.		Midn't.		Means.		B. 32°.
	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.
1st	.50	26	.50	25	.52	22	.51	24	.51	26	.51	30	.51	27	.61	26	.60	29	.62	30	.62	27	.524	24.0	.536
2d	.70	23	.71	24	.70	27	.70	28	.70	28	.70	25	.67	25	.66	26	.66	26	.66	27	.66	24	.674	24.5	.684
3d	.40	24	.45	23	.45	22	.48	24	.50	27	.54	26	.57	26	.60	27	.60	27	.60	25	.60	23	.469	23.2	.483
4th	.68	17	.65	12	.63	12	.62	14	.62	16	.62	20	.63	21	.60	16	.60	19	.60	20	.55	19	.642	19.0	.667
5th	.25	16	.23	15	.24	13	.24	20	.24	20	.26	27	.28	24	.28	15	.28	14	.32	11	.33	15	.327	14.9	.363
6th	.56	17	.57	21	.58	20	.63	20	.65	24	.65	25	.65	24	.65	24	.65	27	.68	7	.70	8	.521	16.6	.553
7th	.90	16	1.15	16	1.05	21	1.07	21	1.12	27	1.15	28	1.16	27	1.23	25	1.23	23	1.25	22	1.30	22	.917	20.3	.938
8th	1.22	14	1.22	18	1.22	17	1.16	16	1.11	20	1.09	23	1.06	21	1.00	24	1.00	19	.95	17	.90	18	1.212	19.3	1.236
9th	.60	14	.60	22	.60	20	.58	19	.54	19	.54	19	.48	19	.46	17	.46	22	.45	20	.43	18	.569	18.9	.595
10th	.80	24	.82	30	.93	18	.91	31	.91	32	.91	30	.91	25	.95	23	.95	25	.95	22	.93	20	.742	19.5	.766
11th	.77	22	.80	24	.80	24	.85	25	.87	24	.90	23	.90	21	.95	22	.95	26	1.00	24	1.00	23	.855	21.8	.874
12th	1.27	28	1.30	30	1.30	28	1.33	29	1.33	27	1.33	27	1.28	22	1.28	21	1.26	24	1.24	25	1.20	28	1.213	24.4	1.223
13th	.90	36	.90	25	.90	24	.90	24	.95	30	.95	35	.95	32	.95	32	.95	25	.95	22	.95	22	.970	25.0	.979
14th	.80	26	.78	31	.73	28	.73	28	.73	30	.73	31	.73	31	.60	28	.58	30	.50	30	.50	30	.812	25.1	.821
15th	.53	24	.59	30	.60	30	.68	30	.70	28	.75	32	.75	30	.76	32	.76	30	.80	25	.80	26	.540	26.9	.544
16th	.97	34	.97	38	.99	35	.99	33	1.00	40	1.00	42	1.00	37	1.00	35	1.00	35	1.01	35	1.01	37	.962	30.8	.956
17th	.87	32	.84	32	.80	28	.75	23	.70	26	.68	28	.65	31	.60	31	.56	33	.50	32	.45	33	.855	31.6	.847
*18th	*.93	37	*.93	37	*.93	45	*.98	38	*.95	31	*.95	31	*.95	29	*.94	38	*.94	38	*.92	35	*.91	34	.030	32.6	.018
*19th	*.95	30	.00	34	.00	36	.03	38	.05	38	.05	38	.05	36	.06	36	.10	30	.11	35	.12	35	*.965	33.5	*.952
20th	.25	34	.25	35	.25	33	.27	33	.27	29	.27	35	.27	33	.25	32	.25	32	.25	32	.25	31	.240	31.8	.232
21st	.25	31	.25	31	.25	32	.29	32	.29	31	.29	28	.27	27	.27	29	.27	28	.27	34	.30	33	.219	30.2	.214
22d	.48	32	.51	34	.52	32	.55	34	.55	35	.56	32	.56	28	.55	30	.55	32	.60	32	.60	32	.465	31.3	.457
23d	.68	33	.70	32	.70	32	.70	28	.74	27	.74	28	.75	29	.76	28	.77	28	.77	26	.80	24	.686	27.7	.688
24th	1.10	27	1.10	25	1.10	26	1.15	25	1.15	27	1.19	28	1.23	31	1.24	32	1.24	31	1.24	30	1.24	29	1.051	28.5	1.051
25th	1.00	30	.95	32	.92	30	.90	24	.84	20	.89	20	.70	19	.65	15	.61	14	.57	18	.54	14	.972	23.9	.984
26th	.34	21	.34	22	.34	22	.40	26	.40	27	.40	26	.43	26	.43	23	.45	23	.48	20	.48	21	.412	21.5	.430
27th	.60	23	.60	24	.60	25	.60	20	.65	25	.65	26	.65	23	.65	22	.62	21	.61	21	.60	21	.595	23.4	.608
28th	.63	26	.65	25	.62	25	.60	18	.59	19	.55	20	.55	22	.56	24	.58	24	.58	22	.58	23	.595	21.8	.613
Means	.640	25.6	.656	26.7	.655	26.0	.664	25.9	.666	26.9	.673	28.0	.664	26.6	.662	26.2	.660	26.2	.660	25.0	.655	24.6	.644	24.7	
B. at 32°	29.648		29.661		29.662		29.671		29.671		29.674		29.669		29.668		29.666		29.669		29.666		29.654		

HOURLY ABSTRACT OF THE READINGS OF THE BAROMETER AND ATTACHED THERMOMETER AT VAN RENSSELAER HARBOR, In March, 1854, in Lat. 78° 37′, Long. 70° 53′ W. of Greenwich.

Mercurial Barometer in house on deck. 29 inches +. Readings in English inches and degrees of Fahrenheit.

Day.	1h.		2h.		3h.		4h.		5h.		6h.		7h.		8h.		9h.		10h.		11h.		Noon.		13h.	
	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°
1st	.56	21	.55	20	.55	21	.56	20	.55	20	.55	20	.55	20	.50	20	.50	22	.50	20	.50	22	.46	20	.46	23
2d	.56	20	.56	18	.60	18	.61	19	.65	18	.65	17	.70	12	.70	15	.70	21	.70	17	.72	19	.74	22	.75	26
3d	.92	16	.94	14	.95	14	.97	15	.99	14	1.00	15	1.05	16	1.10	18	1.15	20	1.16	17	1.17	20	1.20	22	1.20	1
4th	1.25	13	1.35	12	1.35	14	1.36	12	1.38	13	1.38	13	1.40	14	1.40	16	1.45	23	1.45	23	1.45	15	1.45	15	1.43	13
5th	1.27	15	1.26	17	1.24	19	1.24	17	1.24	15	1.20	18	1.20	20	1.20	21	1.15	24	1.15	24	1.12	23	1.10	22	1.07	25
6th	1.00	15	.95	11	.95	11	.95	12	.95	13	.95	13	.95	14	.95	15	.95	24	.95	16	.93	14	.92	13	.90	11
7th	.80	21	.80	20	.80	21	.76	20	.75	17	.75	17	.72	11	.72	13	.72	12	.70	16	.72	19	.67	20	.65	19
8th	.60	10	.60	7	.60	8	.60	8	.60	7	.60	6	.60	8	.60	9	.64	11	.65	12	.66	21	.68	16	.68	15
9th	.72	19	.72	5	.72	4	.72	3	.72	10	.72	17	.72	10	.72	15	.74	20	.77	19	.77	19	.80	19	.80	18
10th	.84	7	.84	4	.84	2	.84	0	.84	2	.84	4	.84	0	.85	11	.87	8	.87	11	.87	10	.87	10	.85	8
11th	.80	11	.80	10	.80	9	.80	8	.80	7	.80	5	.80	7	.80	9	.78	12	.80	14	.80	13	.80	13	.80	16
12th	.70	3	.71	1	.71	0	.71	0	.71	3	.72	3	.72	5	.72	6	.74	9	.71	8	.65	13	.62	15	.62	7
13th	.53	2	.52	1	.52	0	.52	0	.52	0	.52	0	.52	2	.53	6	.54	12	.54	10	.54	10	.54	11	.52	18
14th	.50	8	.50	6	.50	4	.50	4	.50	−14	.48	−14	.45	5	.45	15	.45	12	.45	12	.42	14	.42	14	.41	14
15th	.41	7	.41	6	.41	2	.41	0	.40	− 1	.41	4	.42	7	.43	11	.45	10	.47	20	.47	21	.47	21	.50	21
16th	.65	11	.69	15	.69	13	.70	11	.72	12	.72	14	.76	16	.80	17	.82	21	.84	22	.84	17	.84	16	.85	20
17th	.96	11	.96	10	.96	11	.96	10	1.00	9	1.00	10	1.05	12	1.06	16	1.06	16	1.06	18	1.06	19	1.10	16	1.10	23
18th	1.10	4	1.07	2	1.07	2	1.07	1	1.07	2	1.07	3	.90	9	.90	12	.90	14	.90	14	.85	14	.85	13	.73	13
19th	.55	27	.55	25	.55	25	.55	24	.55	24	.57	22	.60	22	.62	21	.63	21	.65	23	.70	27	.80	24	.82	27
20th	1.11	22	1.12	22	1.10	24	1.07	20	1.06	19	1.08	15	1.08	16	1.05	18	1.05	20	1.02	19	.98	23	.90	23	.87	25
21st	.52	15	.52	16	.52	17	.66	18	.60	19	.60	18	.60	20	.60	21	.72	31	.72	30	.74	29	.74	27	.70	26
22d	.46	22	.46	21	.46	23	.46	24	.47	20	.49	20	.54	19	.56	24	.62	30	.69	31	.69	27	.69	27	.72	25
23d	.88	20	.88	19	.85	17	.85	17	.85	17	.85	19	.84	17	.83	17	.80	23	.80	18	.76	13	.81	18	.83	21
24th	.85	17	.82	15	.82	13	.82	14	.82	14	.82	13	.82	11	.80	20	.82	22	.82	21	.85	16	.86	14	.86	13
25th	.95	11	.97	8	.97	6	.97	6	.97	5	.97	7	.97	6	.97	10	1.00	12	1.02	12	1.04	16	1.05	23	1.09	23
26th	1.06	11	1.06	12	1.06	10	1.06	11	1.06	7	1.06	6	1.05	6	1.05	10	1.05	16	1.05	10	1.05	12	1.03	16	1.02	12
27th	.85	11	.85	11	.85	5	.85	4	.85	−3	.82	−10	.82	−12	.80	−8	.80	0	.80	7	.80	12	.80	15	.79	13
28th	.48	2	.45	0	.43	0	.42	0	.41	1	.40	3	.40	9	.40	15	.40	18	.40	20	.38	16	.38	18	.37	18
29th	.22	10	.20	8	.20	0	.20	−10	.18	9	.18	9	.16	1	.16	7	.16	8	.16	10	.16	11	.16	12	.16	15
30th	.30	2	.35	0	.38	0	.42	− 3	.44	3	.47	1	.50	5	.51	9	.54	10	.55	14	.56	14	.56	15	.60	18
31st	.64	12	.61	10	.60	7	.58	6	.58	6	.53	8	.50	7	.55	9	.55	12	.53	14	.51	17	.50	15	.50	3
Means	.743	12.8	.744	11.2	.744	10.3	.748	9.4	.750	9.3	.748	9.5	.750	10.2	.753	13.5	.766	16.6	.770	16.8	.766	17.3	.768	17.6	.763	17.1
B. at 32°	29.784		29.789		29.792		29.798		29.800		39.798		29.798		29.793		29.798		29.802		29.796		29.798		29.794	

Day.	14h.		15h.		16h.		17h.		18h.		19h.		20h.		21h.		22h.		23h.		Midn't.		Means.		B. 32°.
	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.
1st	.49	25	.49	25	.49	26	.50	26	.50	26	.52	25	.55	25	.52	22	.52	21	.55	21	.55	19	.519	22.1	.536
2d	.75	22	.76	23	.77	22	.78	20	.80	20	.80	21	.80	22	.89	23	.90	22	.90	20	.90	20	.737	19.9	.760
3d	1.18	6	1.21	19	1.23	8	1.23	9	1.25	10	1.25	10	1.30	10	1.32	13	1.34	14	1.34	14	1.35	12	1.158	13.6	1.197
4th	1.45	16	1.44	10	1.42	9	1.42	8	1.40	16	1.40	21	1.40	21	1.40	19	1.40	18	1.35	17	1.32	18	1.396	15.4	1.430
5th	1.07	25	1.07	24	1.05	20	1.05	17	1.05	19	1.05	20	1.05	21	1.05	20	1.05	20	1.03	16	1.00	16	1.123	19.9	1.146
6th	.90	9	.90	12	.90	12	.90	12	.90	13	.90	13	.90	14	.86	12	.86	12	.85	19	.84	18	.917	13.7	.957
7th	.65	19	.65	21	.65	22	.65	20	.65	20	.65	19	.65	12	.65	11	.64	9	.63	7	.62	12	.694	16.6	.726
8th	.68	17	.68	18	.68	15	.70	15	.70	11	.70	14	.70	14	.72	14	.72	13	.72	12	.73	10	.660	12.1	.705
9th	.80	18	.80	18	.80	19	.80	17	.80	17	.82	17	.83	15	.85	11	.85	15	.85	12	.85	10	.779	14.5	.816
10th	.85	9	.83	10	.83	10	.83	9	.83	9	.83	8	.83	10	.83	10	.83	10	.83	10	.83	9	.842	7.5	.897
11th	.80	16	.81	16	.81	16	.82	15	.82	14	.82	12	.82	10	.80	10	.80	7	.74	7	.70	3	.797	10.8	.844
12th	.65	17	.65	12	.65	14	.65	4	.65	6	.65	8	.65	8	.64	10	.55	3	.55	2	.53	2	.661	6.6	.720
13th	.55	15	.55	13	.55	15	.56	14	.56	10	.56	11	.56	10	.55	10	.55	10	.53	10	.52	10	.537	8.3	.590
14th	.41	16	.41	17	.41	16	.41	16	.41	14	.41	17	.41	15	.40	14	.40	13	.40	13	.40	10	.438	10.0	.487
15th	.50	17	.57	26	.57	23	.56	23	.56	21	.56	21	.56	18	.55	24	.55	17	.55	19	.55	14	.489	14.7	.526
16th	.85	19	.90	24	.90	23	.90	22	.90	21	.90	21	.90	20	.90	26	.92	20	.90	16	.92	14	.825	18.0	.853
17th	1.10	10	1.10	20	1.10	22	1.10	16	1.10	12	1.10	9	1.10	8	1.12	21	1.14	20	1.13	7	1.11	5	1.064	13.8	1.103
18th	.70	23	.70	23	.65	21	.65	20	.65	18	.64	18	.64	22	.60	22	.57	25	.57	23	.55	27	.808	14.4	.845
19th	.86	22	1.05	20	.95	23	.98	26	.99	26	1.05	23	1.07	26	1.09	24	1.10	20	1.10	20	1.10	22	.812	23.5	.825
20th	.85	25	.80	23	.75	20	.70	21	.66	21	.65	20	.64	19	.57	16	.57	15	.54	15	.53	12	.865	19.7	.889
21st	.70	32	.68	30	.65	30	.63	22	.62	20	.60	20	.58	18	.57	27	.51	31	.49	26	.47	25	.614	23.7	.627
22d	.70	27	.79	29	.80	23	.82	24	.84	22	.85	25	.85	23	.85	25	.85	25	.85	27	.86	22	.682	24.4	.692
23d	.83	22	.83	25	.83	24	.85	27	.85	30	.85	29	.85	28	.85	26	.86	21	.86	20	.86	13	.839	20.9	.860
24th	.86	14	.89	14	.90	14	.93	18	.94	17	.94	18	.95	18	.96	19	.96	17	.96	14	.96	12	.876	15.7	.909
25th	1.09	29	1.10	29	1.10	19	1.09	13	1.07	18	1.07	17	1.07	14	1.07	16	1.07	17	1.07	16	1.07	17	1.034	14.6	1.071
26th	1.02	14	1.00	14	1.00	15	.97	10	.97	12	.95	10	.95	10	.95	12	.90	7	.90	5	.90	2	1.007	10.4	1.055
27th	.78	16	.77	10	.77	12	.71	10	.67	4	.65	12	.64	9	.63	14	.57	10	.50	5	.50	3	.744	6.3	.804
28th	.37	19	.38	16	.38	14	.37	15	.37	11	.37	13	.37	13	.36	9	.30	2	.28	3	.24	−1	.379	9.7	.429
29th	.15	14	.15	14	.19	16	.21	15	.24	12	.24	10	.27	11	.30	12	.36	9	.30	9	.30	4	.209	9.0	.260
30th	.63	19	.65	16	.65	12	.65	9	.65	12	.69	5	.69	6	.65	14	.67	14	.67	14	.65	15	.560	9.2	.611
31st	.50	−1	.48	7	.45	6	.45	8	.45	9	.45	7	.48	12	.48	13	.48	11	.48	10	.50	20	.516	9.5	.567
Means	.765	17.8	.777	18.6	.770	17.5	.770	16.2	.769	15.8	.772	16.0	.776	15.5	.774	16.7	.767	15.1	.755	13.8	.749	12.7	.761	14.5	
B. at 32°	29.794		29.803		29.800		29.802		29.803		29.805		29.810		29.806		29.803		29.794		29.791		29.798		

Hourly Abstract of the Readings of the Barometer and Attached Thermometer at Van Rensselaer Harbor,

In April, 1854, in Lat. 78° 37′, Long. 70° 53′ W. of Greenwich.

Mercurial Barometer *in* house on deck. 29 inches +. Readings in English inches and degrees of Fahrenheit.

Day.	1h.		2h.		3h.		4h.		5h.		6h.		7h.		8h.		9h.		10h.		11h.		Noon.		13h.	
	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°
1st	.58	−2	.60	−7	.63	1	.68	1	.70	1	.69	3	.70	4	.72	7	.75	8	.75	6	.78	10	.80	10	.83	10
2d	.83	17	.83	6	.83	6	.83	8	.83	5	.85	1	.84	10	.83	16	.83	16	.83	18	.80	17	.80	17	.80	21
3d	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	.27	25
4th	...	...	...	...	...	...	...	...	.33	23	.33	23	.33	21	.33	17	.33	21	.33	27	.35	26	.35	26	.34	27
5th	.35	26	.33	26	.35	28	.33	28	.35	28	.35	29	.35	27	.35	31	.37	31	.37	31	.37	30	.37	33	.37	27
6th	.52	23	.63	24	.65	25	.68	26	.70	22	.71	20	.75	21	.79	25	.84	26	.86	27	.90	24	.94	26	.93	26
7th	1.15	23	1.15	21	1.15	18	1.15	15	1.20	19	1.20	20	1.20	25	1.18	22	1.26	27	1.33	29	1.33	29	1.33	29	1.21	27
8th	1.15	30	1.16	32	1.15	33	1.15	33	1.12	28	1.12	18	1.12	17	1.10	16	1.10	16	1.10	14	1.10	13	1.10	23	1.10	22
9th	1.10	22	1.10	22	1.10	22	1.08	21	1.04	21	1.07	22	1.06	20	1.05	25	1.05	31	1.05	30	1.05	31	1.05	34	.98	37
10th	1.15	31	1.15	31	1.15	31	1.15	31	1.15	27	1.15	26	1.15	23	1.21	30	1.25	36	1.25	34	1.25	34	1.24	23	1.25	23
11th	1.33	27	1.33	30	1.33	33	1.32	27	1.20	13	1.18	15	1.18	16	1.15	18	1.13	22	1.13	23	1.13	23	1.10	30	1.08	30
12th	.85	27	.85	23	.84	24	.84	20	.87	18	.89	17	.96	19	.96	23	.98	34	.98	37	.98	36	1.00	32	1.00	35
13th	1.04	30	1.04	34	1.03	35	1.03	34	1.03	24	1.02	24	1.00	28	1.00	30	1.00	31	.95	31	.95	31	.94	34	.95	33
14th	.80	25	.80	23	.80	21	.80	23	.80	24	.84	30	.84	29	.84	29	.84	23	.85	35	.88	38	.90	38	.90	39
15th	1.00	24	1.00	24	1.02	21	1.03	20	1.04	18	1.04	18	1.03	23	1.05	35	1.05	29	1.05	31	1.05	33	1.05	33	1.05	34
16th	.90	25	.90	25	.90	24	.93	25	.95	24	.98	31	1.03	35	1.06	38	1.10	39	1.10	39	1.10	40	1.10	42	1.13	39
17th	1.24	31	1.24	29	1.23	26	1.21	25	1.21	26	1.21	28	1.20	34	1.20	34	1.20	35	1.20	36	1.18	37	1.18	38	1.18	39
18th	1.14	32	1.14	26	1.14	25	1.14	23	1.15	19	1.15	24	1.16	19	1.20	35	1.20	31	1.23	31	1.22	34	1.25	35	1.25	40
19th	1.30	33	1.34	30	1.34	32	1.34	20	1.31	18	1.31	19	1.31	23	1.31	31	1.31	32	1.30	33	1.30	35	1.30	36	1.30	37
20th	1.30	26	1.30	24	1.30	24	1.30	20	1.35	20	1.34	19	1.36	21	1.35	23	1.36	36	1.36	34	1.36	34	1.35	35	1.35	35
21st	1.24	25	1.16	23	1.16	22	1.16	21	1.15	20	1.14	24	1.12	32	1.12	31	1.12	34	1.12	33	1.08	33	1.05	33	1.06	37
22d	.95	25	.95	22	.95	21	.95	23	.95	22	.95	22	.95	28	.95	29	.95	36	.95	36	.95	38	.95	38	.93	38
23d	.90	28	.90	29	.90	25	.90	25	.90	28	.90	28	.92	29	.94	30	.95	36	.97	37	.97	40	.97	40	.98	46
24th	.98	28	.96	25	.95	27	.92	26	.92	25	.92	29	.92	34	.90	32	.90	39	.90	38	.90	40	.88	43	.90	39
25th	.97	30	.97	28	.97	27	.97	25	.97	27	.97	29	.97	30	.97	30	1.00	32	1.00	34	1.00	36	1.00	37	1.00	39
26th	.95	26	.95	25	.95	24	.96	24	.96	27	.97	30	1.01	33	1.03	37	1.05	38	1.12	37	1.15	40	1.20	39	1.20	38
27th	1.28	37	1.28	37	1.31	28	1.29	30	1.25	33	1.25	35	1.25	35	1.25	33	1.15	36	1.15	40	1.12	40	1.09	40	1.09	40
28th	1.07	35	1.05	34	1.07	35	1.07	37	1.09	36	1.10	32	1.12	35	1.15	36	1.19	37	1.17	38	1.17	40	1.20	43	1.20	42
29th	1.03	34	1.03	36	1.00	37	1.00	36	.98	32	.95	32	.95	35	.93	33	.90	37	.92	39	.90	40	.90	38	.87	38
30th	.90	33	.90	32	.90	30	.90	32	.90	32	.90	31	.95	31	.97	32	.99	37	.99	38	.99	39	1.01	40	1.00	43
Means	.962	26.4	.963	25.3	.964	25.0	.964	24.2	.962	22.8	.964	23.5	.971	25.4	.976	28.1	.984	30.4	.989	31.4	.988	32.2	.990	33.0	.983	33.5
B. at 32°	29.968		29.971		29.973		29.975		29.978		29.977		29.979		29.977		29.979		29.981		29.978		29.978		29.970	

Day.	14h.		15h.		16h.		17h.		18h.		19h.		20h.		21h.		22h.		23h.		Midn't.		Means.		B. 32°.
	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.
1st	.82	10	.85	11	.90	11	.90	12	.90	14	.90	15	.92	17	.92	17	.92	15	.92	15	.92	11	.795	8.3	.848
2d	.73	20	.72	19	.71	22	.70	22	.69	25	.64	23	.65	24	...	...	...	...	...	...	...	...	.748	17.0	.779
3d	.28	25	.29	25	.31	23	.33	26	.35	27	.36	25	.39	27	.40	25	.36	25	.34	26	.33	17	.379	24.8	.388
4th	.38	25	.36	25	.38	27	.39	37	.39	38	.37	34	.38	34	.38	34	.36	35	.36	30	.33	30	.351	26.6	.356
5th	.37	28	.37	28	.40	29	.42	27	.44	29	.45	27	.47	28	.47	25	.51	27	.51	26	.50	20	.397	27.9	.398
6th	.93	27	.98	28	1.00	29	1.08	29	1.08	27	1.10	27	1.11	30	1.10	27	1.14	23	1.14	20	1.16	21	.905	25.1	.914
7th	1.18	25	1.15	25	1.15	26	1.16	23	1.16	22	1.16	21	1.16	24	1.16	23	1.16	24	1.16	25	1.16	27	1.192	23.7	1.205
8th	1.10	22	1.10	22	1.10	23	1.10	23	1.10	27	1.10	31	1.10	33	1.13	31	1.13	27	1.10	22	1.09	23	1.113	24.1	1.125
9th	1.00	36	1.04	34	1.05	33	1.07	33	1.09	29	1.10	27	1.10	32	1.15	35	1.15	36	1.15	33	1.18	30	1.077	29.0	1.076
10th	1.25	24	1.26	25	1.28	26	1.29	27	1.30	33	1.30	30	1.30	34	1.30	...	1.32	...	1.32	...	1.32	...	1.239	29.1	1.238
11th	1.08	37	1.05	35	1.03	32	1.00	30	1.00	30	1.00	29	1.00	30	1.00	30	.93	32	.90	35	.83	35	1.100	27.6	1.103
12th	1.02	36	1.04	37	1.05	36	1.03	34	1.04	35	1.04	30	1.04	28	1.02	29	1.00	28	1.03	29	1.03	29	.972	29.4	.969
13th	.95	34	.93	35	.90	36	.90	33	.88	33	.86	33	.86	34	.80	31	.80	32	.80	33	.80	32	.936	31.9	.927
14th	.90	37	.90	35	.93	27	.95	35	.96	33	.98	39	.98	35	.98	33	.98	32	1.00	33	1.00	35	.894	31.3	.886
15th	1.05	33	1.05	35	1.05	36	1.07	36	1.09	36	1.09	38	1.07	36	1.05	35	1.03	32	1.00	31	1.00	32	1.042	30.1	1.038
16th	1.13	40	1.13	40	1.15	39	1.10	42	1.12	44	1.22	41	1.23	39	1.22	33	1.23	34	1.25	32	1.25	31	1.092	35.0	1.075
17th	1.18	38	1.15	38	1.15	38	1.12	31	1.12	35	1.12	35	1.12	38	1.12	35	1.12	33	1.12	32	1.14	31	1.172	33.4	1.158
18th	1.25	37	1.28	35	1.28	33	1.32	34	1.34	32	1.35	34	1.35	34	1.32	35	1.30	35	1.30	32	1.30	34	1.240	31.2	1.233
19th	1.30	36	1.30	36	1.30	34	1.30	35	1.30	32	1.30	32	1.30	30	1.30	29	1.30	27	1.30	24	1.30	24	1.307	29.9	1.303
20th	1.35	34	1.35	34	1.32	33	1.30	33	1.30	33	1.30	32	1.30	34	1.25	33	1.25	34	1.18	35	1.18	35	1.311	30.0	1.307
21st	1.05	37	1.05	38	1.05	37	1.00	35	1.00	39	1.00	36	1.00	27	1.00	35	1.00	30	1.00	28	1.00	24	1.076	30.6	1.070
22d	.93	37	.93	37	.90	38	.90	35	.90	39	.90	37	.90	38	.88	36	.88	34	.88	33	.90	31	.926	32.2	.916
23d	.97	43	.97	40	.98	37	1.02	39	1.02	41	1.02	43	1.02	41	1.00	40	1.00	36	1.00	31	.95	29	.960	35.0	.943
24th	.90	37	.90	38	.90	37	.92	37	.93	35	.95	35	.95	35	.95	33	.95	32	.96	32	.96	30	.926	33.6	.912
25th	1.00	40	1.00	39	1.00	38	1.00	37	1.00	38	.96	38	.96	38	...	...	...	...	...	...	...	...	.979	33.5	.965
26th	1.20	35	1.20	37	1.20	37	1.22	39	1.25	36	1.25	37	1.25	36	1.25	37	1.28	36	1.25	36	1.25	36	1.129	34.2	1.113
27th	1.09	38	1.09	37	1.05	38	1.02	39	1.05	39	1.05	40	1.06	39	1.07	39	1.07	39	1.07	35	1.07	35	1.144	36.8	1.122
28th	1.19	41	1.19	39	1.18	37	1.14	35	1.14	36	1.14	38	1.14	38	1.14	37	1.10	38	1.07	38	1.04	34	1.130	37.1	1.108
29th	.84	40	.84	38	.84	37	.80	37	.80	37	.82	36	.83	36	.85	35	.85	33	.87	34	.90	34	.900	36.0	.880
30th	1.00	41	1.05	40	1.05	38	1.03	38	1.03	39	1.03	39	1.03	38	1.03	37	1.03	36	1.03	34	1.03	35	.985	36.0	.965
Means	.981	33.1	.984	32.8	.986	32.2	.986	32.4	.992	33.1	.995	32.7	.999	32.9	.994	32.0	.991	31.1	.985	30.0	.981	28.9	.981	29.7	
B. at 32°	29.969		29.973		29.976		29.976		29.980		29.983		29.987		29.985		29.984		29.981		29.980		29.977		

HOURLY ABSTRACT OF THE READINGS OF THE BAROMETER AND ATTACHED THERMOMETER AT VAN RENSSELAER HARBOR, In May, 1854, in Lat. 78° 37′, Long. 70° 53′ W. of Greenwich.

Mercurial Barometer in house on deck. 29 inches +. Readings in English inches and degrees of Fahrenheit.

Day.	1h.		2h.		3h.		4h.		5h.		6h.		7h.		8h.		9h.		10h.		11h.		Noon.		13h.	
	Inch.	°	Inch	°	Inch.	°	Inch.	°	Inch	°	Inch.	°	Inch	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°
1st	1.00	36	1.00	37	1.00	36	1.00	35	1.00	38	1.00	37	1.00	37	1.00	41	1.00	34	1.00	35	1.00	36	.95	34	.95	37
2d	.95	34	.92	28	.90	33	.90	51	.90	52	.90	57	.90	58	.90	48	.90	37	.90	35	.90	35	.90	35	.90	30
3d	.90	34	.90	38	.90	35	.90	38	.87	41	.87	55	.87	61	.87	55	.87	57	.85	58	.80	62	.75	60	.72	61
4th	.46	35	.46	28	.44	30	.42	44	.41	51	.41	58	.41	57	.41	58	.40	56	.40	56	.40	57	.34	52	.29	50
5th	.27	30	.27	30	.30	31	.30	54	.30	56	.32	56	.34	57	.37	55	.37	54	.40	42	.45	40	.46	37	.48	38
6th	.65	30	.65	30	.65	29	.65	30	.69	37	.75	57	.76	56	.76	57	.76	46	.76	46	.76	45	.75	44	.73	46
7th	.75	40	.77	48	.77	54	.78	56	.80	61	.80	64	.82	66	.85	68	.96	54	.97	52	1.00	50	1.00	50	1.00	47
8th	1.20	46	1.20	44	1.24	45	1.24	47	1.25	47	1.25	48	1.28	56	1.28	57	1.30	60	1.30	61	1.30	61	1.30	62	1.30	64
9th	1.33	50	1.33	52	1.33	49	1.33	51	1.35	55	1.33	56	1.30	55	1.27	55	1.27	62	1.25	61	1.23	59	1.23	60	1.20	57
10th	.87	57	.85	56	.85	57	.85	59	.85	59	.85	57	.85	58	.85	59	.84	60	.85	56	.85	58	.85	57	.85	58
11th	.78	61	.78	62	.75	62	.75	58	.75	58	.75	57	.75	57	.75	56	.76	57	.76	56	.72	58	.70	61	.70	60
12th	.71	48	.72	49	.74	50	.75	46	.79	47	.80	50	.80	51	.80	53	.85	56	.86	55	.87	53	.88	58	.90	59
13th	1.02	57	1.02	57	1.03	56	1.03	56	1.02	54	1.02	54	1.04	56	1.04	56	1.06	56	1.06	58	1.06	56	1.07	60	1.07	61
14th	.87	52	.87	54	.87	52	.87	57	.87	50	.87	52	.87	48	.87	51	.87	53	.87	52	.86	52	.84	51	.85	55
15th	.92	52	.92	54	.92	53	.92	56	.92	57	.92	56	.92	55	.92	54	.92	49	.92	47	.92	48	.93	46	.93	42
16th	.97	46	.97	45	.99	47	.99	46	1.00	45	1.02	49	1.04	48	1.06	46	1.07	47	1.07	45	1.07	42	1.07	39	1.07	43
17th	1.06	51	1.06	50	1.06	48	1.05	49	1.05	51	1.03	52	1.03	52	1.00	53	.96	54	.96	56	.96	52	.95	53	.95	55
18th	1.07	61	1.07	60	1.07	52	1.07	48	1.07	51	1.06	51	1.05	52	1.04	54	1.03	56	1.02	57	1.02	50	1.00	50	.98	54
19th	1.05	49	1.05	51	1.05	52	1.05	50	1.03	45	1.03	45	1.05	54	1.05	52	1.05	54	1.08	55	1.10	56	1.15	56	1.17	55
20th	1.24	46	1.24	47	1.24	47	1.24	46	1.24	45	1.24	45	1.24	45	1.23	45	1.25	46	1.25	48	1.25	52	1.25	53	1.27	55
21st	1.35	55	1.35	48	1.35	50	1.35	52	1.35	45	1.35	50	1.37	55	1.40	57	1.42	52	1.42	51	1.43	52	1.45	54	1.47	54
22d	1.50	55	1.50	54	1.50	56	1.52	54	1.52	53	1.52	56	1.52	57	1.52	58	1.50	55	1.45	54	1.45	57	1.45	58	1.40	54
23d	1.23	54	1.23	52	1.23	51	1.23	50	1.20	59	1.20	60	1.18	60	1.17	57	1.15	56	1.15	55	1.15	54	1.14	56	1.14	57
24th	1.17	54	1.17	53	1.17	54	1.17	54	1.17	55	1.17	59	1.17	55	1.15	57	1.14	54	1.11	54	1.10	56	1.10	54	1.10	57
25th	.98	57	.98	58	.95	55	.95	55	.95	52	.95	55	.95	57	.95	57	.93	56	.93	54	.90	55	.90	57	.90	52
26th	.93	52	.93	54	.93	55	.95	54	.95	53	.95	55	.95	58	1.00	57	1.00	59	1.00	57	1.00	55	1.00	56	1.00	57
27th	1.00	54	1.00	55	1.00	57	1.00	53	1.03	57	1.03	55	1.03	56	1.03	54	1.02	54	1.02	56	1.02	54	1.02	55	1.04	54
28th	1.10	56	1.10	54	1.12	53	1.12	54	1.08	55	1.08	54	1.08	56	1.08	55	1.08	57	1.07	58	1.07	58	1.07	59	1.08	56
29th	1.15	57	1.15	55	1.15	56	1.15	58	1.15	55	1.16	56	1.17	56	1.18	57	1.18	56	1.18	58	1.17	59	1.17	60	1.16	60
30th	1.15	56	1.16	57	1.16	57	1.15	55	1.18	53	1.18	53	1.20	54	1.25	55	1.25	57	1.26	56	1.26	58	1.26	60	1.26	60
31st	1.17	48	1.17	47	1.17	49	1.15	48	1.11	50	1.11	47	1.11	48	1.11	49	1.10	48	1.09	51	1.08	53	1.06	52	1.05	54
Means	.994	48.8	.993	48.6	.995	48.7	.995	50.5	.995	51.2	.997	53.4	1.002	54.5	1.005	54.4	1.008	53.3	1.007	52.6	1.005	52.7	.999	52.9	.997	53.0
B. at 32°	29.939		29.939		29.941		29.936		29.934		29.930		29.932		29.935		29.941		29.942		29.940		29.933		29.931	

Day.	14h.		15h.		16h.		17h.		18h.		19h.		20h.		21h.		22h.		23h.		Midn't.		Means.		B. 32°.
	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.
1st	.97	39	.97	37	.97	38	.97	42	.97	48	.97	48	.97	48	.97	47	.97	47	.97	40	.97	40	.982	39.5	.953
2d	.92	26	.95	26	.95	36	.96	47	.97	56	.97	58	.97	57	.97	54	.97	47	.97	45	.97	40	.931	42.7	.893
3d	.70	53	.65	41	.65	40	.65	44	.62	47	.62	51	.61	54	.60	56	.60	50	.60	46	.60	41	.749	49.1	.695
4th	.28	54	.27	49	.26	47	.26	49	.25	53	.27	50	.27	46	.27	36	.27	38	.27	36	.27	35	.341	46.9	.292
5th	.50	38	.52	37	.54	44	.59	48	.60	60	.62	57	.63	51	.65	40	.64	40	.65	37	.65	36	.467	44.5	.424
6th	.71	48	.71	49	.73	52	.76	57	.76	55	.76	49	.76	43	.76	38	.75	36	.75	33	.75	34	.730	43.6	.690
7th	1.01	44	1.01	46	1.02	48	1.08	49	1.16	55	1.20	56	1.19	57	1.19	54	1.19	54	1.19	50	1.19	51	.987	53.1	.921
8th	1.30	60	1.33	57	1.33	54	1.33	57	1.33	60	1.33	61	1.33	57	1.33	53	1.33	50	1.33	47	1.33	45	1.293	54.1	1.224
9th	1.17	60	1.13	61	1.12	62	1.10	60	1.07	57	1.05	55	1.00	56	.96	56	.90	56	.90	56	.87	55	1.167	56.5	1.091
10th	.85	57	.85	60	.85	59	.83	56	.83	57	.83	58	.83	56	.83	57	.83	60	.80	58	.81	57	.842	57.7	.765
11th	.70	58	.70	56	.70	52	.70	51	.70	56	.70	60	.70	62	.70	60	.70	55	.70	51	.72	47	.726	56.9	.651
12th	.96	63	.97	61	1.00	61	1.00	64	1.00	57	1.00	56	1.00	53	1.02	55	1.02	56	1.02	54	1.02	51	.895	54.4	.827
13th	1.05	60	1.00	57	.98	61	.96	62	.95	60	.90	56	.90	54	.90	52	.90	51	.88	46	.88	52	.993	56.2	.919
14th	.85	54	.84	55	.84	55	.85	56	.87	58	.89	57	.91	57	.91	55	.91	55	.92	55	.94	55	.874	53.8	.807
15th	.94	43	.94	41	.94	40	.95	40	.95	41	.95	42	.95	41	.95	42	.95	40	.95	40	.95	35	.933	46.4	.885
16th	1.07	49	1.07	52	1.07	55	1.08	57	1.08	56	1.10	55	1.10	54	1.10	53	1.10	50	1.09	52	1.08	51	1.055	48.8	1.001
17th	.95	56	.95	54	.95	56	.95	54	.95	52	.96	56	.96	54	.97	56	.99	57	1.00	55	1.02	58	.990	53.5	.923
18th	.98	53	.98	52	.98	51	.98	50	.98	53	.98	52	.98	51	1.00	51	1.04	52	1.04	51	1.05	51	1.022	52.6	.957
19th	1.18	56	1.20	54	1.20	53	1.20	52	1.20	55	1.20	54	1.20	52	1.21	50	1.23	47	1.24	45	1.25	46	1.134	51.6	1.072
20th	1.27	57	1.27	56	1.27	55	1.27	57	1.27	54	1.28	52	1.28	52	1.30	...	1.32	...	1.32	...	1.34	...	1.265	50.8	1.205
21st	1.47	50	1.47	52	1.48	47	1.50	45	1.50	44	1.50	46	1.50	44	1.50	45	1.50	42	1.52	43	1.52	41	1.438	48.9	1.383
22d	1.40	52	1.38	55	1.37	53	1.37	52	1.37	54	1.37	52	1.36	51	1.32	53	1.30	52	1.25	55	1.23	54	1.420	54.3	1.350
23d	1.14	56	1.14	54	1.14	52	1.14	50	1.14	54	1.14	53	1.14	54	1.16	53	1.16	52	1.16	57	1.17	55	1.168	54.6	1.098
24th	1.10	58	1.10	56	1.10	55	1.10	56	1.09	55	1.08	57	1.06	56	1.06	...	1.05	...	1.03	...	1.00	...	1.111	55.6	1.039
25th	.90	56	.90	56	.90	55	.90	57	.90	55	.90	53	.92	54	.92	56	.92	57	.92	58	.92	56	.926	55.5	.854
26th	1.00	57	1.00	57	1.00	55	1.00	56	1.00	54	1.00	54	.99	55	.99	56	1.00	54	1.00	53	1.00	52	.982	55.2	.910
27th	1.05	54	1.05	56	1.05	57	1.07	55	1.07	57	1.07	56	1.07	56	1.07	55	1.07	57	1.10	56	1.10	54	1.042	55.3	.970
28th	1.08	55	1.10	57	1.10	54	1.10	54	1.10	56	1.10	54	1.10	52	1.10	53	1.10	52	1.10	53	1.10	52	1.092	54.9	1.034
29th	1.15	59	1.15	58	1.14	57	1.12	59	1.12	58	1.12	57	1.15	56	1.15	57	1.15	59	1.15	58	1.15	58	1.153	57.5	1.076
30th	1.26	57	1.25	56	1.25	53	1.25	56	1.25	56	1.24	57	1.20	...	1.20	...	1.18	...	1.18	...	1.18	...	1.215	55.4	1.142
31st	1.05	55	1.05	57	1.05	57	1.00	57	1.00	56	1.00	55	1.00	57	1.00	58	1.00	57	1.02	53	1.02	54	1.069	52.5	1.005
Means	.999	52.8	.997	52.1	.998	52.1	1.001	53.2	1.001	54.5	1.003	54.1	1.001	53.1	1.002	52.1	1.001	51.2	1.001	49.8	1.002	48.9	1.000	52.0	
B. at 32°	29.934		29.934		29.935		29.935		29.931		29.935		29.935		29.939		29.941		29.943		29.947		29.937		

HOURLY ABSTRACT OF THE READINGS OF THE BAROMETER AND ATTACHED THERMOMETER AT VAN RENSSELAER HARBOR, In June, 1854, in Lat. 78° 37′, Long. 70° 53′ W. of Greenwich.

Mercurial Barometer in house on deck. 29 inches +. Readings in English inches and degrees of Fahrenheit.

Day.	1h.		2h.		3h.		4h.		5h.		6h.		7h.		8h.		9h.		10h.		11h.		Noon.		13h.	
	Inch.	°	Inch	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch	°	Inch.	°	Inch.	°	Inch	°	Inch	°	Inch	°	Inch	°
1st	.98	47	.98	48	.97	48	.95	46	.95	47	.95	46	.95	47	.95	48	.95	49	.95	49	.90	51	.90	52	.88	53
2d	.82	54	.82	52	.82	55	.82	56	.84	57	.85	57	.85	54	.85	50	.85	52	.85	54	.85	58	.85	56	.84	57
3d	1.25	54	1.25	54	1.25	53	1.25	54	...	...	...	...	...	...	...	...	.94	54	.95	53	.97	56	.97	58	.98	57
4th	1.00	62	1.00	60	1.00	62	.92	63	...	...	...	...	...	...	...	...	1.00	62	1.00	64	1.00	60	1.00	60	.93	51
5th	1.00	50	1.00	52	1.00	47	1.00	47	1.00	48	1.00	48	.98	50	.98	49	.98	47	.98	45	.97	47	.95	46	.94	56
6th	.78	50	.75	46	.75	46	.73	47	.80	54	.78	54	.80	54	.80	55	.80	54	.76	54	.73	50	.72	53	.72	53
7th	.69	(45)	.69	44	.69	46	.69	48	.68	49	.68	50	.67	52	.65	53	.62	53	.62	53	.63	60	.63	73	.56	56
8th	.65	56	.56	46	.59	52	.71	53	.70	53	.73	60	.77	68	.79	56	.80	53	.80	50	.81	54	.83	46	.83	46
9th	.85	52	.86	48	.87	50	.87	52	.87	52	.87	53	.87	53	.86	53	.86	55	.83	51	.83	54	.80	63	.80	64
10th	.60	53	.60	54	.59	52	.59	48	.60	47	.60	54	.60	57	.60	58	.61	58	.62	57	.65	54	.68	54	.68	54
11th	.70	52	.70	54	.70	55	.70	56	.70	52	.70	50	.71	53	.71	53	.65	53	.65	54	.69	50	.69	54	.70	52
12th	.68	56	.68	56	.68	54	.67	54	.66	54	.67	(54	.67	(54)	.66	(54)	.62	54	.63	54	.64	56	.64	54	.63	58
13th	.64	56	.64	58	.64	56	.64	58	.67	54	.68	51	.68	53	.68	55	.63	54	.63	54	.64	56	.64	56	.64	54
14th	.58	56	.58	54	.58	53	.58	53	.58	54	.58	55	.58	56	.57	60	.55	...	.56	...	.57	...	.60	...	.60	...
15th	.66	60	.65	60	.65	60	.66	60	.70	56	.70	55	.70	54	.70	53	.67	56	.67	58	.70	54	.70	54	.70	56
16th	.63	56	.62	58	.61	58	.61	58	.60	56	.60	55	.60	56	.58	56	.50	58	.49	58	.50	53	.51	52	.53	54
17th	.60	56	.62	54	.63	56	.65	54	.68	49	.70	53	.70	54	.71	55	.72	56	.72	58	.76	56	.79	54	.78	56
18th	.90	56	.97	54	.99	53	.99	52	.90	56	.90	56	.90	56	.94	59	.92	57	.93	58	.94	58	.94	58	.94	58
19th	.95	56	.95	58	.95	60	.95	60	.96	58	.97	57	.97	58	.97	59	.97	58	.98	60	1.02	58	1.03	58	1.03	60
20th	.96	62	.96	64	.92	64	.90	63	.90	58	.90	59	.86	59	.84	55	.80	56	.78	56	.78	56	.77	58	.76	56
21st	.71	56	.73	58	.73	58	.85	58	.80	58	.80	58	.80	57	.79	56	.80	56	.78	56	.78	56	.90	55	.90	54
*22d	.87	58	.87	58	.83	58	.80	58	.85	63	.80	44	.85	47	.85	45	.85	42	.84	39	.86	40	.86	40	.85	37
*23d	.85	34	.83	36	.82	38	.81	38	.76	34	.77	34	.77	34	.77	34	.75	32	.75	34	.75	34	.75	34	.75	36
24th	.75	56	.78	56	.77	56	.77	56	.73	65	.74	65	.76	66	.85	58	.77	56	.77	59	.77	60	.76	58	.75	56
25th	.80	57	.80	56	.80	56	.80	56	.85	60	.85	61	.85	61	.87	58	.86	57	.88	58	.88	59	.88	59	.87	58
26th	.75	58	.75	64	.75	60	.74	60	.72	58	.72	56	.72	57	.72	56	.70	58	.70	57	.70	57	.79	54	.72	58
27th	.76	60	.76	58	.76	57	.76	55	.78	56	.78	54	.78	55	.78	54	.78	54	.78	54	.78	56	.79	53	.80	52
28th	.57	58	.57	56	.57	56	.57	55	.56	55	.56	55	.56	56	.57	57	.59	58	.59	58	.62	56	.62	54	.63	54
29th	.73	55	.73	56	.74	55	.74	57	.75	42	.75	42	.76	44	.76	46	.78	48	.78	48	.78	52	.78	52	.80	51
30th	.84	58	.84	58	.84	52	.85	51	.85	58	.84	58	.85	58	.85	58	.85	55	.85	55	.87	54	.89	53	.90	50
Means	.785	54.6	.785	54.3	.783	54.2	.786	54.2	.786	54.0	.785	53.7	.787	54.6	.788	54.0	.772	53.8	.771	53.9	.779	54.2	.786	54.4	.781	53.9
B. at 32°	29.716		29.717		29.715		29.718		29.720		29.718		29.719		29.721		29.705		29.704		29.712		29.718		29.714	

Day.	14h.		15h.		16h		17h		18h.		19h		20th.		21h.		22h.		23h.		Midn't.		Means.		B. 32°.
	Inch	°	Inch	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch	°	Inch.	°	Inch.	°	Inch.	°	Inch.
1st	.87	55	.86	57	.86	56	.85	55	.85	56	.83	57	.82	57	.84	56	.84	58	.82	56	.82	54	.897	52.0	.834
2d	.84	55	.84	54	.84	52	.83	54	.84	56	.85	56	.85	55	.88	54	.88	53	.90	54	.90	56	.848	54.6	.778
3d	.98	56	.99	55	.99	56	1.00	57	1.00	57	1.00	55	1.00	53	1.00	52	1.00	53	1.00	54	1.00	53	1.047	54.6	.977
4th	.95	50	.94	50	.95	53	1.00	69	1.00	69	1.00	64	1.00	64	1.00	63	1.00	64	1.00	65	1.00	65	.982	61.3	.894
5th	.93	50	.92	51	.91	53	.90	52	.91	52	.88	...	.87	...	.87	...	.87	...	.87	...	.88	...	.941	49.8	.882
6th	.72	45	.73	50	.73	50	.73	52	.73	53	.73	...	.73	...	.74	...	.78	...	.78	...	.75	...	.753	50.6	.693
7th	.59	52	.60	59	.55	57	.55	57	.56	56	.66	...	.65	...	.63	...	.64	...	.65	...	.65	...	.634	54.1	.566
8th	.87	53	.87	52	.87	53	.87	53	.87	53	.87	...	.86	...	.81	...	.86	...	.80	...	.78	...	.787	53.0	.722
9th	.75	64	.74	56	.74	55	.74	54	.73	53	.85	...	.83	...	.81	...	.82	...	.82	...	.85	...	.822	54.2	.754
10th	.66	54	.66	52	.67	52	.67	52	.67	52	.72	56	.73	57	.64	52	.65	52	.64	52	.65	52	.641	53.5	.575
11th	.70	54	.70	53	.70	52	.69	56	.69	55	.67	56	.68	55	.67	56	.67	54	.65	56	.64	54	.686	53.7	.620
12th	.62	52	.63	55	.63	56	.63	57	.63	54	.61	57	.62	56	.64	54	.65	48	.64	48	.64	54	.644	54.3	.576
13th	.64	54	.64	54	.64	54	.64	53	.64	53	.60	54	.61	54	.62	54	.62	56	.59	56	.59	54	.637	54.6	.568
14th	.60	...	.60	...	.60	...	.61	...	.60	...	.60	...	.60	...	.61	...	.61	...	.61	...	.62	...	.590	58.4	.511
15th	.70	54	.73	56	.73	54	.73	54	.73	54	.66	56	.64	58	.65	58	.64	56	.65	58	.64	58	.682	56.3	.608
16th	.53	54	.53	56	.53	56	.53	56	.53	56	.53	58	.52	56	.54	56	.54	56	.56	56	.56	56	.553	56.0	.480
17th	.79	58	.79	56	.79	54	.79	54	.79	54	.79	56	.79	56	.80	58	.78	56	.79	56	.79	56	.740	55.2	.669
18th	.94	56	.94	58	.95	57	.94	56	.94	56	.94	46	.94	44	.99	45	.94	59	.94	60	.94	60	.940	55.3	.869
19th	1.03	60	1.02	60	1.01	60	1.00	60	1.00	60	1.00	58	.97	58	.96	58	.97	58	1.02	58	1.02	58	.987	58.7	.908
20th	.75	54	.70	54	.67	53	.65	52	.65	48	.65	58	.66	53	.66	55	.65	59	.67	59	.70	59	.772	57.1	.696
21st	.90	53	.90	52	.90	48	.90	46	.90	54	.90	56	.92	54	.93	51	.94	50	.94	49	.93	45	.851	53.9	.793
*22d	.85	54	.84	42	.84	42	.83	41	.83	40	.89	34	.87	36	.86	38	.86	34	.88	32	.88	32	.850	43.9	.809
*23d	.75	45	.75	44	.75	44	.75	46	.75	53	.74	57	.74	57	.74	56	.74	54	.76	54	.78	52	.766	42.2	.730
24th	.75	54	.75	52	.75	52	.76	50	.77	54	.83	56	.83	56	.84	56	.84	55	.83	56	.82	56	.781	56.8	.707
25th	.87	55	.87	55	.87	56	.88	57	.86	57	.83	56	.84	53	.86	54	.83	55	.86	54	.86	55	.851	56.8	.777
26th	.71	56	.71	54	.71	54	.71	53	.71	52	.70	58	.69	58	.70	58	.70	58	.69	58	.69	58	.713	57.1	.637
27th	(.80)	(52)	.80	50	.79	53	.75	54	.73	54	.70	58	.70	58	.69	56	.67	56	.66	56	.65	58	.751	55.1	.681
28th	.64	53	.65	52	.65	52	.65	52	.65	54	.70	55	.70	56	.70	56	.72	56	.72	54	.72	53	.628	55.0	.558
29th	.80	50	.80	52	.80	52	.80	54	.80	53	.80	55	.80	57	.80	57	.80	56	.80	57	.80	57	.778	52.0	.716
30th	.91	53	.92	52	.92	52	.93	52	.94	52	.94	48	.94	47	.94	46	.94	45	.94	43	.94	43	.891	52.1	.829
Means	.781	53.8	.781	53.4	.778	53.3	.777	53.9	.777	54.3	.782	54.9	.780	54.4	.781	54.1	.782	54.1	.783	54.0	.783	53.8	.781	54.1	
B. at 32°	29.714		29.714		29.711		29.709		29.708		29.712		29.710		29.712		29.713		29.715		29.716		29.714		

HOURLY ABSTRACT OF THE READINGS OF THE BAROMETER AND ATTACHED THERMOMETER AT VAN RENSSELAER HARBOR, In July, 1854, in Lat. 78° 37′, Long. 70° 53′ W. of Greenwich.

Mercurial Barometer on deck. 29 inches +. Readings in English inches and degrees of Fahrenheit.

Day.	1h.		2h.		3h.		4h.		5h.		6h.		7h.		8h.		9h.		10h.		11h.		Noon.		13h.	
	Inch	°	Inch.	°	Inch	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch	°
1st	.94	43	.94	43	.94	44	.94	42	.94	44	.94	46	.94	46	.95	45	.95	48	.97	48	.97	48	.97	50	.94	52
2d	.94	43	.94	44	.94	42	.95	44	.93	48	.93	48	.91	49	.90	49	.90	50	.90	50	.90	51	.90	52	.90	53
3d	.89	43	.86	42	.85	43	.84	42	.84	43	.85	44	.85	46	.84	46	.83	46	.83	48	.82	49	.82	51	.84	52
4th	.90	47	.90	48	.89	47	.88	48	.90	53	.90	55	.90	48	.90	56	.90	56	.90	56	.90	55	.90	56	.91	57
5th	.83	52	.82	52	.81	47	.80	47	.80	46	.80	46	.80	49	.80	52	.78	50	.78	51	.78	51	.78	51	.78	60
6th	.77	52	.78	51	.78	57	.78	57	.79	48	.79	49	.79	48	.79	49	.78	49	.78	48	.78	47	.77	46	.77	45
7th	.81	40	.82	41	.82	41	.82	42	.82	40	.82	41	.82	44	.82	45	.81	45	.81	44	.81	44	.81	44	.80	45
8th	.83	42	.83	47	.83	45	.83	41	.83	41	.83	42	.84	43	.84	44	.84	44	.84	44	.83	45	.83	45	.83	45
9th	.78	39	.78	40	.78	38	.79	38	.79	40	.78	40	.78	42	.78	43	.78	44	.78	44	.78	45	.78	49	.77	52
10th	.71	41	.71	41	.70	41	.70	40	.70	42	.70	44	.70	45	.70	46	.70	47	.68	45	.68	49	.67	49	.65	50
11th	.66	42	.65	42	.68	42	.65	42	.65	42	.64	44	.64	45	.64	47	.60	49	.60	49	.60	50	.60	50	.56	57
12th	.64	46	.64	47	.64	46	.64	46	.64	47	.64	48	.64	47	.65	49	.65	47	.65	47	.65	45	.65	43	.65	46
13th	.65	42	.65	43	.65	43	.67	44	.67	45	.67	45	.67	46	.70	48	.70	47	.71	47	.73	45	.73	46	.75	47
14th	.81	40	.81	41	.78	40	.78	41	.78	40	.78	41	.78	43	.78	44	.79	44	.80	47	.79	49	.79	51	.79	51
15th	.66	43	.66	44	.65	44	.65	44	.62	43	.63	41	.63	43	.63	44	.63	45	.63	42	.63	42	.63	43	.64	41
16th	...	...	...	...	...	...	...	...	.50	40	.50	42	.52	41	.52	42	.52	42	.53	42	.53	43	.53	42	.54	42
17th	...	...	...	...	...	...	...	...	.72	46	.73	45	.75	44	.75	45	.76	46	.76	46	.77	48	.77	49	.77	50
18th	...	...	...	...	...	...	...	...	.75	45	.75	43	.75	44	.78	42	.78	42	.78	41	.77	41	.77	41	.77	42
19th	...	...	...	...	...	...	...	...	.80	42	.80	42	.81	44	.82	45	.82	46	.82	47	.85	49	.90	50	.90	50
20th	.98	45	.99	43	1.00	40	1.00	41	1.00	40	1.00	41	1.00	43	1.00	44	1.01	46	1.01	48	1.02	48	1.03	50	1.02	52
21st	.98	42	.98	42	.98	41	.98	41	.95	41	.95	42	.94	43	.94	43	.90	44	.95	44	.95	43	.95	43	.81	44
22d	.79	43	.78	43	.78	44	.79	44	.79	43	.79	44	.81	42	.81	43	.81	45	.81	47	.81	49	.81	54	.81	55
23d	.80	46	.79	45	.79	43	.78	42	.78	45	.78	46	.78	47	.78	48	.78	50	.78	53	.77	53	.77	54	.79	57
24th	.87	44	.86	43	.86	50	.86	48	.86	50	.86	52	.87	42	.87	42	.87	46	.87	48	.89	50	.89	50	.89	49
25th	.80	45	.80	45	.78	44	.78	44	.75	45	.75	45	.75	48	.75	48	.76	49	.77	50	.79	51	.78	52	.78	53
26th	.85	43	.85	42	.85	41	.84	42	.82	40	.82	40	.82	42	.83	42	.83	40	.85	42	.90	43	.90	43	.90	44
27th	.90	42	.92	45	.92	41	.93	40	.92	40	.91	39	.91	38	.90	37	.90	46	.90	46	.88	47	.84	48	.82	49
28th	.54	42	.52	41	.50	42	.46	42	.43	41	.45	42	.48	42	.50	43	.53	44	.54	45	.55	45	.55	45	.58	46
29th	.90	45	.90	43	.90	42	.90	41	.90	38	.90	39	.90	40	.90	47	.90	47	.90	47	.90	47	.90	47	.87	46
30th	.67	38	.65	36	.64	36	.63	34	.63	36	.63	38	.65	40	.65	42	.64	44	.62	49	.61	50	.62	52	.62	54
*31st	.67	37	.66	36	.65	35	.63	36	...	...	...	...	...	...	...	...	.69	42	.70	44	.75	49	.77	52	.77	56
Means	.789	43.1	.786	43.3	.781	42.9	.778	42.8	.772	42.9	.773	43.6	.778	44.0	.781	45.2	.779	46.1	.782	46.7	.787	47.5	.790	48.3	.781	49.7
B. at 32°	29.750		29.746		29.743		29.741		29.734		29.733		29.737		29.736		29.733		29.734		29.739		29.737		29.725	

Day.	14h.		15h.		16h.		17h.		18h.		19h.		20h.		21h.		22h		23h.		Midn't		Means.		B. 32.°
	Inch.	°	Inch.	°	Inch	°	Inch	°	Inch	°	Inch.	°	Inch.	°	Inch	°	Inch.	°	Inch	°	Inch.	°	Inch.	°	Inch.
1st	.94	54	.95	56	.95	59	.95	46	.95	47	.96	46	.96	46	.94	44	.94	45	.94	44	.94	44	.948	47.1	.898
2d	.90	51	.90	49	.90	52	.90	46	.90	46	.90	47	.90	46	.91	47	.91	45	.90	46	.90	45	.912	47.7	.860
3d	.84	52	.84	59	.84	62	.84	57	.84	56	.85	58	.85	57	.87	56	.87	52	.89	55	.90	49	.850	50.3	.792
4th	.91	60	.93	64	.93	59	.92	57	.91	56	.91	57	.91	57	.91	59	.89	59	.85	62	.83	60	.899	55.5	.827
5th	.76	63	.76	65	.77	67	.78	58	.78	61	.78	62	.78	63	.77	58	.77	60	.77	58	.77	54	.785	55.1	.714
6th	.80	46	.80	46	.80	45	.80	43	.80	43	.80	42	.80	42	.80	42	.80	40	.80	48	.80	40	.789	46.8	.740
7th	.80	44	.80	44	.80	43	.80	42	.80	44	.81	44	.81	42	.81	42	.83	41	.83	45	.83	48	.813	43.1	.774
8th	.82	44	.82	44	.82	44	.82	43	.81	44	.81	44	.81	44	.80	44	.80	41	.80	40	.80	39	.822	43.3	.783
9th	.77	51	.77	51	.77	50	.77	51	.77	51	.76	51	.76	52	.75	52	.75	50	.74	46	.71	44	.770	46.0	.724
10th	.65	51	.65	56	.64	60	.64	57	.64	57	.63	55	.62	53	.61	51	.61	52	.61	49	.56	45	.661	48.6	.608
11th	.56	60	.59	62	.64	56	.64	57	.64	58	.64	58	.64	56	.65	49	.65	48	.65	45	.65	44	.630	49.7	.573
12th	.65	46	.65	46	.65	47	.65	46	.65	45	.65	45	.65	44	.65	43	.68	41	.65	43	.65	43	.648	45.5	.603
13th	.75	49	.75	50	.75	50	...	...	...	...	.77	45	.77	45	...	...	...	...	...	...	...	...	.725	45.5	.680
14th	.79	52	.79	55	.79	55	.78	40	.79	54	.79	53	.78	57	.73	47	.71	44	.69	43	.67	43	.774	46.5	.726
15th	.64	41	.64	40	.64	40	.65	42	.65	41	.65	43	.65	42	.65	42	.65	42	.65	41	.65	41	.642	42.2	.605
16th	.54	41	.55	42	.63	44	.60	42	.60	43	.63	42	.65	41	.66	41	.67	42	.68	42	.69	42	.580	41.6	.545
17th	.77	49	.77	46	.77	45	.77	45	.77	45	.77	44	.76	43	...	...	...	...	...	...	...	...	.751	45.4	.706
18th	.77	42	.77	41	.79	42	.81	43	.82	45	.83	44	.84	44	.84	43	.84	43	.84	42	.83	42	.787	43.0	.749
19th	.90	47	.92	51	.93	50	.94	49	.94	48	.94	47	.93	47	.94	45	.96	44	.94	43	.92	43	.877	45.7	.831
20th	1.03	53	1.02	54	1.02	55	1.02	56	1.03	56	1.00	55	1.00	55	1.00	54	1.00	53	1.00	51	1.00	51	1.007	48.9	.953
21st	.81	44	.82	44	.82	45	.82	48	.82	47	.82	49	.82	50	.82	45	.82	46	.82	47	.80	47	.885	44.4	.842
22d	.81	56	.81	55	.80	53	.80	52	.80	53	.80	53	.80	52	.90	44	.95	44	.95	43	.95	43	.823	47.7	.773
23d	.79	57	.78	56	.77	55	.77	55	.75	53	.75	52	.75	51	.73	50	.73	52	.72	51	.73	51	.768	50.5	.709
24th	.85	48	.85	48	.85	48	.80	47	.80	49	.80	49	.80	46	.76	44	.78	44	.78	43	.78	42	.840	46.8	.791
25th	.78	53	.78	53	.78	61	.78	52	.77	50	.77	49	.77	47	.78	47	.75	44	.73	44	.72	43	.769	48.4	.716
26th	.90	43	.90	44	.90	44	.92	49	.92	49	.92	47	.92	46	.93	44	.93	44	.93	44	.93	44	.882	43.4	.842
27th	.80	52	.80	53	.80	55	.80	49	.76	48	.73	47	.69	47	.65	45	.60	44	.58	43	.56	44	.809	45.2	.764
28th	.64	47	.66	46	.70	47	.72	47	.75	46	.78	45	.81	44	.90	44	.90	43	.90	43	.90	42	.637	43.9	.596
29th	.86	45	.86	45	.86	45	.82	44	.80	44	.78	44	.75	44	.72	44	.72	41	.72	43	.69	39	.844	43.6	.804
30th	.62	60	.63	64	.63	60	.63	57	.63	52	.63	49	.63	49	.63	49	.63	46	.63	41	.63	41	.632	46.5	.584
*31st	.73	55	.75	58	.77	57	.78	49	.77	49	.78	47	.78	47	.77	46	.76	45	.75	43	.75	40	.721	44.9	.677
Means	.780	50.2	.784	51.2	.791	51.5	.790	48.9	.788	49.2	.788	48.8	.787	48.4	.788	46.7	.788	45.9	.784	45.7	.777	44.5	.783	46.5	
B. at 32°	29.723		29.724		29.730		29.736		29.733		29.735		29.734		29.740		29.742		29.739		29.734		29.736		

HOURLY ABSTRACT OF THE READINGS OF THE BAROMETER AND ATTACHED THERMOMETER AT VAN RENSSELAER HARBOR,

In August, 1854, in Lat. 78° 37′, Long. 70° 53′ W. of Greenwich.

Mercurial Barometer on deck. 29 inches +. Readings in English inches and degrees of Fahrenheit.

Day.	1h.		2h.		3h.		4h.		5h.		6h.		7h.		8h.		9h.		10h.		11h.		Noon.		13h.	
	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°
1st	.75	42	.75	42	.74	42	.73	42	.74	41	.72	40	.70	45	.70	46	.67	48	.65	52	.63	50	.63	51	.64	52
2d	.54	37	.54	38	.54	37	.54	38	.54	37	.56	39	.56	42	.57	43	.58	43	.58	43	.60	45	.60	47	.60	45
3d	.60	40	.62	41	.62	42	.65	43	.66	42	.68	42	.69	42	.69	40	.70	39	.70	40	.71	41	.71	42	.75	42
4th	.80	39	.80	39	.80	38	.80	37	.80	37	.80	38	.80	40	.82	43	.82	45	.83	44	.83	44	.85	43	.86	44
5th	.90	40	.90	41	.90	39	.90	38	.90	39	.90	40	.90	41	.90	42	.90	44	.90	46	.90	49	.90	51	.90	50
6th	.85	41	.85	40	.83	39	.83	37	.83	38	.83	37	.83	41	.83	42	.83	45	.82	47	.82	52	.82	52	.82	54
7th	.81	39	.81	37	.80	35	.80	33	.80	36	.80	38	.80	40	.80	42	.80	47	.80	49	.80	51	.80	53	.80	57
8th	.85	40	.85	40	.86	41	.87	40	.87	40	.88	42	.89	44	.91	45	.92	47	.95	49	.95	49	.96	49	.96	47
9th	1.08	45	1.08	43	1.08	41	1.08	41	1.08	39	1.08	40	1.08	41	1.08	43	1.09	44	1.09	45	1.09	45	1.09	45	1.07	43
10th	.98	39	.97	40	.96	41	.96	40	.95	41	.95	40	.95	39	.95	40	.95	41	.95	44	.95	45	.95	47	.94	48
11th	.93	41	.95	40	.95	38	.95	38	.94	39	.94	37	.94	38	.94	39	.94	39	.94	40	.94	46	.94	45	.92	43
12th	.82	40	.82	39	.82	37	.82	37	.82	36	.82	37	.82	38	.81	38	.80	39	.79	40	.78	41	.78	42	.77	44
13th	.77	38	.76	41	.75	36	.74	36	.74	36	.73	36	.73	36	.70	35	.66	35	.65	35	.64	36	.63	36	.62	36
14th	.38	36	.37	34	.35	34	.34	35	.33	35	.32	36	.31	35	.31	35	.31	35	.30	35	.30	36	.30	36	.30	35
15th	.45	34	.46	33	.50	33	.51	33	.64	34	.65	35	.66	36	.67	37	.68	38	.69	39	.71	38	.72	38	.72	39
16th	.76	28	.76	29	.76	28	.76	28	.76	29	.76	31	.76	35	.76	36	.75	38	.75	40	.75	41	.74	43	.74	50
17th	.65	33	.65	32	.64	33	.64	34	.65	36	.66	36	.67	37	.67	36	.67	37	.70	37	.72	39	.70	40	.70	41
18th	.74	34	.74	32	.74	32	.74	31	.74	35	.74	36	.74	38	.74	38	.74	39	.73	38	.73	39	.73	40	.72	41
19th	.70	39	.71	31	.70	32	.70	32	.69	32	.69	32	.69	32	.69	33	.69	32	.69	34	.68	36	.68	37	.67	35
20th	.63	36	.63	37	.63	36	.63	36	.64	34	.64	35	.64	35	.64	35	.64	35	.65	36	.65	35	.65	35	.65	36
21st	.70	32	.70	32	.70	33	.70	32	.70	34	.70	33	.70	34	.70	36	.70	36	.70	37	.70	36	.70	36	.70	36
22d	.72	30	.72	29	.72	25	.72	26	.74	27	.75	28	.75	30	.75	31	.76	32	.76	32	.78	32	.75	34	.77	32
23d	.65	30	.65	28	.64	27	.64	25	.63	26	.60	24	.59	25	.58	24	.56	30	.55	31	.57	34	.57	38	.57	39
24th	.61	28	.61	27	.61	28	.60	28	.73	24	.73	25	.73	28	.73	37	.74	36	.74	37	.74	35	.74	38	.74	36
25th	.74	29	.75	29	.75	30	.75	31	.75	28	.75	29	.76	30	.76	31	.76	32	.75	32	.75	33	.74	34	.74	33
26th	.60	30	.60	29	.60	29	.60	28	.59	26	.58	25	.57	24	.57	27	.65	27	.65	30	.65	30	.65	30	.66	30
*27th	...	...	...	...	...	...	...	...	.65	30	.65	31	.65	30	.65	30	.83	...	.84	...	.84	...	.85	...	.86	...
28th	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	.68	33	.68	34	.68	35	.67	33	.67	36
29th	.70	25	.71	29	.71	29	.71	30	.71	29	.71	30	.72	32	.72	33	.71	34	.71	33	.71	32	.71	32	.70	33
30th	.52	33	.50	33	.47	32	.44	32	.42	32	.41	31	.39	31	.34	30	.30	31	.29	31	.29	32	.29	33	...	...
31st	.30	30	.32	28	.33	27	.34	28	.36	28	.37	30	.38	32	.39	31	.39	32	.39	33	.38	33	.38	33	.38	33
Means	.705	35.2	.706	34.6	.704	34.1	.704	33.9	.712	34.0	.712	34.4	.712	35.6	.711	36.5	.717	37.5	.717	38.5	.718	39.4	.717	40.1	.717	40.5
B. at 32°	29.687		29.690		29.689		29.689		29.697		29.696		29.694		29.690		29.694		29.690		29.689		29.687		29.685	

Day.	14h.		15h.		16h.		17h.		18h.		19h.		20h.		21h.		22h.		23h.		Midn't.		Means.		B. 32°.
	Inch	°	Inch	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.
1st	.64	53	.63	52	.61	51	.60	50	.59	48	.57	47	.56	47	.55	45	.55	44	.55	42	.55	39	.644	46.3	.597
2d	.60	45	.60	45	.60	45	.61	41	.60	52	.60	49	.60	45	.61	49	.61	48	.61	45	.61	43	.583	43.4	.544
3d	.78	42	.80	41	.80	40	.80	41	.80	42	.80	42	.80	41	.80	42	.80	41	.80	40	.80	38	.732	41.1	.698
4th	.87	43	.88	42	.89	47	.88	45	.88	45	.89	45	.89	43	.90	41	.90	41	.90	40	.90	40	.850	41.7	.815
5th	.90	51	.90	(50)	.90	(50)	.90	50	.90	48	.90	48	.90	47	.90	47	.87	45	.85	44	.85	43	.895	45.1	.851
6th	.82	59	.82	60	.82	54	.83	55	.83	54	.83	52	.82	50	.81	50	.81	49	.81	45	.80	46	.825	47.4	.775
7th	.82	54	.83	59	.85	62	.84	54	.84	54	.84	53	.85	53	.85	51	.85	47	.85	39	.85	41	.820	46.8	.772
8th	.96	48	.96	48	.96	49	.97	44	.97	50	.98	51	1.01	51	1.02	51	1.02	51	1.06	52	1.07	43	.946	46.3	.899
9th	1.06	42	1.03	42	1.04	45	1.02	46	1.02	45	1.00	44	.98	44	.98	43	.98	42	.98	41	.98	41	1.047	42.9	1.009
10th	.94	47	.94	49	.94	52	.94	50	.95	50	.95	53	.95	54	.98	37	.95	39	.95	40	.95	41	.952	44.0	.910
11th	.92	43	.91	45	.91	44	.90	43	.90	40	.88	41	.87	42	.84	42	.84	43	.84	42	.84	42	.911	41.2	.877
12th	.77	47	.77	50	.77	51	.77	49	.77	48	.77	47	.77	46	.77	44	.78	43	.77	42	.77	41	.790	42.3	.753
13th	.58	36	.57	36	.54	36	.54	36	.54	35	.51	35	.49	34	.47	34	.45	34	.41	35	.39	34	.609	35.7	.590
14th	.30	36	.30	36	.31	36	.33	35	.34	35	.35	34	.37	36	.38	34	.40	35	.40	35	.40	35	.337	35.2	.319
15th	.72	39	.73	39	.74	39	.75	39	.76	38	.77	37	.77	35	.79	35	.79	34	.79	34	.79	34	.686	36.2	.666
16th	.73	49	.72	48	.72	49	.70	51	.68	48	.67	46	.67	45	.67	41	.67	39	.65	34	.65	31	.723	39.0	.695
17th	.70	41	.70	43	.70	39	.73	34	.73	33	.73	32	.73	32	.73	35	.74	36	.74	34	.74	32	.695	35.9	.675
18th	.72	44	.72	48	.72	46	.72	45	.72	45	.73	43	.72	43	.71	43	.70	37	.70	35	.70	33	.726	39.0	.698
19th	.65	34	.64	34	.64	34	.64	38	.63	39	.62	38	.62	38	.62	37	.62	37	.63	36	.64	32	.664	34.7	.647
20th	.66	37	.65	38	.67	37	.68	38	.69	37	.70	35	.70	32	.70	30	.70	31	.70	31	.70	31	.661	34.9	.643
21st	.70	35	.70	35	.71	36	.74	36	.73	35	.73	33	.72	33	.72	33	.72	33	.71	33	.70	31	.707	34.2	.692
22d	.76	34	.75	34	.75	34	.75	33	.75	32	.75	32	.75	32	.72	31	.70	31	.67	30	.65	29	.737	30.8	.730
23d	.57	40	.56	41	.56	40	(.57)	(41)	.58	42	.62	34	.63	25	.65	25	.65	25	.65	26	.65	26	.604	31.1	.597
24th	.74	37	.74	38	.74	37	.73	36	.74	36	.74	34	.75	34	.75	33	.76	32	.79	32	.74	32	.720	32.8	.709
25th	.74	33	.74	35	.74	34	.74	34	.70	34	.68	32	.65	32	.65	32	.65	33	.64	32	.60	32	.720	31.8	.712
26th	.67	32	.65	31	.64	31	.62	33	.62	34	.61	35	...	...	...	...	...	...	...	...	...	...	.621	30.1	.617
*27th	.86	...	.85	...	.85	...	.86	...	.86	...	.86	...	.84	...	.84	...	.86	...	.86	...	.86	...	.783	30.8	.777
28th	.67	37	.68	35	.68	35	.67	36	.67	31	.66	34	.66	34	.67	35	.67	37	.68	38	.66	36	.675	34.2	.660
29th	.70	34	.70	34	.70	34	.70	35	.70	34	.70	34	.69	34	.68	33	.68	33	.67	32	.65	32	.700	32.1	.691
30th	...	...	...	...	...	...	...	...	...	...	...	...	...	...	.23	34	.25	33	.30	32	.30	32	.323	32.5	.313
31st	.40	34	.42	34	.43	33	.45	32	...	...	...	...	...	...	.50	26	.50	24	.50	24	.50	23	.410	29.8	.407
Means	.717	41.0	.715	41.5	.715	41.5	.717	40.8	.716	40.6	.715	39.8	.713	39.0	.713	38.0	.713	37.5	.713	36.4	.707	35.4	.713	37.7	
B. at 32°	29.684		29.681		29.681		29.685		29.684		29.685		29.685		29.688		29.690		29.692		29.689		29.689		

HOURLY ABSTRACT OF THE READINGS OF THE BAROMETER AND ATTACHED THERMOMETER AT VAN RENSSELAER HARBOR,

In September, 1854, in Lat. 78° 37′, Long. 70° 53′ W. of Greenwich.

Mercurial Barometer on deck. 29 inches +. Readings in English inches and degrees of Fahrenheit.

Day.	1h.		2h.		3h.		4h.		5h.		6h.		7h.		8h.		9h.		10h.		11h.		Noon.		13h.	
	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°
1st	.51	23	.51	20	.51	20	.51	20	.53	20	.53	21	.52	20	.51	27	.51	27	.51	32	.51	34	.51	25	.51	22
2d	...	...	...	...	.34	20	.34	20	.34	22	.33	23	.33	25	.33	25	.33	25	.33	26	.33	27	.33	28	.33	28
3d	.33	18	.34	19	.34	20	.34	18	.34	18	.34	19	.34	19	.34	20	.34	21	.39	21	.43	23	.47	23	.48	19
*4th	.53	10	.56	8	.56	9	.56	9	.57	9	.59	13	1.02	17	1.04	20	1.05	23	1.06	24	1.09	30	1.12	32	1.15	28
5th	1.16	9	1.16	10	1.16	9	1.16	9	1.12	9	1.11	10	1.09	12	1.07	12	1.06	14	1.06	19	1.05	20	1.05	22	1.01	20
6th	.91	10	.92	11	.93	11	.92	11	.92	12	.92	13	.92	19	.92	21	.93	22	.92	23	.93	23	.94	29	.95	23
7th	.94	14	.94	13	.93	12	.92	12	.91	12	.90	12	.89	12	.88	12	.88	13	.88	14	.86	19	.85	21	.83	21
8th	.84	10	.86	10	.86	11	.87	11	.88	11	.88	12	.88	14	.87	14	.87	19	.86	18	.86	17	.85	16	.85	17
9th	.92	10	.92	10	.92	11	.92	11	.93	(12)	.94	(13)	.94	(14)	.94	(15)	.94	16	.94	17	.95	17	.95	18	.95	19
*10th	.75	13	.77	12	.76	12	.75	12	.77	12	.77	14	.77	15	.77	16	.80	23	.80	26	.80	25	.78	25	.75	27
*11th	...	...	...	...	.75	10	.74	8	.75	9	.75	9	.72	11	.72	12	.70	14	.70	15	.74	18	.75	23	.76	22
12th	.86	46	.87	46	.88	45	.88	43	.89	41	.89	41	.90	42	.90	45	.90	49	.90	49	.92	47	.95	45	.97	41
13th	.92	34	.92	34	.92	33	.92	33	.90	33	.90	37	.90	35	.90	47	.90	45	.90	45	.90	46	.90	54	.90	35
*14th	.75	42	.74	39	.72	37	.70	38	.70	38	.70	40	.69	48	.68	52	.67	49	.64	45	.60	41	.60	42	.57	42
15th	.48	47	.47	45	.45	44	.45	42	.44	43	.44	45	...	...	...	...	.43	48	.43	49	.43	49	.43	43	.43	40
16th	.55	56	.53	51	.45	47	.46	46	.45	45	.47	45	.46	42	.46	44	.63	64	.70	66	.74	64	.78	60	.80	50
17th	.62	49	.62	49	.62	50	.64	48	.65	46	.65	45	.65	45	.65	58	.69	57	.72	57	.86	57	.86	56	.85	56
18th	.68	56	.69	54	.85	61	.80	60	.78	54	.78	51	.78	48	.77	46	.75	43	.80	42	.80	56	.80	58	.80	49
19th	.85	50	.85	47	.86	46	.86	45	.86	42	.85	41	.84	45	.82	58	.75	56	.75	54	.75	56	.75	54	.75	58
20th	.73	54	.73	48	.72	46	.73	45	.75	44	.75	43	.80	59	.80	64	.80	66	.80	62	.82	56	...	...	...	...
21st	.85	53	.84	54	.83	54	.81	55	.80	56	.80	55	.78	56	.75	64	.74	67	.72	68	.70	66	.63	66	.60	59
22d	.25	55	.22	48	.21	47	.19	48	.17	50	.13	51	.10	56	.10	64	.10	58	.10	50	.10	50	.10	67	.12	69
23d	.33	53	.33	55	.34	56	.37	53	.37	53	.37	50	.37	50	.37	53	.37	54	.37	53	.35	54	.31	49	.31	57
24th	.20	51	.20	49	.20	48	.20	48	.20	48	.20	52	.20	58	.20	64	.25	79	.27	68	.27	69	.31	67	.28	67
25th	.22	53	.22	54	.21	56	.20	56	.20	55	.20	57	.20	59	.20	64	.29	65	.18	61	.18	62	.18	63	.19	64
26th	.35	59	.37	57	.40	55	.40	53	.42	54	.45	55	.49	63	.53	65	.54	64	.54	65	.56	65	.55	65	.53	55
27th	.70	56	.73	56	.75	56	.77	55	.80	55	.80	54	.80	56	.83	63	.84	68	.86	62	.86	62	.86	60	.86	60
28th	.83	50	.83	52	.83	52	.83	54	.83	48	.83	47	.85	61	.85	64	.85	60	.83	57	.79	55	.75	54	.71	44
29th	.69	64	.69	57	.69	56	.69	56	.70	56	.70	53	.75	71	.75	73	.71	69	.64	61	.69	63	.72	65	.74	64
*30th	.85	48	.85	50	.83	44	.83	42	.83	42	.84	43	.84	50	.86	53	.90	54	.90	52	.90	65	.90	55	.89	55
Means	.657	37.5	.659	36.3	.661	35.9	.659	35.4	.660	35.0	.660	35.5	.675	38.9	.675	42.7	.684	44.3	.683	43.4	.692	44.5	.694	44.6	.690	42.1
B. at 32°	29.634		29.638		29.641		29.641		29.643		29.642		29.647		29.638		29.641		29.643		29.647		29.651		29.654	

Day.	14h.		15h.		16h.		17h.		18h.		19h.		20h.		21h.		22h.		23h.		Midn't.		Means.		B. 32°.
	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.
1st	.51	23	.51	25	.50	25	.45	25	.45	26	.45	27	.45	26	.43	26	.42	24	.40	23	.40	23	.485	24.3	.495
2d	.33	26	.33	24	.33	23	.33	22	.33	23	.33	24	.33	24	.33	23	.33	23	.33	22	.33	21	.335	23.6	.348
3d	.49	20	.49	19	.49	21	.49	21	.49	20	.49	20	.49	19	.50	17	.50	17	.52	11	.53	11	.429	18.9	.454
*4th	1.17	29	1.18	27	1.21	27	1.21	26	1.22	22	1.22	22	1.23	22	1.20	18	1.20	15	1.20	11	1.20	13	1.006	19.3	1.031
5th	1.00	20	.99	15	.97	13	.94	12	.94	12	.93	12	.91	11	.90	14	.90	13	.90	13	.90	12	1.023	13.4	1.063
6th	.95	22	.95	22	.95	22	.96	20	.96	21	.96	23	.97	24	.97	22	.96	20	.96	17	.95	14	.940	19.0	.966
7th	.80	22	.78	18	.77	17	...	...	...	...	...	...	...	...	.75	10	.75	10	.75	9	.75	10	.834	14.0	.872
8th	.85	16	.85	17	.85	15	.85	15	.85	14	.85	13	.87	13	.90	16	.90	14	.90	11	.90	11	.867	14.0	.905
9th	.95	20	.95	20	.95	20	.94	20	.94	20	.94	19	.92	19	.85	17	.85	17	.87	16	.87	14	.925	16.0	.959
*10th	.75	26	.75	25	.76	24	.75	20	.74	(18)	.73	(16)	.72	(14)	.70	12	.70	11	...	...	...	...	.753	17.4	.783
*11th	.76	22	.77	21	.79	25	.79	13	.79	10	.81	39	.84	44	.88	49	.88	51	.86	58	.86	57	.774	23.3	.787
12th	.95	42	.81	39	.80	41	.80	46	.80	49	.83	45	.84	48	.90	46	.90	44	.91	43	.92	42	.882	44.4	.839
13th	.90	38	.90	40	.90	44	.90	46	.90	46	.90	45	.87	46	.85	48	.83	46	.79	52	.79	49	.888	42.1	.851
*14th	.57	41	.52	48	.52	50	.52	50	.52	51	.56	55	.56	56	.54	58	.54	57	.54	55	.54	50	.612	46.8	.564
15th	.43	40	.43	37	.43	38	.43	39	.43	48	.42	47	.43	47	.45	58	.45	60	.45	59	.46	56	.440	46.5	.393
16th	.80	47	.82	62	.87	67	.86	74	.86	75	.81	72	.72	69	.65	64	.65	64	.62	62	.62	57	.657	58.0	.579
17th	.85	56	.85	57	.85	56	.85	58	.87	60	.87	64	.86	62	.86	63	.86	63	.82	62	.82	63	.768	55.7	.696
18th	.80	47	.80	46	.83	47	.86	58	.86	64	.86	58	.85	58	.85	58	.85	58	.85	56	.85	51	.806	53.3	.740
19th	.75	60	.75	62	.75	64	.75	65	.75	62	.75	61	.75	57	.75	55	.75	57	.74	60	.74	56	.782	54.6	.714
20th	...	...	.85	47	.86	56	.87	69	.90	69	.90	67	.90	60	.90	56	.88	58	.86	57	.85	54	.821	55.5	.749
21st	.59	55	.55	54	.55	65	.55	68	.59	68	.55	57	.51	55	.40	52	.40	50	.37	56	.28	48	.633	58.4	.554
22d	.14	60	.15	58	.16	54	.17	55	.19	57	.28	68	.30	65	.32	55	.32	53	.30	57	.30	61	.188	56.5	.115
23d	.31	63	.33	56	.32	57	.32	61	.30	74	.30	68	.30	63	...	...	...	...	...	...	...	...	.323	56.7	.250
24th	.28	67	.29	63	.30	62	.31	61	.30	64	.30	63	.30	62	.30	65	.27	64	.23	63	.19	67	.252	61.2	.167
25th	.20	69	.20	70	.21	57	.20	54	.25	66	.30	70	.32	63	.33	57	.33	57	.33	57	.33	56	.236	60.2	.153
26th	.52	57	.50	67	.50	67	.53	75	.54	76	.57	72	.65	70	.65	67	.65	66	.66	65	.66	64	.523	63.4	.431
27th	.86	60	.85	58	.85	59	.86	60	.87	68	.87	65	.87	64	.95	57	.95	56	.86	54	.86	51	.838	59.0	.758
28th	.71	43	.71	54	.71	63	.71	65	.72	69	.73	72	.73	67	.73	65	.73	65	.74	54	.74	55	.774	57.1	.698
29th	.74	63	.75	63	.75	67	.75	70	.75	70	.75	68	.75	62	.82	55	.82	56	.82	57	.82	55	.737	62.2	.647
*30th	.90	61	.90	57	.90	55	.90	54	.90	55	.90	58	.70	58	.90	52	.90	54	.90	55	.90	53	.880	52.8	.815
Means	.690	42.1	.684	42.4	.688	43.4	.687	44.6	.693	46.4	.697	46.7	.697	45.3	.695	43.9	.691	43.4	.681	42.7	.677	41.2	.680	41.6	
B. at 32°	29.654		29.647		29.649		29.644		29.645		29.649		29.652		29.654		29.651		29.644		29.643		29.645		

HOURLY ABSTRACT OF THE READINGS OF THE BAROMETER AND ATTACHED THERMOMETER AT VAN RENSSELAER HARBOR, In October, 1854, in Lat. 78° 37′, Long. 70° 53′ W. of Greenwich.

Mercurial Barometer in cabin. 29 inches +. Readings in English inches and degrees of Fahrenheit.

Day.	1h.		2h.		3h.		4h.		5h.		6h.		7h.		8h.		9h.		10h.		11h.		Noon.		13h.	
	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°
1st	.90	51	.90	50	.90	49	.90	48	.90	48	.90	50	.90	55	.90	55	.95	57	.90	56	.95	59	.95	53	.93	54
*2d	.93	49	.93	47	.92	46	.92	46	.92	45	.92	44	.92	45	.92	48	.93	63	.93	57	.92	50	.92	50	.93	52
3d	1.00	44	1.00	44	1.00	44	1.00	43	1.00	54	1.03	56	1.03	56	1.03	58	1.00	58	1.00	54	1.03	51	1.02	55	1.02	53
4th	.95	51	.95	48	.95	48	.95	47	.95	46	.95	45	.95	44	.95	57	1.00	57	1.00	55	1.00	55	1.00	54	1.00	56
5th	1.15	46	1.15	46	1.15	50	1.15	49	1.15	49	1.15	49	1.15	54	1.15	59	1.15	59	1.15	58	1.14	57	1.11	59	1.10	58
6th	.86	65	.83	61	.79	58	.76	58	.73	58	.70	56	.65	58	.64	62	.63	66	.60	63	.58	64	.57	63	.54	63
7th	.50	59	.50	59	.50	59	.50	56	.50	55	.50	55	.50	65	.50	64	.44	60	.44	59	.42	59	.38	63	.38	65
8th	.20	64	.20	60	.20	58	.18	52	.15	57	.15	58	.17	59	.15	65	.15	67	.15	66	.15	65	.15	63	.15	56
9th	.30	58	.30	58	.32	58	.33	59	.34	49	.35	52	.35	51	.35	58	.37	62	.40	64	.42	55	.43	53	.45	54
10th	.58	47	.58	48	.58	48	.58	47	.60	46	.60	45	.64	45	.65	46	.65	54	.65	50	.65	53	.65	56	.68	53
11th	.72	45	.70	43	.70	43	.70	46	.65	47	.65	48	.65	49	.65	49	.65	51	.65	50	.54	55	.53	53	.48	55
12th	.23	49	.23	48	.23	45	.23	44	.23	37	.23	37	.21	43	.21	57	.22	56	.22	54	.20	55	.20	58	.20	54
13th	.06	43	.05	41	.03	40	.03	39	.03	38	.03	37	.02	37	.02	36	.10	48	.10	49	.15	54	.16	53	.17	52
14th	.15	52	.17	49	.19	47	.18	45	.17	45	.16	47	.15	48	.15	49	.15	56	.14	58	.13	57	.10	56	.09	58
15th	.00	57	.04	51	.10	46	.14	44	.20	43	.25	51	.30	59	.31	62	.35	60	.41	61	.50	61	.54	62	.55	65
16th	.84	55	.86	49	.85	51	.88	48	.90	56	.90	48	.92	51	.95	52	.97	58	.97	58	1.00	56	1.00	52	1.00	55
17th	.92	52	.89	50	.85	48	.87	47	.87	45	.87	45	.87	50	.87	48	.86	47	.85	49	.84	50	.84	54	.90	55
18th	.60	50	.57	47	.55	45	.54	46	.50	44	.50	44	.50	45	.50	50	.48	50	.48	49	.48	50	.48	59	.48	57
19th	.74	52	.76	52	.80	50	.80	48	.82	50	.83	52	.82	52	.81	57	.80	53	.80	53	.80	52	.82	51	.84	50
20th	.74	50	.74	48	.71	47	.69	46	.67	45	.65	46	.62	45	.62	51	.60	52	.59	50	.57	52	.57	52	.55	53
21st	.55	52	...	(50)	.56	48	.56	50	.57	45	.57	42	.58	39	.60	43	.60	52	.65	53	.66	48	.64	49	.63	50
*22d	...	...	...	...	.76	45	.79	46	.84	45	.84	44	.83	47	.84	49	.84	49	.84	48	.84	48	.86	50	.86	49
23d	...	...	...	...	1.02	52	1.02	50	1.00	51	1.05	52	1.05	52	1.05	53	1.04	53	1.05	53	1.05	52	1.04	49	1.04	49
24th	1.00	46	1.00	45	.96	46	.95	47	.96	45	.96	44	.97	44	.97	47	.97	47	.97	49	.97	51	1.00	52	1.00	52
25th	1.05	48	1.05	48	1.05	47	1.05	44	1.05	44	1.05	44	1.05	37	1.05	42	1.05	55	1.04	53	1.01	49	1.01	52	1.07	50
26th	1.20	46	1.20	45	1.17	45	1.17	45	1.15	39	1.14	37	1.12	43	1.12	46	1.11	51	1.11	53	1.13	52	1.14	51	1.12	51
27th	1.09	48	1.05	46	1.05	45	1.05	48	1.05	56	1.05	44	1.05	43	1.05	52	1.05	49	1.05	48	1.05	46	1.05	46	1.05	50
28th	.95	46	.94	48	.95	44	.95	40	.99	37	.99	36	.96	40	.94	45	.95	46	.94	48	.93	48	.93	45	.90	44
29th	.85	46	.85	44	.85	43	.85	43	.85	44	.85	41	.85	42	.85	46	.84	47	.85	44	.83	46	.83	45	.84	46
30th	.95	52	.97	52	.97	51	.97	48	.98	46	.99	46	.99	45	.99	48	.99	46	1.03	41	1.07	46	1.06	44	1.06	43
31st	1.12	42	1.12	41	1.15	45	1.12	44	1.10	37	1.09	33	1.08	34	1.07	35	1.04	32	1.03	25	1.03	21	1.00	31	1.00	44
Means	.738	50.7	.737	49.0	.736	48.1	.736	47.2	.736	46.6	.739	46.1	.737	47.6	.737	51.3	.740	53.6	.742	52.6	.743	52.2	.741	52.7	.742	53.1
B. at 32°	29.680		29.683		29.684		29.686		29.688		29.693		29.686		29.677		29.674		29.679		29.680		29.677		29.677	

Day.	14h.		15h.		16h.		17h.		18h.		19h.		20h.		21h.		22h.		23h.		Midn't.		Means.		B. 32°.
	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.
1st	.93	55	.93	60	.93	57	.93	52	.93	53	.93	55	.93	56	.90	57	.93	56	.93	53	.93	50	.920	53.7	.853
*2d	.95	48	.95	47	.95	47	.95	55	.99	59	1.02	50	1.04	60	1.04	55	1.04	50	1.04	49	1.04	45	.959	50.3	.900
3d	1.00	50	.99	50	.99	50	.99	59	.99	61	.98	61	.98	59	.98	57	.98	55	.97	53	.97	52	.999	53.2	.932
4th	1.00	56	1.00	57	1.00	55	1.08	52	1.08	60	1.10	64	1.15	64	1.15	62	1.15	59	1.14	59	1.14	57	1.025	54.5	.955
5th	1.10	59	1.10	59	1.09	58	1.09	62	1.06	64	1.04	62	1.00	59	.96	59	.95	62	.95	66	.90	65	1.087	57.0	1.011
6th	.52	62	.52	68	.54	67	.54	64	.54	67	.53	66	.53	68	.52	62	.52	63	.51	62	.51	60	.611	62.7	.519
7th	.36	64	.34	64	.34	65	.33	67	.30	67	.31	67	.28	66	.28	63	.28	64	.27	64	.27	64	.392	62.2	.303
8th	.15	58	.15	59	.20	60	.22	64	.23	63	.27	63	.27	64	.27	62	.27	63	.27	64	.27	61	.197	61.3	.110
9th	.46	55	.51	52	.51	51	.52	52	.55	60	.57	59	.58	52	.57	52	.57	49	.59	49	.58	50	.447	54.7	.378
10th	.68	46	.67	43	.69	44	.69	49	.75	55	.75	56	.76	57	.75	48	.75	49	.75	47	.74	45	.670	49.0	.616
11th	.44	44	.40	42	.40	49	.40	52	.40	55	.38	60	.35	58	.35	58	.33	63	.33	57	.31	54	.515	51.1	.455
12th	.15	52	.13	46	.13	48	.13	53	.12	56	.12	56	.10	52	.10	49	.10	50	.10	46	.08	45	.171	49.6	.115
13th	.17	51	.20	48	.20	53	.25	62	.27	65	.29	62	.31	60	.32	52	.30	55	.30	55	.30	52	.161	49.2	.107
14th	.09	56	.06	54	.06	52	.05	55	.05	59	.05	59	.05	60	.04	59	.02	59	.00	59	.00	59	.100	54.1	.034
15th	.60	59	.65	61	.66	59	.70	60	.75	61	.77	61	.77	62	.79	61	.80	59	.83	59	.83	58	.493	57.6	.417
16th	1.00	51	1.00	51	1.01	50	1.00	50	1.00	55	1.00	58	1.00	54	1.00	52	.99	52	.98	52	.96	52	.958	52.8	.893
17th	.90	55	.81	44	.80	43	.80	53	.80	58	.75	58	.73	56	.69	53	.67	51	.64	50	.63	50	.813	50.5	.755
18th	.50	49	.50	45	.54	43	.60	51	.62	55	.65	54	.65	52	.67	53	.68	53	.70	53	.72	53	.562	49.9	.505
19th	.84	51	.82	48	.82	50	.80	51	.80	52	.82	56	.80	52	.79	52	.78	53	.75	53	.76	53	.801	51.8	.739
20th	.53	51	.53	53	.52	52	.55	51	.55	53	.55	57	.55	57	.55	55	.55	55	.55	54	.55	53	.596	51.2	.536
21st	.63	51	.67	42	.68	43	.68	44	.71	47	.74	50	.74	52	.75	52	.75	53	.75	53	.77	50	.650	48.3	.597
*22d	.86	51	.86	53	.95	48	.95	51	.97	52	.98	53	.98	54	.99	55	.99	56	.99	56	.99	59	.882	50.1	.825
23d	1.04	51	1.05	52	1.05	53	1.05	50	1.05	50	1.05	50	1.04	51	1.03	52	1.02	51	1.00	47	1.00	46	1.033	51.3	.973
24th	1.01	53	1.03	52	1.03	50	1.00	52	1.02	57	1.04	60	1.04	56	1.05	51	1.05	52	1.05	55	1.06	54	1.002	50.3	.943
25th	1.07	58	1.11	43	1.12	47	1.16	56	1.17	58	1.20	64	1.20	63	1.20	56	1.20	56	1.21	55	1.21	54	1.101	51.0	1.041
26th	1.12	47	1.10	45	1.09	49	1.10	50	1.10	52	1.10	55	1.09	54	1.10	56	1.10	53	1.10	50	1.10	50	1.124	48.5	1.070
27th	1.05	46	1.05	48	1.05	50	1.04	52	1.02	51	1.02	47	1.02	46	1.02	46	1.02	45	1.02	48	1.02	48	1.042	47.8	.991
28th	.90	44	.88	43	.88	47	.88	47	.88	47	.86	47	.86	46	.86	46	.85	46	.85	46	.85	45	.911	44.6	.868
29th	.84	44	.84	46	.84	46	.84	46	.84	48	.84	45	.84	45	.85	45	.85	45	.86	44	.86	49	.845	45.0	.801
30th	1.07	41	1.08	42	1.08	45	1.08	46	1.10	48	1.11	44	1.11	41	1.11	43	1.11	43	1.11	43	1.11	43	1.045	45.4	1.000
31st	1.00	50	1.00	44	1.00	46	1.00	40	1.00	42	1.00	43	1.00	42	1.00	39	1.00	41	1.00	47	1.00	46	1.040	39.3	1.011
Means	.741	51.9	.740	50.4	.747	50.9	.755	53.2	.763	55.8	.768	56.2	.766	55.4	.764	53.6	.761	53.6	.759	53.2	.757	52.3	.747	51.5	
B. at 32°	29.679		29.682		29.688		29.689		29.691		29.694		29.694		29.698		29.695		29.693		29.694		29.686		

HOURLY ABSTRACT OF THE READINGS OF THE BAROMETER AND ATTACHED THERMOMETER AT VAN RENSSELAER HARBOR, In November, 1854, in Lat. 78° 37′, Long. 70° 53′ W. of Greenwich.

Mercurial Barometer in cabin. 29 inches +. Readings in English inches and degrees of Fahrenheit.

Day.	1h.		2h.		3h.		4h.		5h.		6h.		7h.		8h.		9h.		10h.		11h.		Noon.		13h.	
	Inch	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°
1st	1.00	45	1.00	45	1.00	45	1.00	45	1.00	43	1.00	42	1.01	43	1.01	45	1.01	46	1.01	47	1.02	44	1.02	40	1.03	44
2d	1.04	43	1.02	43	1.02	43	1.00	44	.98	44	.95	42	.92	41	.92	47	.89	47	.87	46	.83	45	.81	43	.80	45
3d	.80	42	.80	40	.82	40	.83	41	.84	38	.87	38	.87	39	.87	40	.90	49	.91	48	.90	41	.92	42	.92	41
*4th																										
5th																										
6th																										
7th																										
8th																										
9th																										
10th																										
11th	.90	60	.94	58	.90	56	.89	51	.78	46	.75	47	.70	47	.70	52	.70	52	.65	52	.62	53	.61	52	.69	58
12th	.60	58	.60	57	.60	55	.60	55	.60	53	.62	55	.65	58	.65	59	.73	59	.74	60	.74	57	.74	59	.75	56
13th	.80	58	.80	60	.80	54	.80	54	.80	54	.80	54	.80	59	.80	58	.71	62	.71	61	.74	55	.74	53	.75	50
14th	.70	54	.70	54	.70	53	.73	53	.75	54	.75	54	.76	56	.78	58	.84	57	.84	54	.84	51	.84	50	.79	51
15th	1.02	54	.99	56	1.03	51	1.03	53	1.02	56	1.02	56	1.02	55	1.02	51	.94	53	.99	50	1.00	49	1.00	47	1.00	50
16th	.95	61	.95	62	.95	52	.95	54	.95	57	.95	56	.96	59	.99	58	1.00	58	1.05	57	.99	51	.99	53	1.00	58
17th	1.00	57	1.00	56	1.10	49	1.10	48	1.10	50	1.10	51	1.10	52	1.10	53	1.10	58	1.09	57	1.09	54	1.09	53	1.00	58
18th	1.00	38	1.00	36	1.11	33	1.11	32	...	...	...	...	1.21	41	1.25	42	1.34	51	1.35	51	1.34	48	1.35	48	1.33	56
19th	1.20	62	1.17	60	1.15	43	1.08	41	1.09	40	1.05	35	1.00	48	1.00	50	1.00	53	1.00	54	1.00	52	1.00	56	1.00	58
20th	1.08	48	1.09	45	1.10	42	1.10	40	1.12	46	1.12	45	1.25	55	1.25	58	1.35	60	1.33	56	1.33	51	1.33	52	1.34	61
21st	1.43	46	1.43	43	1.42	42	1.41	41	1.37	39	1.35	35	1.31	42	1.31	49	1.31	43	1.29	48	1.23	47	1.18	48	1.15	52
22d	.76	49	.65	43	.64	41	.63	41	.60	40	.59	40	.55	42	.60	43	.56	45	.55	53	.53	49	.53	53	.53	60
23d	.55	46	.57	45	.60	44	.60	43	.60	42	.60	40	.60	41	.60	49	.55	51	.59	52	.64	47	.64	52	.67	56
24th	.67	52	.64	50	.64	48	.64	47	.60	45	.60	44	.60	51	.60	58	.61	60	.61	57	.59	54	.59	58	.59	59
25th	.70	47	.69	44	.73	49	.75	48	.75	47	.75	47	.75	45	.80	56	.81	63	.84	60	.84	60	.85	61	.87	62
26th	.85	52	.88	52	.89	45	.89	48	.87	46	.87	44	.87	41	.88	46	.89	60	.90	61	.90	56	.90	53	.80	52
27th	.87	56	.87	56	.83	45	.80	44	.77	44	.74	40	.74	49	.74	56	.73	58	.68	52	.66	51	.65	54	.62	54
28th	.20	50	.17	48	.13	46	.12	45	.10	42	.05	40	.05	45	.05	48	.05	56	.09	51	.09	54	.10	57	.10	57
29th	.50	47	.51	45	.53	44	.58	43	.58	42	.59	37	.65	40	.67	41	.70	52	.73	53	.72	52	.75	52	.76	50
30th	.90	53	.95	52	.94	51	.95	49	.95	46	.95	45	.98	49	.92	51	.95	55	.96	53	.97	51	.97	52	.97	53
Means	.849	51.2	.844	50.0	.853	46.6	.852	46.1	.842	45.6	.836	44.6	.841	47.7	.848	50.8	.855	54.3	.860	53.6	.853	51.0	.852	51.7	.842	54.0
B. at 32°	29.789		29.786		29.805		29.805		29.797		29.793		29.790		29.790		29.787		29.793		29.793		29.790		29.774	

Day.	14h.		15h.		16h.		17h.		18h.		19h.		20h.		21h.		22h.		23h.		Midn't.		Means.		B. 32°.
	Inch	°	Inch.	°	Inch	°	Inch	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch	°	Inch.	°	Inch.	°	Inch.	°	Inch.
1st	1.03	46	1.05	51	1.05	51	1.05	52	1.06	53	1.06	50	1.07	48	1.05	47	1.05	46	1.06	45	1.06	45	1.029	46.2	.981
2d	.80	46	.80	48	.80	48	.80	49	.80	48	.80	45	.80	46	.80	45	.80	43	.80	44	.80	44	.869	45.8	.823
3d	.92	44	.92	47	.92	47	.93	49	.90	49	.89	52	.85	51	.85	50	.85	51	.71	50	.70	45	.862	44.7	.819
*4th																									
5th																									
6th																									
7th																									
8th																									
9th																									
10th																									
11th	.60	57	.48	57	.41	57	.55	56	.52	57	.53	55	.55	56	.55	55	.55	55	.56	58	.56	57	.650	54.3	.582
12th	.75	58	.75	60	.75	61	.76	59	.76	58	.76	57	.76	55	.77	55	.76	54	.76	56	.76	59	.707	57.2	.631
13th	.73	54	.71	59	.71	59	.71	59	.71	57	.72	58	.70	56	.70	54	.70	55	.70	56	.70	57	.743	56.5	.669
14th	.77	50	.75	43	.75	52	.84	54	.96	55	.97	51	.98	51	.99	53	1.00	52	1.00	46	1.00	52	.834	52.4	.771
15th	1.00	51	.97	51	.96	52	.95	54	.95	55	1.00	51	1.00	52	.96	53	.95	52	.95	56	.94	57	.988	52.7	.924
16th	1.00	59	1.00	50	1.03	52	1.03	48	1.05	44	1.05	49	1.09	52	1.07	51	1.08	48	1.09	47	1.09	47	1.011	53.4	.944
17th	.98	61	1.08	57	1.11	61	1.12	58	1.11	58	1.10	51	1.10	50	1.11	52	1.11	49	1.11	44	1.11	40	1.084	53.2	1.018
18th	1.35	54	1.40	55	1.40	56	1.37	52	1.35	52	1.35	52	1.31	53	1.28	52	1.27	53	1.27	52	1.25	50	1.262	47.1	1.212
19th	1.00	60	1.00	59	1.00	59	1.03	63	1.04	62	1.04	64	1.05	60	1.04	56	1.06	52	1.06	50	1.07	48	1.047	53.5	.980
20th	1.35	63	1.39	60	1.45	64	1.49	62	1.50	66	1.50	61	1.45	57	1.45	54	1.45	51	1.45	49	1.44	46	1.321	53.8	1.253
21st	1.12	52	1.11	51	1.09	52	1.05	60	1.00	60	.95	57	.99	50	.85	51	.82	49	.75	47	.74	45	1.152	47.9	1.100
22d	.53	60	.53	58	.52	61	.52	59	.52	58	.52	55	.52	58	.52	56	.55	53	.56	51	.55	49	.565	50.7	.506
23d	.63	58	.68	58	.70	61	.85	59	.86	61	.74	60	.74	60	.72	57	.72	55	.72	54	.72	52	.662	51.8	.600
24th	.58	59	.60	62	.62	63	.65	64	.65	59	.65	62	.65	63	.68	60	.70	58	.71	55	.71	53	.632	55.9	.559
25th	.89	66	.89	63	.89	66	.92	56	.92	62	.90	62	.90	61	.90	59	.90	59	.90	56	.90	55	.835	56.4	.761
26th	.81	54	.78	54	.92	60	.92	59	.91	59	.90	60	.90	55	.91	53	.91	52	.90	50	.89	49	.881	52.5	.718
27th	.63	58	.58	65	.51	58	.51	58	.51	58	.43	57	.40	58	.35	59	.33	57	.25	55	.23	52	.601	53.9	.534
28th	.17	58	.20	59	.25	61	.26	57	.30	58	.30	60	.35	59	.36	56	.40	54	.42	51	.46	49	.199	52.5	.136
29th	.77	50	.85	54	.88	56	.88	54	.87	52	.91	56	.91	56	.93	56	.93	54	.94	55	.94	58	.753	50.0	.696
30th	.98	50	.99	54	1.00	50	1.00	55	1.00	54	1.00	58	1.00	58	1.00	55	.98	54	.99	52	1.00	52	.971	52.2	.908
Means	.843	55.1	.848	55.4	.857	56.8	.878	56.3	.880	56.3	.873	55.8	.873	55.0	.863	53.9	.864	52.4	.855	51.3	.853	50.5	.855	51.9	
B. at 32°	29.772		29.776		29.782		29.804		29.806		29.801		29.802		29.796		29.801		29.794		29.794		29.792		

HOURLY ABSTRACT OF THE READINGS OF THE BAROMETER AND ATTACHED THERMOMETER AT VAN RENSSELAER HARBOR,

In December, 1854, in Lat. 78° 37′, Long. 70° 53′ W. of Greenwich.

Mercurial Barometer in cabin. 29 inches +. Readings in English inches and degrees of Fahrenheit.

Day.	1h.		2h.		3h.		4h.		5h.		6h.		7h.		8h.		9h.		10h.		11h.		Noon.		13h.	
	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°
1st	1.02	50	.95	48	.90	40	.90	39	.90	37	.91	31	.90	33	.90	37	.90	50	.97	60	.85	44	.85	43	.79	40
2d	.71	36	.71	35	.70	35	.70	34	.70	34	.70	33	.70	37	.69	42	.77	52	.80	50	.82	49	.84	43	.87	43
3d	.68	48	.70	44	.70	44	.69	42	.68	40	.68	39	.69	48	.70	58	.70	56	.70	54	.70	53	.70	51	.71	55
4th	.85	45	.85	44	.85	44	.85	42	.85	39	.86	35	.86	43	.86	51	.89	52	.89	53	.88	48	.88	50	.90	50
5th	.99	30	.99	28	1.00	26	1.05	25	1.12	25	1.12	24	1.11	40	1.12	47	1.14	46	1.15	46	1.16	45	1.15	50	1.12	47
6th	1.15	36	1.14	32	1.15	36	1.13	39	1.10	43	1.07	44	1.05	45	1.02	46	.96	48	.90	44	.88	46	.80	50	.75	54
7th	...	...	...	...	.40	42	.40	41	.40	43	.40	48	.41	51	.41	49	.41	49	.40	50	.40	49	.39	45	.39	43
8th	...	...	...	...	...	...	...	...	...	45	...	48	.70	59	.70	59	.75	60	.77	59	.82	60	.83	55	.85	53
9th	...	...	...	...	...	45	...	44	...	...	...	...	.75	42	.72	48	.67	59	.65	55	.60	43	.56	48	.50	50
*10th	...	...	...	...	.00	40	.00	43	...	...	...	...	*.94	48	*.96	49	*.97	58	*.98	57	*.99	57	*.99	57	.01	56
11th	...	...	...	...	.35	44	.39	44	.41	43	.45	42	.49	48	.50	48	.52	48	.53	42	.54	49	.53	49	.55	48
12th	...	...	...	...	.50	48	.45	48	.43	49	.41	50	.40	51	.36	51	.36	52	.35	52	.35	52	.36	50	.40	50
13th	...	...	.50	49	.50	50	.47	52	.43	53	.39	57	.35	58	.35	59	.35	57	.37	58	.40	56	.45	58	.47	56
14th	.70	48	.70	53	.70	54	.70	56	.70	60	.70	62	.71	64	.75	65	.78	60	.80	55	.80	47	.83	50	.83	51
15th	.84	56	.83	57	.81	57	.76	56	.72	52	.70	49	.70	50	.67	52	.65	54	.62	54	.58	49	.54	49	.54	51
16th	.71	50	.71	51	.76	49	.78	48	.80	46	.80	46	.80	45	.80	48	.81	50	.81	50	.81	51	.81	50	.85	50
17th	1.00	52	1.02	49	1.02	45	1.03	46	1.00	46	.99	45	.97	53	.96	53	.96	48	.96	49	.95	50	.93	51	.88	55
18th	.45	42	.45	40	.45	40	.45	37	.44	36	.44	36	.45	57	.47	56	.48	51	.50	52	.57	55	.62	57	.68	60
19th	.80	46	.80	45	.80	44	.80	44	.80	43	.80	43	.82	48	.83	52	.85	57	.85	57	.85	58	.86	61	.87	63
*20th	.73	46	.73	44	.73	41	.70	40	.68	39	.63	43	.57	48	.55	53	.50	58	.46	54	.41	51	.36	52	.32	55
21st	.21	45	.23	44	.24	43	.30	41	.35	39	.41	38	.47	52	.47	54	.50	65	.55	60	.57	60	.58	59	.59	60
22d	.76	44	.76	45	.76	45	.77	46	.77	44	.78	42	.78	55	.81	60	.85	62	.85	58	.88	57	.85	57	.85	59
23d	.86	45	.86	45	...	...	.87	43	.87	42	.85	42	.82	42	.80	60	.80	46	.80	41	.80	40	.80	40	.83	44
24th	...	...	.80	32	.80	32	.80	31	.80	31	.83	30	.85	32	.85	36	.85	40	.87	45	.87	42	.88	41	.91	37
25th	1.05	45	...	...	1.00	46	.98	39	.97	37	.95	35	.96	35	.95	46	.95	54	.92	55	.92	57	.92	59	.92	60
26th	1.02	48	1.02	45	1.02	44	1.02	40	1.02	37	1.02	35	1.02	34	1.02	48	1.02	49	1.03	43	1.05	41	1.07	41	1.05	44
27th	.93	45	.91	42	.87	40	.85	38	.83	39	.80	45	.79	50	.75	58	.73	54	.70	48	.65	46	.63	44	.61	48
28th	.41	40	.41	39	.40	39	.40	37	.47	39	.52	44	.56	48	.57	50	.59	54	.59	53	.59	54	.58	54	.58	55
29th	.55	53	.56	50	.56	47	.56	51	.56	53	.56	54	.57	55	.58	54	.58	56	.61	54	.65	52	.64	57	.65	59
30th	.97	45	1.02	44	1.05	43	1.07	43	1.07	42	1.05	40	1.03	48	1.05	50	1.05	51	1.03	53	1.01	55	1.00	57	1.00	56
31st	.82	61	.82	60	.82	54	.87	52	.92	50	.98	51	1.00	51	1.01	54	1.03	58	1.05	59	1.11	59	1.14	63	1.16	64
Means	.720	46.0	.724	44.7	.715	43.5	.716	42.8	.717	42.4	.717	42.6	.717	47.4	.715	51.4	.722	53.4	.725	52.3	.725	50.8	.722	51.3	.724	52.1
B. at 32°	29.674		29.681		29.675		29.679		29.680		29.680		29.667		29.655		29.656		29.662		29.666		29.662		29.662	

Day.	14h.		15h.		16h.		17h.		18h.		19h.		20h.		21h.		22h.		23h.		Midn't		Means.		B. 32°.
	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.
1st	.79	40	.80	47	.80	48	.76	44	.75	43	.73	...	.72	...	.70	52	.70	...	.70	42	.71	...	.829	43.7	.789
2d	.87	48	.89	55	.89	54	.89	52	.90	51	.86	48	.83	45	.81	46	.78	45	.75	50	.75	49	.789	44.4	.746
3d	.74	55	.81	57	.81	53	.83	53	.85	53	.85	54	.85	55	.84	52	.84	46	.84	48	.85	48	.756	50.2	.698
4th	.91	51	.93	50	.95	49	.95	55	.95	56	.97	59	.97	57	.96	49	.96	45	.96	42	.97	29	.906	47.4	.855
5th	1.12	52	1.11	54	1.10	52	1.21	51	1.21	52	1.22	57	1.21	56	1.21	49	1.21	45	1.20	42	1.19	38	1.134	42.8	1.096
6th	.73	58	.71	55	.70	54	.65	53	.64	54	.60	53	.57	49	.50	45	.48	41	.44	52	.45	53	.815	47.1	.765
7th	.40	46	.40	49	.41	48	.42	52	.42	53	.42	52	.45	50	...	...	...	...	...	...	...	...	.425	47.9	.374
8th	.88	51	.88	50	.87	47	.90	46	.92	45	.91	45	.92	45	.92	46	.92	49	.92	50	.92	51	.799	50.3	.741
9th	.48	54	...	...	...	...	.34	50	.31	46	.26	45	.25	46	.17	47	.12	48	...	...	...	...	.512	47.9	.460
*10th	.04	58	.05	62	.10	63	.14	59	.16	58	.18	56	.22	55	.22	52	.25	49	...	...	...	...	.074	52.0	.012
11th	.58	51	.60	54	.60	52	.63	51	.64	53	.64	53	.64	51	.64	47	.64	49	...	...	...	...	.532	48.1	.480
12th	.40	51	.42	50	.46	47	.47	48	.49	53	.50	56	.50	54	.50	49	.49	50	...	...	...	...	.446	50.3	.388
13th	.49	59	.50	58	.55	58	.56	59	.59	59	.60	61	.63	60	.47	64	.54	50	.59	52	.64	45	.487	55.7	.415
14th	.85	51	.89	50	.90	54	.92	55	.93	53	.92	53	.91	52	.91	52	.91	51	.88	50	.86	49	.816	54.0	.749
15th	.53	52	.53	53	.56	51	.56	51	.58	52	.60	53	.64	53	...	...	...	...	...	...	...	...	.652	52.3	.589
16th	.87	53	.90	55	.91	54	.91	53	.91	54	.94	45	.95	48	.97	50	.99	51	.99	52	1.00	50	.858	50.0	.801
17th	.86	56	.85	57	.80	57	.80	55	.82	56	.82	59	.82	50	.82	50	.82	51	.80	50	.80	48	.903	51.3	.843
18th	.71	62	.75	64	.73	62	.74	59	.74	58	.74	48	.75	44	.75	42	.75	41	...	...	...	...	.611	49.4	.557
19th	.89	63	.90	59	.90	60	.88	65	.87	66	.85	65	.82	68	...	...	...	...	...	...	...	...	.830	55.4	.758
*20th	.29	61	.25	63	.24	62	.23	59	.22	58	.19	63	.19	60	.18	56	.18	53	.18	50	.20	46	.405	52.3	.341
21st	.62	61	.64	62	.67	64	.69	62	.70	61	.75	65	.75	60	...	...	.75	48	.75	48	.76	49	.554	53.9	.488
22d	.86	62	.87	65	.89	64	.90	60	.90	58	.87	50	.86	44	.83	48	.84	50	.86	46	.87	45	.834	52.7	.770
23d	.87	52	.80	45	.80	58	.80	59	.80	54	.80	58	.80	55	...	...	.80	46	.80	44	.80	40	.820	47.3	.770
24th	.94	31	.99	48	1.00	49	1.02	54	1.02	53	1.03	54	1.07	55	1.11	49	1.16	50	1.12	46	1.07	42	.935	41.5	.900
25th	.92	65	.92	68	.92	65	.92	60	.93	58	.91	56	.90	50	.87	50	.87	50	.90	50	1.05	45	.942	51.2	.882
26th	1.03	47	.98	51	1.00	53	1.03	55	1.05	54	1.04	53	1.03	48	1.00	45	1.00	45	1.00	43	1.00	40	1.022	45.1	.978
27th	.60	54	.60	57	.58	59	.54	57	.52	57	.50	55	.48	53	.47	50	.45	45	.45	42	.41	42	.652	48.7	.600
28th	.59	57	.60	60	.60	62	.60	63	.60	63	.60	60	.57	58	.55	55	.55	54	.54	55	.55	55	.542	52.0	.480
29th	.68	62	.70	63	.70	61	.75	62	.78	64	.79	65	.87	60	.95	55	.95	53	.94	50	.95	48	.695	55.7	.623
30th	1.00	54	.89	51	.85	53	.83	56	.84	57	.84	58	.84	57	.84	61	.83	62	.82	62	.81	63	.949	52.5	.885
31st	1.21	63	1.27	60	1.31	61	1.33	64	1.39	64	1.40	66	1.41	63	1.42	65	1.42	65	1.45	62	1.45	59	1.158	59.5	1.075
Means	.734	54.2	.737	55.6	.741	55.6	.748	55.6	.756	55.4	.753	55.2	.755	53.2	.745	51.4	.746	49.6	.745	48.6	.752	47.0	.732	50.1	
B. at 32°	29.666		29.665		29.669		29.676		29.685		29.682		29.689		29.685		29.690		29.692		29.703		29.675		

HOURLY ABSTRACT OF THE READINGS OF THE BAROMETER AND ATTACHED THERMOMETER AT VAN RENSSELAER HARBOR, In January, 1855, in Lat. 78° 37′, Long. 70° 53′ W. of Greenwich.

Mercurial Barometer in cabin. 29 inches +. Readings in English inches and degrees of Fahrenheit.

Day.	1h.		2h.		3h.		4h.		5h.		6h.		7h.		8h.		9h.		10h.		11h.		Noon.		13h.	
	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°
1st	1.45	55	1.45	53	1.45	51	1.45	50	1.45	49	1.45	49	1.45	48	1.45	57	1.45	60	1.45	62	1.45	65	1.45	63	1.45	62
2d	1.19	45	1.12	41	1.10	39	1.12	39	1.13	40	1.15	42	1.16	53	1.15	58	1.15	57	1.14	57	1.13	59	1.15	58	1.15	58
3d	1.25	46	1.24	43	1.22	40	1.21	38	1.20	39	1.19	42	1.19	45	1.16	47	1.15	49	1.15	56	1.15	58	1.14	59	1.14	58
4th	.92	48	.91	45	.89	43	.89	42	.87	41	.85	42	.85	56	.85	58	.79	57	.78	57	.78	55	.75	58	.75	59
5th	...	...	.74	40	.77	39	.79	38	.79	37	.80	37	.83	39	.86	44	.88	52	.89	50	.90	53	.93	54	.95	58
6th	...	...	...	...	1.05	38	1.05	35	1.09	33	1.17	32	1.19	36	1.22	47	1.28	51	1.30	50	1.32	52	1.43	54	1.43	55
7th	...	...	...	...	1.45	20	1.44	30	1.44	...	1.45	...	1.45	...	1.49	...	1.53	...	1.54	...	1.54	...	1.54	...	1.54	...
8th	1.44	...	1.43	46	1.40	...	1.38	...	1.34	...	1.31	...	1.27	...	1.22	...	1.18	...	1.16	...	1.14	...	1.12	...	1.09	...
9th	.75	51	.75	50	.78	43	.75	42	.75	41	.74	41	.74	40	.80	46	.78	42	.76	41	.75	44	.74	46	.74	48
10th	.80	46	...	...	.80	...	.78	...	.79	32	.80	32	.80	46	.80	50	.80	...	.80	...	.80	...	.80	...	.80	49
11th	1.00	...	1.00	...	.98	...	.99	...	1.01	37	1.06	40	1.08	44	1.08	50	1.09	...	1.10	...	1.12	...	1.13	...	1.14	...
12th	1.20	...	1.20	...	1.14	...	1.12	...	1.10	...	1.09	...	1.08	...	1.06	...	1.04	...	.99	...	.96	...	.94	...	.92	42
13th	.65	...	.65	...	.61	...	.61	...	.61	45	.60	45	.54	46	.54	46	.61	...	.62	...	.63	...	.63	...	.63	48
14th	.98	...	.97	...	.95	...	.96	...	.96	42	.95	42	.94	43	.95	44	.96	...	.95	...	.93	...	.91	...	.90	49
15th	.70	...	.72	...	.70	...	.68	...	.67	41	.66	40	.66	40	.66	42	.69	...	.70	...	.72	...	.74	...	.75	53
16th	.90	...	.91	...	.90	...	.90	...	.90	37	.89	38	.88	40	.86	45	.85	...	.85	...	.86	...	.86	...	...	...
17th	.90	...	.90	...	.89	...	.89	...	.89	41	.89	42	.90	49	.91	50	.93	...	.94	...	.95	...	.96	...	...	...
18th	.90	...	.91	...	1.23	...	1.22	...	...	...	...	...	1.19	49	1.17	50	1.15	...	1.14	...	1.14	...	1.15	...	...	...
19th	1.33	...	1.34	...	1.30	...	1.32	...	...	...	...	...	1.36	46	1.37	48	1.40	...	1.40	...	1.40	...	1.40	...	...	...
*20th	1.67	...	1.67	...	1.69	...	1.70	...	...	...	...	...	...	...	...	...	1.81	...	1.82	...	1.84	...	1.85	...	...	...
*21st	2.02	...	2.02	...	2.02	...	2.02	...	...	...	...	...	...	...	...	...	1.98	...	1.96	...	1.94	...	1.94	...	...	...
*22d	1.75	...	1.72	...	1.70	...	1.69	...	...	...	...	...	...	...	...	...	1.66	...	1.66	...	1.66	...	1.65	...	...	...
*23d	1.58	...	1.58	...	1.55	...	1.52	...	...	...	...	...	...	...	...	...	1.52	...	1.51	...	1.50	...	1.51	...	1.52	...
*24th	1.33	...	1.35	...	1.24	...	1.25	...	1.19	...	1.18	...	1.18	48	1.18	50	1.18	...	1.17	...	1.17	...	1.17	...	1.16	...
25th	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26th	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27th	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28th	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29th	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30th	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31st	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Means	1.173	46.4	1.166	44.8	1.159	43.4	1.155	42.8	1.152	42.4	1.155	42.9	1.153	45.5	1.155	48.0	1.161	48.8	1.157	49.0	1.157	49.9	1.162	50.4	1.164	50.9
B. at 32°	30.125		30.123		30.119		30.117		30.115		30.117		30.108		30.103		30.107		30.102		30.100		30.103		30.104	
*	30.101		30.099		30.095		30.093		30.091		30.093		30.084		30.079		30.083		30.078		30.076		30.079		30.080	

Day.	14h.		15h.		16h.		17h.		18h.		19h.		20h.		21h.		22h.		23h.		Midn't.		Means.		B. 32.°
	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.
1st	1.45	63	1.41	63	1.38	61	1.35	60	1.32	59	1.28	57	1.25	54	1.20	50	1.23	50	1.20	48	1.18	48	1.379	55.7	1.306
2d	1.16	59	1.19	60	1.20	61	1.20	61	1.21	60	1.22	58	1.23	57	1.24	55	1.24	54	1.24	54	1.25	48	1.176	53.0	1.109
3d	1.10	57	1.09	59	1.07	61	1.06	65	1.05	64	1.05	64	1.04	63	1.04	62	1.03	59	1.00	53	.94	51	1.119	53.2	1.051
4th	.75	60	.75	61	.75	60	.74	58	.74	58	.75	56	.75	53	.75	48	.75	52	.75	50	.76	50	.797	52.8	.732
5th	.95	60	.95	61	.86	62	.98	60	.99	58	1.05	55	1.12	52	1.23	50	1.26	45	1.29	46	1.32	48	.953	49.3	.898
6th	1.44	57	1.46	56	1.46	57	1.47	58	1.50	...	1.45	51	1.47	50	1.48	48	...	...	1.48	38	1.45	31	1.335	46.3	1.286
7th	1.54	...	1.53	...	1.53	...	1.53	...	1.53	...	1.52	...	1.50	...	1.47	48	1.47	50	1.47	50	1.45	50	1.495	38.4	1.468
8th	1.05	...	1.00	...	.98	...	.97	51	.95	55	.90	59	.88	56	.85	...	.82	50	.84	40	.80	50	1.105	49.9	1.046
9th	.76	49	.77	50	.79	50	.80	...	.80	...	.80	50	.80	52	.80	50	.80	50	.80	...	.80	46	.773	46.7	.724
10th	.80	50	.80	52	.80	51	.80	52	.80	51	.80	50	.80	48	...	...	.98	50	.98	...	.99	...	.825	46.5	.777
11th	1.16	...	1.18	...	1.19	...	1.20	...	1.20	...	1.23	...	1.24	...	1.20	48	1.20	46	1.20	...	1.20	49	1.124	46.6	1.076
12th	.90	43	.86	42	.82	44	.71	45	.70	46	.69	48	.69	46	.80	48	.70	48	.65	49	.65	...	.917	45.6	.872
13th	.65	50	.67	51	.70	49	.73	49	.77	50	.79	48	.83	51	.87	50	.91	44	.91	40	.92	40	.695	46.8	.647
14th	.90	50	.91	50	.93	49	.94	49	.94	50	.95	48	.95	47	...	...	...	...	...	...	...	...	.922	45.7	.876
15th	.75	54	.77	52	.79	50	.80	49	.81	50	.83	51	.83	49	...	...	...	...	...	...	...	...	.753	46.3	.706
16th	...	...	...	...	...	...	...	...	...	...	.85	50	.85	51	.84	54	.86	52	.87	50	...	...	.868	46.0	.822
17th	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1.20	50	1.20	46	1.19	56	1.16	50	1.017	48.5	.964
18th	...	...	...	...	...	...	1.15	...	1.14	...	1.18	47	1.20	48	...	...	...	...	...	...	...	...	1.163	48.7	1.109
19th	...	...	...	...	...	...	1.61	...	1.63	...	...	...	...	...	...	...	1.66	58	1.69	54	1.67	48	1.480	51.6	1.418
*20th	...	...	...	...	...	...	1.96	...	1.96	...	...	...	...	...	...	...	...	...	...	...	...	...	1.856	48.4	1.803
*21st	...	...	...	...	...	...	1.90	...	1.89	...	...	...	...	...	...	...	...	...	...	...	...	...	1.927	51.0	1.867
*22d	...	...	...	...	...	...	1.63	...	1.62	...	...	...	...	...	...	...	...	...	...	...	...	...	1.647	50.1	1.589
*23d	1.52	...	1.52	...	1.52	...	1.51	...	1.51	...	...	...	...	...	1.50	...	1.50	...	1.48	...	1.47	...	1.517	50.8	1.458
*24th	1.16	...	1.15	...	1.14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1.155	49.0	1.100
25th	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...*	1.148	49.1	1.092
26th	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1.445	50.7	1.386
27th	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1.499	52.5	1.434
28th	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1.482	52.3	1.417
29th	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	.964	52.8	.899
30th	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	.592	51.3	.531
31st	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	.360	49.1	.305
Means	1.166	51.6	1.168	51.9	1.167	51.9	1.172	51.9	1.173	51.9	1.175	51.4	1.177	50.8	1.185	50.4	1.186	49.0	1.182	47.9	1.174	47.4	1.166	48.6	
B. at 32°	30.104		30.106		30.105		30.110		30.111		30.114		30.118		30.127		30.131		30.130		30.124		30.113		
*	30.080		30.082		30.081		30.086		30.087		30.090		30.094		30.103		30.107		30.106		30.100		30.089		

NOTES TO PRECEDING ABSTRACTS.

September, 1853. During the whole month, the readings were taken from the aneroid barometer. They were converted by means of a table to the corresponding readings of the mercurial barometer.

11th. The dates before the 11th, were changed from nautical into civil reckoning.

14th. At 3 P. M., the aneroid barometer was removed from the cabin to the deck; a change of six feet of greater elevation.

19th. At 9 A. M., the barometer was brought from deck to cabin (six feet lower). During the hours 7 and 8 A. M., it became colder than the scale could register.

14th–19th. A correction of +0.006 inch has been applied to the barometer readings, to refer them to the level of the cabin.

October, 1853. 24th. From this day, the readings of the mercurial barometer are given. The position was *in house on deck*.

25th. Readings at 1, 2, 3, and 4 P. M., supplied from the aneroid in cabin.

January, 1854. 23d. The star prefixed to the hours between 9 A. M. and midnight, indicates that the decimals belong to 28 inches.

24th and 25th. The star indicates 28 inches as above.

February, 1854. 18th and 19th. The star in the place of the units indicates that the decimals belong to 28 inches.

June, 1854. 22d and 23d. The deck house was removed; the mercurial barometer, however, remained on deck.

July, 1854. 31st. Between 1 A. M. and 2 P. M., the readings of the aneroid appear to have been inadvertently inserted in the column for the mercurial barometer. In the abstract the readings were accordingly exchanged.

August, 1854. 27th. The readings of the two barometers between the hours 5 A. M. and 12 P. M. appear to have been accidentally exchanged, as indicated by the temperature readings. After 9 A. M. the aneroid was read, and its indications were changed to those of the mercurial barometer.

September, 1854. 4th. The sudden rise of the barometer between 6 and 7 A. M. is indicated by both instruments. There is apparently no cause for this singular change, so far as is shown by the remaining meteorological observations at these hours.

10th and 11th. Barometer not read during four hours, on account of the darkness.

14th. The readings at 7 and 8 P. M. were changed from 29.65 to 29.56; a correction confirmed by the aneroid readings.

30th. The barometer stand removed to the most forward stanchion of the cabin. Height above the water-line, one foot six inches.

October, 1854. 2d. The original record has the readings 30.2, 30.4, etc., for the hours 19 P. M., etc. It should evidently read 30.02, 30.04, etc., as given in the preceding abstract, and as confirmed by the aneroid readings. Similar mistakes in the displacement of a decimal have occurred in two or three other cases.

22d. Mercurial barometer in cabin against stanchions amidships. Height of cistern, six feet.

November, 1854. 4th to 10th. No record for this interval.

December, 1854. 10th. The star in front of the figures indicates that the decimal places refer to 28 inches.

20th. The mercurial and aneroid barometers were removed to-day; the mercurial barometer being placed six inches lower than before, and the aneroid placed two feet below it.

January, 1855. 20th, 21st, 22d, 23d, and 24th. The temperature readings for these days have been taken from page 422 of the second volume of the Narrative.

25th, 26th, 27th, 28th, 29th, 30th, and 31st. The barometer and temperature readings have been taken from the same page of the Narrative.

The last horizontal column of the reduced barometer readings is derived from the preceding column by subtracting 0.024 inch, so as to allow for the introduction of the means of the last seven days.

February, March, and April, 1855. For these months the original record could not be found. The daily and monthly means of the atmospheric pressure (and corresponding temperature), will be found in Appendix No. XII. of the second volume of the Narrative.

Diurnal Variation of the Atmospheric Pressure.—The following table exhibits the diurnal change of the barometric pressure, for each month of the year and for the whole year, as made out from the preceding abstract. For the months between September and January (inclusive), the mean from the two sets is given.

ABSTRACT OF THE MEAN HOURLY READINGS OF THE (REDUCED) BAROMETER AT THE LEVEL OF THE SEA, FROM OBSERVATIONS AT VAN RENSSELAER HARBOR, BETWEEN SEPT. 1853 AND JAN. 1855.

Atmospheric Pressure in English inches.

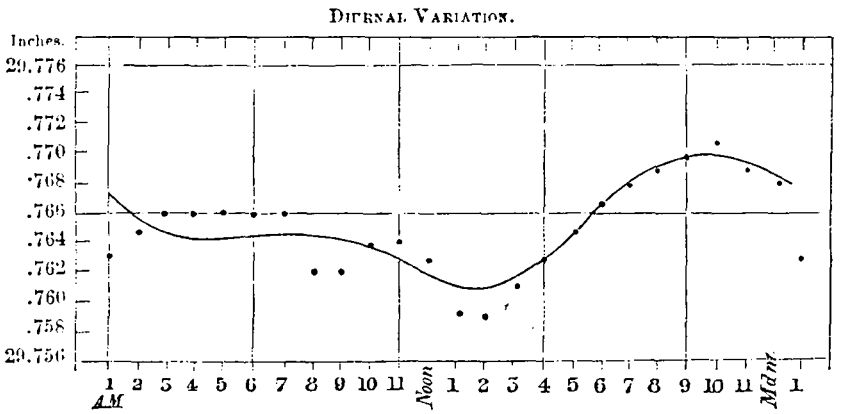
Hour.	Sept. 1853-54.	Oct. 1853-54.	Nov. 1853-54.	Dec. 1853-54.	Jan. 1854-55.	Feb. 1854.	March. 1854.	April. 1854.	May. 1854.	June. 1854.	July. 1854.	Aug. 1854.	Means.
1h.	29.642	29.751	29.751	29.749	29.781	29.637	29.784	29.968	29.939	29.716	29.750	29.687	29.763
2	.646	.753	.756	.754	.782	.636	.789	.971	.939	.717	.746	.690	.765
3	.652	.752	.767	.753	.778	.632	.792	.973	.941	.715	.743	.689	.766
4	.650	.753	.766	.757	.775	.632	.798	.975	.936	.718	.741	.689	.766
5	.652	.748	.757	.756	.775	.646	.800	.978	.934	.720	.734	.697	.766
6	.650	.751	.756	.756	.777	.647	.798	.977	.930	.718	.733	.696	.766
7	.653	.750	.754	.750	.772	.651	.798	.979	.932	.719	.737	.694	.766
8	.649	.745	.749	.741	.766	.647	.793	.977	.935	.721	.736	.690	.762
9	.654	.744	.747	.740	.768	.646	.798	.979	.941	.705	.733	.694	.762
10	.656	.746	.749	.743	.766	.655	.802	.981	.942	.704	.734	.690	.764
11	.657	.750	.750	.745	.764	.653	.796	.978	.940	.712	.739	.689	.764
Noon	.657	.746	.748	.743	.765	.648	.798	.978	.933	.718	.737	.687	.763
13	.656	.750	.742	.735	.765	.644	.794	.970	.931	.714	.725	.685	.759
14	.656	.747	.741	.735	.766	.648	.794	.969	.934	.714	.723	.684	.759
15	.652	.747	.742	.738	.766	.661	.803	.973	.934	.714	.724	.681	.761
16	.655	.750	.748	.739	.767	.662	.800	.976	.935	.711	.730	.681	.763
17	.655	.754	.747	.748	.770	.671	.802	.976	.935	.709	.736	.685	.765
18	.660	.753	.755	.753	.772	.671	.803	.980	.931	.708	.733	.684	.767
19	.659	.755	.753	.750	.774	.674	.805	.983	.935	.712	.735	.685	.768
20	.660	.758	.752	.754	.777	.669	.810	.987	.935	.710	.734	.685	.769
21	.660	.756	.755	.752	.782	.668	.806	.985	.939	.712	.740	.688	.770
22	.658	.754	.760	.756	.787	.666	.803	.984	.941	.713	.742	.690	.771
23	.654	.750	.756	.755	.785	.669	.794	.981	.943	.715	.739	.692	.769
Midn't	29.651	29.749	29.755	29.760	29.784	29.666	29.791	29.980	29.947	29.716	29.734	29.689	29.768
Means	29.653	29.750	29.753	29.748	29.773	29.654	29.793	29.977	29.937	29.714	29.736	29.689	29.765

Owing to the small amplitude, the comparatively short period of observation, and the magnitude of the occasional disturbances, the law of the diurnal variation is apparently subject to considerable fluctuations; and it has, therefore, only been attempted to express the figures in the last vertical column, or the mean variation, analytically. Using Bessel's formula, the variation can be expressed by the formula:—

$$\overset{\text{Inches.}}{29.765} + \overset{\text{Inch.}}{0.0034}\ \sin(\theta + 290^\circ) + \overset{\text{Inch.}}{0.0022}\ \sin(2\,\theta + 204^\circ);$$

the terms containing $3\,\theta$, etc., becoming too small to have any real value. The angle θ counts from noon, and is expressed in degrees at the rate of 15° an hour.

The annexed diagram exhibits the observed (by dots) and the computed (by a fine line) diurnal variation. Its principal feature is the afternoon inflection, with a



maximum pressure at about 10 P. M. The principal minimum is reached at 1 P. M. The 10 P. M. maximum is in strict conformity with the general law deduced from observations in the northern hemisphere. The 1 P. M. minimum seems to occur about three hours earlier than indicated by more southern stations. Kaemtz takes as amplitude of the diurnal variation, the difference between the mean of the maxima and the mean of the minima. Other meteorologists take the maximum difference. According to this latter view, we have the diurnal amplitude 29.7701 — 29.7604 = 0.0097 inches. The diurnal fluctuation here considered is the change in the gross pressure of the atmosphere, there being no means on hand for separating the pressure of dry air from the pressure of aqueous vapor.[1]

In connection with this subject, it may be stated that the latitude of Van Rensselaer Harbor is about 14° higher north, than the latitude (64°) in which the mean height of the barometer is a minimum (at the level of the sea).

Annual Fluctuation of the Atmospheric Pressure.—The following is an abstract of the monthly means of the barometer readings (reduced to 32°). The values for February, March, and April, 1855, were taken from the second volume of the Narrative.

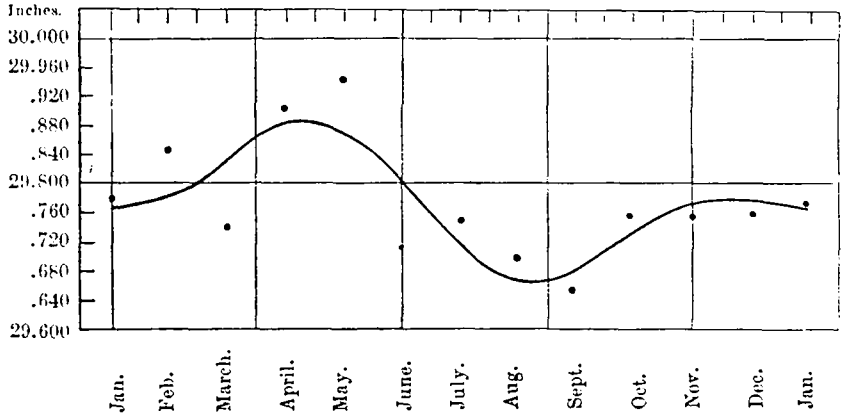
Year.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1853	...	...	...	...	...	...	...	...	29.662	29.815	29.713	29.821
1854	29.458	29.654	29.798	29.977	29.937	29.714	29.736	29.689	29.645	29.686	29.792	29.675
1855	30.089	30.032	29.693	29.820	...	...	...	...	...	...	...	...
Means	29.773	29.843	29.745	29.898	29.937	29.714	29.736	29.689	29.653	29.750	29.753	29.748

According to the resulting values, the height of the barometer is above the mean in the months of January, February, March, April, and May, and descends below the mean in the remaining summer and autumn months. The maximum pressure

[1] Although a long series of hygrometric observations were made, yet, owing to the peculiar delicacy which such observations require in a latitude of such low temperature, they proved, on close examination, too uncertain to be relied on in their results

was observed in May, the minimum in September. The range between these two months is 0.284 inch.

ANNUAL VARIATION.



According to the above diagram, in which the dots indicate the mean monthly readings, the law of the annual fluctuation does not, perhaps, as plainly appear as we might expect from a longer-continued series of observations. In the month of January, for instance, we have a difference in the height of the barometer in the two years (1854 and 1855) of not less than 0.631 inch.

The general law that the height of the barometer is less in summer than in winter, is here prominently brought out. In the following expression, I have attempted to exhibit the course of the annual variation:—

$$B = \overset{\text{Inches.}}{29.770} + \overset{\text{Inch.}}{0.079}\ sin\ (\theta + 4^\circ) + \overset{\text{Inch.}}{0.044}\ sin\ (2\,\theta + 194^\circ),$$

the angle θ counting from January 1st, and is expressed in degrees at the rate of 30° a month.

The computed annual range is 29.875 — 29.668 = 0.207 inch. If we add 0.005 as correction to the constant 29.770, to refer it to the level of the sea, we find the mean barometric height, in the latitude 78° 37′ N., 29.775 inches.

Irregular Oscillations of the Pressure; Monthly and Annual Extremes.—The irregular changes in the atmospheric pressure are, like those of the temperatures, much greater in winter than in summer, of which an instance has already been given (see the means for the months of January and February of 1854 and 1855). If we deduce the average difference, irrespective of sign, in the barometric height between any two consecutive days, we obtain the following table of mean diurnal change, as made out from 17 months of observations:—

	Inch.		Inch.
January	0.17	August	0.10
February	0.26	September	0.11
March	0.17	October	0.15
April	0.12	November	0.17
May	0.14	December	0.26
June	0.10		
July	0.09	Mean	0.15

In the months of December, January, and February, the variability between successive diurnal means is a maximum, and in the months of June, July, and August, it reaches a minimum value; the ratio of the highest and lowest being as 2½ to 1.

The following table contains the maxima and minima of atmospheric pressure as observed in each month, and the extreme ranges for each month of the year:—

Month.	Maxima.			Minima.			Range.
	1853.	1854.	1855.	1853.	1854.	1855.	Inches.
September	30.06	30.25	...	29.07	29.01	...	1.11
October	30.50	30.16	...	29.11	29.00	...	1.28
November	30.26	30.41	...	29.05	29.01	...	1.30
December	30.50	30.37	...	29.01	28.89	...	1.48
January	...	29.92	30.97	...	28.86	(29.30)	1.36
February	...	30.45	...	...	28.84	...	1.61
March	...	30.49	...	...	29.18	...	1.31
April	...	30.37	...	...	29.28	...	1.09
May	...	30.49	...	...	29.19	...	1.30
June	...	30.19	...	...	29.41	...	0.78
July	...	29.97	...	...	29.40	...	0.57
August	...	30.05	...	...	29.22	...	0.83

Mean range of monthly extremes 1.17 inch; the maxima rise, on the average, to 30.31 inches, and the minima fall to 29.14 inches. As in the preceding table of the diurnal fluctuation, the greatest monthly range takes place in December, January, and February (1.48 inch), and the least in June, July, and August (0.73 inch). The ratio of highest and lowest values is as 2¼ : 1. Between the extremes, both tables show a regular progression.

The absolute highest reading was 30.97 inches; it occurred in the morning of January 22st, 1855. The absolute lowest reading was 28.84 inches, and occurred near noon of February 19th, 1854. Extreme range observed 2.13 inches.

Of the gales noted in my discussion of the winds at Van Rensselaer Harbor,[1] only the following ones were accompanied by a notable amount of change of atmospheric pressure:—

Before the setting in of the gale of December 28th, 1853, the barometer fell 0.35 inch in nine hours, or at a rate of 0.04 inch an hour. For three days preceding the gale of October 15th, 1854, the barometer was very low, and reached its lowest point at the hour when the gale was at its height; after this time, it rose 0.77 inch in eighteen hours, or at a rate of 0.04 inch an hour. Before the gale of December 18th, 1854, the barometer fell 0.36 inch in five hours, or 0.07 inch an hour; and before the setting in of the gale of January 13th, 1855, it fell 0.26 inch in eleven hours.

State of the Barometer during the Fall of Snow (or Rain).—To ascertain whether there is any change in the barometric pressure caused by the fall of snow, I have tabulated the readings during the hours of precipitation, and compared them with an equal number of readings, half immediately preceding, half immediately follow-

[1] See record and results of my discussion of the observations of winds at Van Rensselaer Harbor, in Vol. XI. of the Smithsonian Contributions to Knowledge.

ing, each fall of snow. If snow fell for less than three consecutive hours, I have taken no notice of it in this investigation. The mean result from 563 hours of comparison, gave only a difference of 0.006 inch, by which quantity the barometer is lower during the fall of snow than otherwise.

Variability of Atmospheric Pressure with the Direction of the Wind.—The connection of the atmospheric weight with the direction of the wind requires, in order to find its average effect, a great number of observations, particularly on account of the irregular oscillations of the barometer in the winter months. The following results are derived from a comparison of the barometric readings at the hours 6 A. M., noon, 6 P. M., and midnight, for each day, with the respective mean monthly reading during 17 months of observations. These difference were then arranged according to the directions of the wind. The result is as follows ($\pm$ indicating $\left\{\begin{matrix}\text{above}\\ \text{below}\end{matrix}\right\}$ the mean):—

Magnetic direction.	Inch.	
N.	—0.022	
N. E.	+0.072	On account of the comparatively small number of observations for these directions, they may be combined: E. N. E. —0.044 in.
E.	—0.100	
S. E.	0.000	
S.	+0.038	
S. W.	+0.045	
W.	—0.031	
N. W.	—0.031	

From 1050 comparisons of calms and barometric readings, the latter were found 0.005 inch above their mean value.

It is only during S. and S. W. (magnetic) winds that the barometer rises above the mean value; during all other winds it is depressed.

Relation of the Atmospheric Pressure to each Wind and to the Temperature of the same.—To show this dependence, it is best to put the relation of the atmospheric pressure, as well as that of the temperature, to the winds, in an analytical form. In my discussion of the observed temperatures at Van Rensselaer Harbor, a table was made out showing the dependence of the temperature on the direction of the wind. If we deduct the mean elevation of temperature by the winds from each separately, we obtain the following table of the effect of each wind on the temperature ($\pm$ indicating an $\left\{\begin{matrix}\text{elevation}\\ \text{depression}\end{matrix}\right\}$ of temperature):—

Magnetic direction.		Magnetic direction.	
N.	—1°.4	S.	+0°.6
N. E.	0.0	S. W.	+0.4
E.	—0.1	W.	+0.1
S. E.	+0.9	N. W.	—1.4

Counting θ from the north (or belonging to a (magnetic) north wind) round by E. to 360°, we obtain, by using Bessel's formula,

$$T = +1^\circ.02 \sin(\theta + 286^\circ);$$

or, for the true directions,

$$T = +1^\circ.02 \sin(\theta + 34^\circ);$$

and similarly, from the barometric relation to the winds,

$$B = +0.018 \text{ in.} \sin(\theta + 354^\circ).$$

A comparison of the angular constants in these two expressions does not show a correspondence of the wind of maximum temperature with a minimum pressure; on the contrary, there is a much nearer correspondence of the wind of maximum temperature with maximum pressure. According to the first formula, the hottest wind is from the direction N. E. ½ E. (true); and, by the second formula, the maximum atmospheric pressure is from the direction E. (true) nearly.

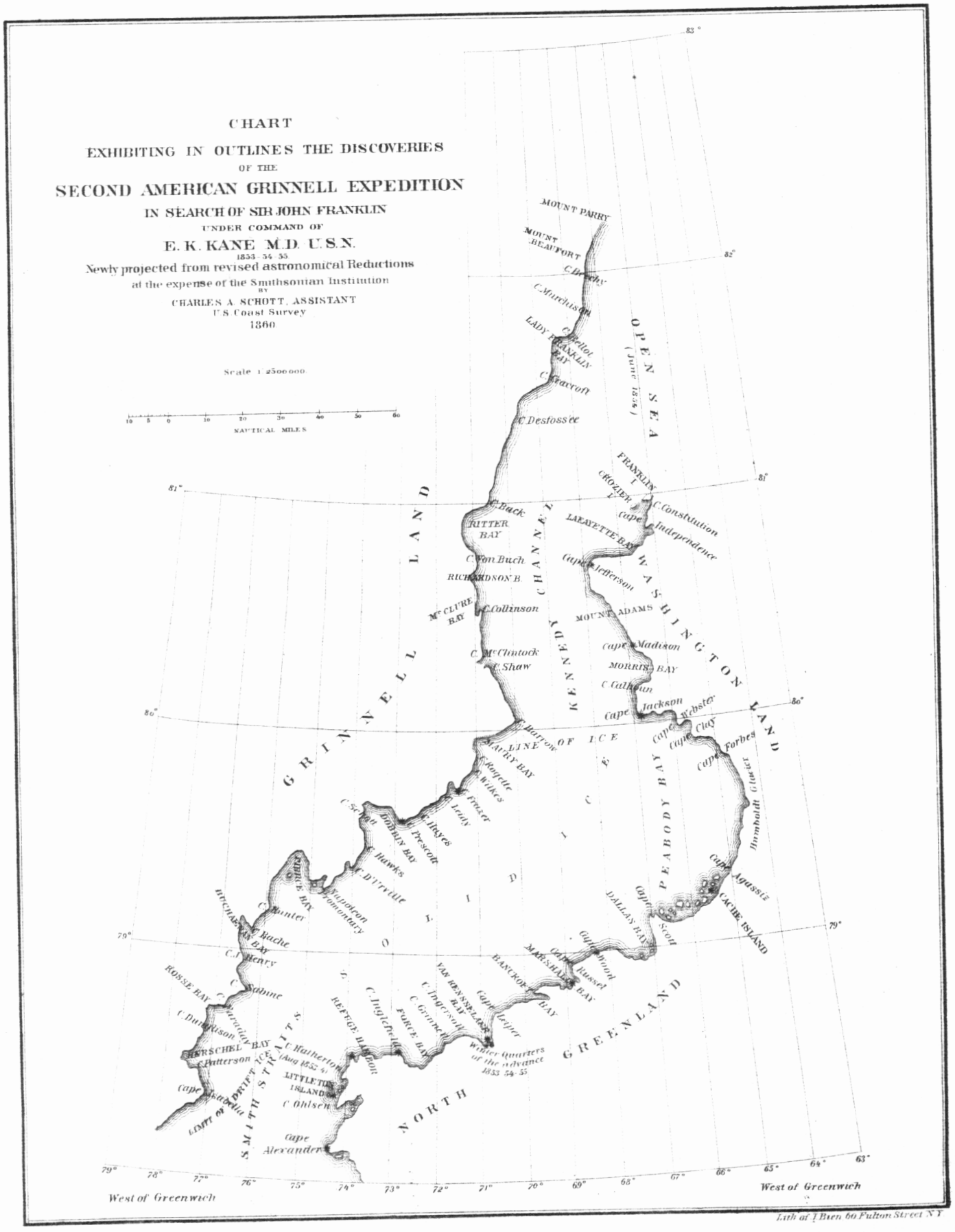


CHART
EXHIBITING IN OUTLINES THE DISCOVERIES
OF THE
SECOND AMERICAN GRINNELL EXPEDITION
IN SEARCH OF SIR JOHN FRANKLIN
UNDER COMMAND OF
E. K. KANE M.D. U.S.N.
1853-54-55
Newly projected from revised astronomical Reductions
at the expense of the Smithsonian Institution
BY
CHARLES A. SCHOTT, ASSISTANT
U.S. Coast Survey
1860
Scale 1:2500000
NAUTICAL MILES
MOUNT PARRY
MOUNT BEAUFORT
C. Murchison
LADY FRANKLIN BAY
C. Farcroft
C. Destosses
OPEN SEA
(June 1854)
FRANKLIN I.
CROZIER I.
C. Constitution
Cape Independence
LAFAYETTE BAY
Cape Jefferson
WASHINGTON LAND
C. Back
RITTER BAY
C. von Buch
RICHARDSON B.
McCLURE BAY
C. Collinson
MOUNT ADAMS
Cape Madison
MORRIS BAY
C. Calhoun
Cape Jackson
Cape Webster
Cape Clay
Cape Forbes
GRINNELL LAND
KENNEDY CHANNEL
C. McClintock
C. Shaw
BARROW
LINE OF ICE
MARRY BAY
C. Rogerle
C. Wilkes
C. Fraser
C. Lady
C. Hayes
C. Prescott
GODFREY BAY
C. Hawks
C. D'Urville
PORTER BAY
C. Napoleon
C. Sonomany
C. Hunter
RICHARDSON BAY
C. Rache
C. Henry
ROSSE BAY
C. Sabine
C. Dunderison
HERSCHEL BAY
C. Patterson
Cape Isabella
LIMIT OF DRIFT ICE
SMITH STRAITS
C. Hatherton
(Aug 1853)
LITTLETON ISLAND
C. Ohlsen
Cape Alexander
C. Inglefield
REFUGE HARBOR
C. Gurney
FORTE BAY
C. Ingersoll
VAN RENSSELAER BAY
Winter Quarters of the advance 1853-54-55
BANCROFT BAY
Cape Leiper
MARSHALL BAY
Cape Russel
Cape Wood
DALLAS BAY
Cape Scott
PEABODY BAY
Humboldt Glacier
Cape Agassiz
CACHE ISLAND
GREENLAND
NORTH
West of Greenwich
West of Greenwich
Lith. of J. Bien 60 Fulton Street N.Y.

SMITHSONIAN CONTRIBUTIONS TO KNOWLEDGE.

ASTRONOMICAL OBSERVATIONS

IN THE

ARCTIC SEAS.

BY

ELISHA KENT KANE, M.D., U.S.N.

MADE DURING THE SECOND GRINNELL EXPEDITION IN SEARCH OF SIR JOHN FRANKLIN, IN 1853, 1854, AND 1855, AT VAN RENSSELAER HARBOR, AND OTHER POINTS IN THE VICINITY OF THE NORTHWEST COAST OF GREENLAND.

REDUCED AND DISCUSSED.

BY

CHARLES A. SCHOTT.
ASSISTANT U. S. COAST SURVEY

[ACCEPTED FOR PUBLICATION, MARCH, 1860.]

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INTRODUCTORY LETTER.

WASHINGTON, March 7, 1860.

PROFESSOR JOSEPH HENRY, LL.D.,

Secretary of the Smithsonian Institution:

DEAR SIR: The records of the astronomical observations made under the direction of Dr. Kane, in the second expedition to the Arctic regions, were placed in my hands by his late lamented father, Judge Kane, in December, 1857.

Dr. Kane had selected Assistant Charles A. Schott, of the Coast Survey, for the reduction of a considerable portion of the observations made in that expedition; and I, therefore, placed these in Mr. Schott's possession for reduction and discussion. The work has been faithfully performed, and I recommend it for publication in the "Smithsonian Contributions to Knowledge." It is proper to state that the instruments were furnished in part by the U. S. Coast Survey, and that the computations have been made at the expense of the Smithsonian Institution.

Very respectfully, yours,

A. D. BACHE.

ASTRONOMICAL OBSERVATIONS AND REDUCTIONS.

Of the astronomical observations made by the second Grinnell Expedition, under command of Dr. Kane, those for the longitude of Van Rensselaer Harbor, the winter quarters during 1853–'54 and 1854–'55, were most numerous and most carefully attended to. The geographical location of the shore line, traced by the expedition, depends for its longitude on that of Van Rensselaer Harbor, as the central meridian. The latitude of Van Rensselaer Harbor, or Fern Rock Observatory, was likewise carefully determined, as far as the instrumental means of the expedition permitted. The astronomical and geodetic material collected by the various travelling parties, and required for the geographical position of their tracks, is given in Appendix No. 6, to the second volume of the Narrative of the Expedition. Part of this material was collated with the manuscript, and the revised results will be given, in the present paper, after the discussion of the latitude and longitude of Van Rensselaer Harbor. The record of the observations discussed is taken from the original log-book, or other manuscript documents, belonging to the expedition. The astronomical observations were under the special care of Mr. Augustus Sonntag. The principal instruments for the determination of the geographical positions, were sextants, a Gambey theodolite, a transit instrument, and five mean time chronometers.

Fern Rock Observatory was established on the northernmost of the rocky group of islets in Van Rensselaer Harbor: the highest point of Observatory Island is twenty-nine feet above mean tidal level. For directions to sites of Van Rensselaer Harbor, it will be sufficient to refer to note 56, page 430, of the first volume of the Narrative.[1]

On the 25th of August, 1853, a general survey of the harbor was made, and on the 12th of September following, the site of the Observatory was selected. This observatory consisted of four walls of granite blocks, cemented together with moss and water, and the aid of frost. These walls were covered in with a substantial wooden roof, with openings in the direction of the meridian and prime vertical. The transit and theodolite were mounted on piers, formed by a conglomerate of gravel and ice, well rammed down, in iron-hooped pemmican casks, and cemented by freezing water. These piers were found as firm as the rock on which they rested.[2]

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[1] For a copy see appendix (No. 1) to this paper.

[2] See page 116, vol. I, of the Narrative.

Observations for Latitude of Van Rensselaer Harbor Observatory, and the Winter Quarters of the Brig Advance.

The first observation for latitude was made on September 12, 1853, with the theodolite. Later observations were obtained by means of a sextant and artificial horizon. The Gambey theodolite[1] was furnished with repeating circles; the diameter of the horizontal circle was six inches, with the limb divided from five to five seconds, and provided with two verniers; the vertical circle has four verniers, and is of the same size and graduation as the horizontal circle. The following observations were made by Mr. Sonntag, at Washington, D. C., for the angular value of a division of the large level belonging to the instrument.

Level readings.		Difference.	Value of 10″.	Level readings.		Difference.	Value of 10″.	Level readings.		Difference.	Value of 10″.
32.5	—0.5	33.0	15d.6	8.2	25.2	—17.0	9d.7	32.1	2.0	30.1	9d.6
24.7	7.3	17.4	7.7	13.0	20.3	— 7.3	8.9	27.2	6.7	20.5	9.3
21.0	11.3	9.7	7.8	17.8	16.2	+ 1.6	6.7	23.2	11.0	11.2	7.1
17.0	15.1	1.9	8.3	21.0	12.7	+ 8.3	10.0	19.2	15.1	4.1	8.6
13.0	19.4	— 6.4	9.7	26.2	7.9	+18.3	8.6	15.0	19.5	— 4.5	10.7
9.0	25.1	—16.1	5.4	30.2	3.3	+26.9	8.3	9.8	25.0	—15.2	7.6
5.7	27.2	—21.5		34.3	—0.9	+35.2		6.0	28.8	—22.8	
			9.08				8.70				8.82

One division of level from set 1	1.″10
" " " 2	1.15
" " " 3	1.13
Resulting value	1.13

(The length of the bubble was 16d.3, 16d.7, and 17d.1 in the three sets respectively.) The level is connected with the Y supporting the vertical circles.

This instrument was much injured by a fall in the water, and rendered unfit for use, by a second accident, two months later, in November, 1853, when it fell from the pier at the observatory. It may be remarked, here, that Mr. Sonntag has deduced approximate results from his observations with this instrument, and with the sextant, insufficient refraction tables not permitting him to deduce final results.

Observations of September 12, 1853. (A. M.)

Observations of the sun's zenith distance for time.

Circle east.	Chronometer time.	Level.	Reading of circle.		Circle west.	Chronometer time.	Level.	Reading of circle	
⊙	3h 04m 42s	9d.5	195° 02′ 25″	45″	⊙	3h 14m 44s	11d.0	76° 18′ 35″	30″
		14.7	35	45			14.3	35	30
⊙	3 09 25	16.0	195 40 25	15	⊙	3 17 42	10.5	75 43 30	20
		8.0	25	30			14.2	25	25

[1] This instrument, marked United States Coast Survey, No. 34, was kindly lent by the Superintendent of the Survey, Prof. A. D. Bache.

The north end of the level was always read first; the temperature of the air, and the barometer and attached thermometer readings, are taken from the meteorological record, and discussed by me in 1859 (see Smithsonian Contributions to Knowledge, vol. XI, Parts I and III, of the Meteorological paper).

Thermometer + 22°.6 Fahr.	Approximate latitude + 78° 37′ 12″.
Barometer 29.70 inch.	Approximate longitude 4^h 43^m 28^s west of Greenwich.
Attached thermometer 66°.	From a preliminary discussion of the moon culminations.

Time is noted by the pocket chronometer.

We find: Reading of ⊙'s centre, corrected for level . . .	195°	21′	29″.9	Circle east.
" " " " . . .	76	00	56.8	" west.
⊙'s apparent zenith distance	75	19	43.4	
Correction for refraction	+	3	50.3	
" for parallax	—		8.2	
⊙'s corrected zenith distance	75	23	25.5	

Hence, by the usual formula:—

Apparent time of observation	22^h	32^m	$00^s.7$
Equation of time		3	48.4
Mean time of observation	22	28	12.3
Chronometer time of observation	27	11	38.2
Pocket chronometer fast of Fern Rock mean time .	4	43	25.9

(Hence this chronometer indicates very nearly Greenwich mean time.)

Observations of circum-meridian altitudes of the sun, for latitude.

Circle east.	Chronometer.	Level.	Reading of circle.	Circle east.	Chronometer.	Level.	Reading of circle.
⊙	4^h 27^m 40^s	$13^d.0$	195° 58′ 50″ 45″	⊙	4^h 45^m 12^s	$14^d.0$	195° 58′ 60″ 35″
		10.6	55 60			11.0	50 65
⊙	4 30 40	12.0	196 30 40 30	⊙	4 47 32	13.3	196 30 25 05
		12.0	40 55			11.4	10 35
Circle west.				Circle west.			
⊙	4 35 45	10.3	75 33 25 15	⊙	4 53 54	10.8	75 35 30 25
		14.0	10 15			13.4	25 30
⊙	4 38 10	10.8	75 01 30 30	⊙	4 56 30	11.2	75 03 65 55
		14.0	35 25			14.0	60 70

Thermometer + 20°.1.					
Barometer 29.71 inch. We find:	Reading of ⊙, corr'd for level,	196° 14′ 45″	Cir. E.	196° 14′ 34″
Attached thermometer 68°.	" " "	75 17 21	" W.	75 19 43
Approx. rate of pocket chrom.	⊙'s apparent zenith distance	74 31 18		74 32 34
2 .5 gaining on mean time.	Corr'n for refraction.—paral.	+ 3 31		3 31
	Corrected zenith distances	74 34 49		74 36 05

Chronometer time of observation	4^h	33^m	$03^s.8$	4^h	50	$47^s.0$
Chronometer fast	4	43	25.9	4	43	25.9
Mean time of observation	23	49	37.9	0	07	21.1
Equation of time	+	3	55.2		3	55.4
Apparent time	23	53	33.1	0	11	16.5

Hence, by the usual formula, reduction to meridian 16″.8 and 51″.2.

Meridional zenith distance	74°	34′	32″	74°	35′	14″
⊙'s declination	+ 4	03	00	+ 4	02	43
Resulting latitude of Fern Rock	78	37	32	78	37	57
Mean	78	37	44			

The following observations were made with the Gambey sextant and artificial mercurial horizon. The mercury was covered with a glass roof, the sides of which were reversed during the observations, in order to eliminate any error arising from a want of parallelism in the surfaces of the glass. The zero-point of the sextant was examined, and its index determined for each set of observations. The positive sign of the index error indicates that the zero-point is on the large arc, and that the correction to the observed altitude is subtractive. The long astronomical telescope belonging to the sextant was always used.[1] In Appendix, No. X, of the second volume of the Narrative,[2] Dr. Kane remarks, that the sextants used were made by Gambey, and divided to ten seconds; he believed that an error of ten seconds, depending on the want of parallelism in the glass cover of the horizon, could not exist in the results.

The time observations, with the transit instrument, made between November 18, 1853, and January 10, 1854, will be found recorded and discussed after the completion of the latitude observations; the following record, and result for time on February 20, 1854, however, is here inserted, as made with the Gambey sextant, and in order to follow the date as near as may be convenient.

February 20, 1854. Observation of the altitude of Saturn, for time.
(With Gambey sextant and artificial horizon.) Time noted by pocket chronometer.

Chronometer time.	Double altitude.	Chronometer time.	Double altitude.
$12^h\ 35^m\ 11^s$	53° 7′ 20″	$12^h\ 40^m\ 17^s$	52° 49′ 50″
36 22	3 30	42 16	43 00
38 37.5	52 56 30	43 21.5	38 00

Approx. long. + $4^h\ 43^m\ 28^s$. Approx. lat. 78° 37′ 12″. Index error + 8′ 22″.5.
t = —28°.6 F. b = 29.27 in. τ = + 33°.

Apparent altitude of Saturn	26° 27′ 00″.4	26° 17′ 37″.1
Correction for refraction and parallax	— 2 15.8	— 2 16.7
Corrected altitude	26 24 44.6	26 15 20.4
Saturn's declination	+17 17 28.1	+17 17 28.4
From which data we find the hour angle	$2^h\ 21^m\ 51^s.7$	$2^h\ 26^m\ 55^s.2$
AR of Saturn	3 34 33.0	3 34 33.0
Sidereal time of observation	5 56 24.7	6 01 28.2
" " mean noon	22 01 08.7	22 01 08.7
Whence mean time of observation	7 53 58.1	7 59 00.8
And chronometer time	12 36 43.5	12 41 58.2
Pocket chronometer fast of Fern Rock mean time	4 42 45.4	4 42 57.4
Chronometer error (mean)	— 4 42 51.4	

[1] Extracted from a Report of Mr. Sonntag's to the Commander, dated "Brig Mariane, Godhavn, September 12, 1855."

[2] See Appendix containing extracts.

May 14, 1854. Observations of circum-meridian altitudes of the sun, for latitude.
Gambey sextant; on the floe near the brig.

Pocket chronometer.	Double altitude.	Pocket chronometer.	Double altitude.
⊙ $4^h\ 33^m\ 16^s$	59° 35′ 55″	⊙ $4^h\ 40^m\ 56^s$	59° 36′ 00″
34 31	35 40	41 47	35 50
35 35	35 50	42 35	35 40
⊙ 4 36 35	60 39 00	⊙ 4 43 40	60 38 45
37 24	38 50	44 40	38 20
38 58	39 40	45 34	37 50

Index error — 1′ 10″. $t = +7°.4$ F. $b = 29.84$ in. $\tau = +51°$.
For chronometer error and rate, see observations for time, May 16, 17, 19.

⊙'s corrected alt. (for index, refraction, and parallax)	30° 02′ 38″	30° 02′ 25″
Chronometer time of observation	$4^h\ 36^m\ 03^s$	$4^h\ 43^m\ 12^s$
Chronometer fast of Fern Rock mean time . .	4 39 27[1]	4 39 27
Mean time of observation	23 56 36	0 03 45
Hour angle	+ 0 0 30	+ 0 07 40
Hence reduction to meridian	+ 0″.2 and	+ 24″.9
⊙'s declination	+18° 39′ 53″	18° 39′ 57″
Resulting latitude	78 37 15	78 37 07
Mean	78 37 11	

May 15, 1854. Observations of circum-meridian altitudes of the sun, for latitude.
Gambey sextant; on the floe near the brig.

Pocket chronometer.	Double altitude.	Pocket chronometer.	Double altitude.
⊙ $4^h\ 28^m\ 38^s$	59° 51′ 10″	⊙ $4^h\ 35^m\ 25^s$	59° 52′ 40″
29 12	51 45	36 22	52 40
30 15	51 30	37 12	52 30
⊙ 4 31 37	60 55 10	⊙ 4 38 07	60 55 10
32 30	55 10	39 14	55 10
34 23	55 30	39 53	54 30

Index error — 14′ 1″. $t = +8°.4$ F. $b = 29.93$ in. $\tau = +46°$.

⊙'s corrected alt. (for index, refraction, and parallax)	30° 17′ 01″	30° 17′ 13″
Chronometer time of observation	$4^h\ 31^m\ 06^s$	$4^h\ 37^m\ 42^s$
Chronometer fast of Fern Rock mean time . .	4 32 26[2]	4 39 26
Mean time of observation	23 51 40	23 58 16
Hour angle	— 0 04 26	+ 0 02 10
Reduction to meridian	+ 8″.3	+ 2″.0
⊙'s declination	+18° 54′ 09″	+18° 54′ 10″
Resulting latitude	78 37 00	78 36 55
Mean	78 36 58	

[1] For chronometer error and rate see subsequent observations.
[2] For chronometer error and rate see further on.

May 16, 1854. Observations of circum-meridian altitudes of the sun, for latitude.
Gambey sextant; on the floe near the brig.

Pocket chronometer.	Double altitude.	Pocket chronometer.	Double altitude.
⊙ $4^h\ 29^m\ 15^s$	60° 33′ 20″	⊙ $4^h\ 39^m\ 05^s$	61° 37′ 30″
32 56	33 40	39 39	37 10
34 05	33 40	40 47	37 05
⊙ 4 35 36	61 37 05	⊙ 4 42 08	60 33 40
36 35	37 30	43 00	33 45
37 41	36 50	44 09	33 20

Index error + 0′ 16″. $t = +12°.5$ F. $b = 30.07$ in. $\tau = +39°$.

⊙'s corrected alt. (for index, refraction, and parallax)	30° 30′ 56″	30° 30′ 58″
Chronometer time of observation	$4^h\ 34^m\ 21^s$	$4^h\ 41^m\ 28^s$
Chronometer error	— 4 39 25[1]	4 39 25
Mean time of observation	23 54 56	0 02 03
Hour angle	— 1 10	+ 5 58
Reduction to meridian	+ 0″.5 and	+ 15″.1
⊙'s declination	+19° 08′ 08″	+19° 08′ 12″
Resulting latitude	78 37 12	78 36 59
Mean	78 37 06	

May 16, 1854. Observations of equal altitudes of the sun, for time.
Gambey sextant; on the floe near the brig.

Pocket chronometer. A. M.	Double altitude.	Pocket chronometer. P. M.	Pocket chronometer. A. M.	Double altitude.	Pocket chronometer. P. M.
$0^h\ 46^m\ 18^s$	⊙ 49° 30′	$8^h\ 25^m\ 21^s.5$	$0^h\ 53^m\ 16^s.5$	⊙ 50° 05′	$8^h\ 18^m\ 31^s.5$
47 24	35	24 21	54 15	10	17 36
48 17.5	40	23 29	55 16.5	15	16 33.5
0 49 33	⊙ 50 50	8 22 0.5	0 56 22.5	⊙ 51 25	8 15 20.5
50 35.5	55	21 11	57 33.5	30	14 19.5
51 31	51 00	20 10.5	58 32.5	35	13 8.5

A. M. Index error + 0′ 26″. $t = +11°.2$ F. $b = 30.06$ in. $\tau = +46°$.
P. M. Index error + 0′ 24″. $t = +15°.0$ F. $b = 30.07$ in. $\tau = +53°$.

The reductions of observations of equal altitudes are made according to the method given in the American Ephemeris and Nautical Almanac, for 1856.

On reducing the observations, it was found that the chronometer error came out too small by $24^s.5$; and, after working each set separately, the discrepancy was traced to the morning observations. The following reductions, therefore, are based on the two sets taken in the afternoon. It is probable that there was either an

[1] For chronometer error see following observation.

unusual amount of refraction in the morning, or else the rate of the chronometer has changed in the interval.

Afternoon altitudes of the sun.	1st set.	2d set.
⊙'s corrected altitude (for index, refraction, and parallax)	25° 05′ 11″	25° 22′ 44″
⊙'s declination	19 10 18	19 10 26
And the hour angle	3^h 47^m $12^s.5$	3^h 40^m $24^s.9$
Equation of time . . . . . —	3 53.4	3 53.4
Mean time of observation	3 43 19.1	3 36 31.5
Chronometer time of observation	8 22 45.5	8 15 55.0
Chronometer error on Fern Rock mean time . . . —	4 39 26.4	— 4 39 23.5
Mean . . . . . —	4 39 24.9	

May 17, 1854. Observations of equal altitudes of the sun, for time.
Gambey sextant; on the floe near the brig.

Pocket chronometer. A. M.	Double altitude.	Pocket chronometer. P. M.	Pocket chronometer. A. M.	Double altitude.	Pocket chronometer. P. M.
0^h 16^m 45^s	⊙̄ 48° 10′	8^h 55^m $39^s.5$	0^h 23^m 32^s	⊙̄ 48° 45′	8^h 49^m $14^s.2$
17 37	15	54 36	24 20	50	48 22.5
18 36	20	53 48.5	25 22	55	47 21.5
0 20 23	⊙̲ 47 25	8 52 18	0 26 48	⊙̲ 48 0	8 46 26
21 13	30	51 23	27 44	5	45 35
22 15	35	50 24.5	28 34	10	44 41

For A. M. observations, index error — 7′ 46″. $t = +9°.3$ F. $b = 30.00$ in. $\tau = +53°$.
For P. M. observations, index error — 7′ 28″. $t = +14°.1$ F. $b = 29.95$ in. $\tau = +56°$.

A. M. Chronometer time	0^h 19^m $28^s.1$	P. M. Chronometer time 8^h 53^m $01^s.5$ set 1.
A. M. Chronometer time	0 26 03.4	P. M. Chronometer time 8 46 56.7 set 2.
Equation of equal altitudes . . .		— $50^s.8$ (set 1.) — $50^s.2$ (set 2.)
Middle chronometer time		4^h 36^m 14.8 4^h 36^m 30.0
Chronometer time of apparent noon. . .		4 35 24.0 4 35 39.8
Equation of time		+ 3 52.5 + 3 52.5
Chronometer time of mean noon . .		4 39 16.5 4 39 32.3
Chronometer error on Fern Rock mean time		— 4 39 24.4

May 17, 1854. Observations of circum-meridian altitudes of the sun, for latitude.
Gambey sextant; on the floe near the brig.

Pocket chronometer.	Double altitude.	Pocket chronometer.	Double altitude.
⊙̄ 4h 29m 46s.5	61° 56′ 0″	⊙̄ 4h 37m 05s.5	61° 56′ 20″
30 39.5	56 30	37 49	56 30
31 32.0	56 25	38 27	56 30
⊙̲ 4 33 02	60 53 30	⊙̲ 4 39 25	60 53 45
34 12	54 00	40 01.5	53 30
35 55	53 40	40 58.5	53 25

Index error —7′ 40″. $t = +10°.5$ F. $b = 29.95$ in. $\tau = +53°$.

⊙'s corrected altitude (for index, refraction, and parallax)	30° 44′ 31″	30° 44′ 31″
Chronometer time of observation	4h 32m 31s.2	4h 38m 57s.8
Chronometer error	— 4 39 24.4	— 4 39 24.4
Mean time of observation	23 53 07	23 59 33
Hour angle	— 3 01	+ 3 26
Reduction to meridian	3″.9 and	5″.0
⊙'s declination	+19° 21′ 45″	+19° 21′ 49″
Resulting latitude	78 37 10	78 37 13
Mean	78 37 12	

May 19, 1854. Observations of equal altitudes of the sun, for time.
Gambey sextant; on the floe near the brig.

Pocket chronometer. A. M.	Double altitude.	Pocket chronometer. A. M.	Pocket chronometer. P. M.	Double altitude.	Pocket chronometer. P. M.
0h 33m 29s	⊙̄ 50° 30′	8h 39m 9s.5	0h 37m 09s	⊙̲ 49° 45′	8h 35m 34s
34 37	35	38 4	37 57	50	34 41
35 28	40	37 16.5	38 54	55	33 43.5

A. M. Index error — 8′ 44″. P. M. Index error — 9′ 22″.
$t = +13°.5$ F. $b = 30.05$ in. $z = +52°$. $t = +19°.3$ F. $b = 30.20$ in. $\tau = +53°$.
Observation not very exact, the mercury being in motion.

A. M. Chronometer time 0h 36m 15s.6	P. M. Chronometer time 8h 36m 24s.7
Equation of equal altitudes	— 46s.7
Middle chronometer time	4h 36m 20.1
Chronometer time of apparent noon	4 35 33.4
Equation of time	+ 3 48.4
Chronometer time of mean noon	4 39 21.8

RECAPITULATION OF CHRONOMETER ERRORS DETERMINED IN MAY, 1854.

May 16.	Pocket chronometer fast of Fern Rock mean time . . .	4h 39m 24s.9
" 17.	" " " " " . . .	4 39 24.4
" 19.	" " " " " . . .	4 39 21.8

Approximate rate 1s losing per day.

The pocket chronometer was made to indicate Greenwich mean time within a few minutes; between October 5 and October 10, 1853, it ran down; October 29, it was carried about for nine hours; again, November 4, it was carried on a journey for three days; on the 22d of November it ran down, and on December 21 it was exposed for four hours to a temperature of —38° F. Its rate, as indicated by the other chronometers, 2143, 370, 2721, and 264 (all mean time chronometers), was tolerably uniform, and varying between 3s.6 and 0s.0.

May 20, 1854. Observations of circum-meridian altitudes of the sun, for latitude. Gambey sextant; on the floe near the brig.

Pocket chronometer.	Double altitude.	Pocket chronometer.	Double altitude.
⊙ 4h 31m 09s.5	63° 14′ 5″	⊙ 4h 36m 44s.5	63° 14′ 5″
32 09.5	13 50	37 28	14 5
33 02	14 5	38 23.5	13 55
⊙ 4 33 59	62 11 20	4 40 07	62 10 45
34 41	11 00	40 49	10 40
35 30.5	11 10	41 40	10 45

Index error — 8′ 17″.5. $t = +12°.9$ F. $b = 39.25$ in. $\tau = +53°$.

⊙'s corrected altitude (for index, refraction, and parallax)	31° 23′ 49″	31° 23′ 43″
Chronometer time of observation	4h 33m 25s.2	4h 39m 12s.0
Chronometer error	— 4 39 21.0	4 39 21.0
Mean time of observation	23 54 04	23 59 51
Hour angle	— 2 11	+ 3 37
Reduction to meridian	— 2″.0	and 5.″6
⊙'s declination	+20° 00′ 43″	+20° 00′ 46″
Resulting latitude	78 36 52	78 36 57
Mean	78 36 55	

RECAPITULATION OF RESULTS FOR LATITUDES OF VAN RENSSELAER HARBOR.

September 12, 1853. From two sets of Z. D.'s of the sun at the Fern Rock Observatory 78° 37′ 44″.

This result will be used for the reduction of the transit observations at the observatory. This observatory was some distance (as we learn from pages 108, 116, 167, and 168, of vol. I, of the Narrative) to the northward of the position of the brig. The following results for latitude refer to the position of the Brig Advance in the winter quarters:—

May 14, 1854. From two sets of altitudes	78° 37′ 11″[1]
" 15, " " " "	36 58
" 16, " " " "	37 06
" 17, " " " "	37 12
" 20, " " " "	36 55
Mean	78 37 04 ± 3″

[1] The recapitulation of the approximate values for latitude of the brig, on p. 387, appendix No. VI, vol. II of the Narrative, has two additional values between May 14 and 15, for which I could not find any record.

which result is to be used for the reduction of astronomical observations taken on or near the brig; it gives also the position of the meteorological observatory on the floe.

In the above reductions, Ivory's refraction tables have been used, as given in the convenient form for logarithmic computation (and extended if required) in Lee's Collection of Tables and Formulæ. All observed altitudes were greater than $14\frac{1}{2}°$.

Observations for Longitude of Van Rensselaer Harbor Observatory, and the Winter Quarters of the Brig Advance.

OBSERVATIONS OF TRANSIT FOR TIME AND OF THE MOON AND MOON CULMINATING STARS FOR LONGITUDE OF FERN ROCK OBSERVATORY.

The transit observations commence November 18, 1853, and end January 10, 1854. The time was noted by the pocket chronometer, showing within a few minutes Greenwich mean time. The transit instrument was supplied with five wires, and the observations are recorded, from I to V, in the order in which the star (or moon) passes them at the upper culmination, the circle being east of the telescope. The letter R, attached to the name of the object observed, indicates that its transit was observed reflected from a mercurial horizon; this method of observing became necessary for the measure of the inclination of the axis, in consequence of the intense cold affecting the length of the bubble of the level to such a degree that it became useless. At temperatures below —40°, no use could be made of the instrument. The instrument was properly adjusted, an operation somewhat troublesome in so high a latitude, and at so low temperatures. For the azimuthal adjustment there remained but an arc of $11\frac{1}{2}°$ between the pole and the zenith; Dr. Kane remarks,[1] "Some of our instruments, in consequence of the cold, became difficult to manage in consequence of the unequal contraction of brass and iron."

Appendix No. VIII, of vol. II of the Narrative, contains the record of the transit observations, as made by Mr. Sonntag. The following pages contain the same extracted from the manuscript.

In the reduction, I have adopted the latitude $78° 37\frac{1}{2}'$, and the longitude $4^h\ 43^m\ 28^s$ W. of Greenwich (an approximate result from the moon culminations). The reduction was made by application of the method of least squares; to know the instrumental deviations with the greatest accuracy is not of so much importance for the moon culminations, since the result for longitude depends more on the differences of time between the transit of the moon and stars, but it is otherwise with the occultations, where the chronometer error must be known with the greatest precision.

A peculiarity in the construction of the instrument requires to be noticed, viz: it does not permit direct observation of a star elevated more than about 50° above the horizon, hence all observations upon the pole star, and others near the zenith, had to be taken reflected.

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[1] Page 154, vol. I. of the Narrative.

OBSERVATIONS OF THE TRANSIT OF THE STARS AND THE MOON AT FERN ROCK OBSERVATORY.

Transit instrument. A. SONNTAG, Observer.

Object.		Wire I.	Wire II.	Wire III.	Wire IV.	Wire V.
November 18, 1853. Circle West. Time by pocket chronometer.						
☾ II.	s. p.[1]	6h 49m 16s	49m 37s	50m 01s.5	50m 24s	50m 45s.5
μ Geminor.	s. p.	7 05 39.5	06 01.5	06 23	06 44.5	07 06.5
ε Geminor.	s. p.	7 26 24	26 45.5	27 07	27 29.5	27 51.5
Changed azimuth and inclination.						
Polaris	R.	14 16 44	02 39	49 21	36 50	13 22 55
η Ursæ maj.	s. p.	14 32 12	32 41.5	.. ..	33 42.5	34 15
α Arietis		50 26.5	50 05	49 44	49 23.0	14 .. ..
α Bootis	s. p.	14 59 19	59 39	00 00.5	00 21.0	15 00 42.5
γ Ceti		27 14	26 54	26 34.5	26 14.5	15 25 54
Circle East.						
β Ursæ min.	R. s. p.	15 45 17	44 01.5	42 47	41 31.5	15 40 14
November 21, 1853. Circle East. Pocket chronometer.						
51 Cephei	R. s. p.	7	16 42.5	09 18.5	02 45	6 .. ..
β Lyræ		7 23 03	23 29	23 53.5	24 14.5	24 37.5
ϱ Aquilæ		7 37 14.5	37 34.5	37 54.0	38 16.0	38 37.0
δ Geminor.	s. p.	51 32.5	51 12.0	50 50.0	50 29.5	7 50 07.0
δ Aquilæ		7 56 41.5	57 02.0	57 19.5	57 43.0	58 02.5
γ Cancri	s. p.	9 14 44.0	14 24.0	14 02.5	13 42.5	9 .. ..
☾ II.	s. p.	20 01.0	.. ..	19 15	18 52.5	9 18 28.5
ι Ursæ maj.	s. p.	29 35	29 06.5	28 37	28 07.5	9 27 35
ζ Cygni		9 44 46.5	45 09	45 30.5	45 53.5	46 17
α Cephei	R.	9 52 49	53 30	54 13.5	54 55	55 38.5
λ Leonis	s. p.	03 11	02 50.5	02 28.5	02 07	10 01 44
November 23, 1853. Circle East. Pocket chronometer.						
η Draconis	R.	4 53 44	54 27	55 06.5	55 50	56 32.5
α Tauri	s. p.	5 01 11	00 51	00 29.5	00 09	4 59 47
α Aurigae	s. p.	40 01	39 33	39 04.5	38 35	5 38 06.5
γ Draconis	R.	6 24 56.5	25 31	26 02	26 33	27 07
α Lyræ		7 03 12.5	03 39	04 04	04 30	04 56
β Lyræ		7 15 02	15 25	15 47	16 12	16m 35s + 1m
ζ Aquilæ		7 30 16.5	30 36.5	30 57	31 17	31m 37s.5
δ Geminor.	s. p.	44 40	44 21	43 59	43 36	7 43 14.5
α Leonis		22 29 44.5	30 04	30 25.5	30 45	31 05.5
γ Leonis		22 40 56	41 16	41 37	41 59	42 23
☾ II.		23 18 25	18 45	19 07	19 29	19 49.5
χ Leonis		23 26 30	26 50	.. ..	27 31	27 52
December 8, 1853. Circle East. Pocket chronometer.						
ι Piscium		11 03 55	04 15	04 35	04 54	05 15
α Andromedæ		11 31 46	32 08	32 31	32 54	33 16.5
γ Pegasi		11 36 57	37 17	37 37	37 57.5	38 19
☾ I.		11 54 49	55 11.5	55 31	55 53.5	56 13
δ Piscium		12 12 23	12 41	13 03.5	13 22	13 42.5

[1] Sub polo.

Object.		Wire I.	Wire II.	Wire III.	Wire IV.	Wire V.
December 9, 1853. Circle East. Pocket chronometer.						
α Andromedæ		11h 27m 52s	28m 15s	28m 36s	29m 00s	29m 21s.5
γ Pegasi		11 33 02	33 22.5	33 42	34 03.5	34 24
☾ I.		12 36 57.5	37 17	37 38	37 58.5	38 20[1]
December 12, 1853. Circle East. Pocket chronometer.						
δ Arietis		2	18 41	19 03.5	19 25	19 44
☾ I.		2 44 30	44 53.5	45 15	45 36.5	45 58
η Tauri		2 53 38.5	54 00	54 23.5	54 44.5	55 07
27 Tauri[2]		2 55 20	55 41	56 04	56 25.5	56 48
A′ Tauri		3 10 55.5	11 17	11 38.5	12 00	12 22
December 13, 1853. Circle East. Pocket chronometer.						
Polaris	R.	11 51 56	04 10	17 39.5		
Circle West.						
Polaris	R.	12 41 37	28 36.5			
α Arietis	R.	11 27	11 06	10 44.5	10 23.5	1 10 04
α Bootis	s. p.	1 20 04.5	20 26	20 46.5	21 08	21 29.5
γ Ceti		48 10.0	47 51	47 30	47 11	1 46 49.5
β Ursæ min.	R. s. p.	2	01 38	02 56.5	04 13	05 28
α Coronæ	s. p.	2 39 20	39 42	40 03.5	40 25	40 48
η Tauri		2 51 05.5	50 43.5	50 22.5	50 02.0	2 49 38
27 Tauri[2]		52 45	52 25	52 03	51 39	2 51 20
A′ Tauri		08 18.5	07 57	07 30.5	07 12	3 06 50.5
☾ I.		31 20.5	30 59.5	30 38	30 17	3 29 52.5
December 14, 1853. Circle West. Pocket chronometer.						
ε Ursæ min.[3]	R. s. p.	4 03 52.5	06 27	09 21.5	.. ..	.. .. ..
☾ I.		19 01	18 41.5	18 16.5	17 56	4 17 35.5
☾ II.		21 15	20 52.5	20 31	20 07.5	4 19 44.5
ο Tauri		26 56	26 34.5	26 13	25 50.5	4 25 30
δ Orionis		32 36.5	32 16.5	31 57	31 36.5	4 31 16.5
ζ Tauri		36 58	36 35.5	36 15.5	35 53.5	4 35 31.5
α Orionis		55 15.5	54 54	54 35	54 14	4 53 53.5
μ Geminor		22 05.5	21 43.5	21 23	21 01	5 20 39.5[4]
December 15, 1853. Circle West. Pocket chronometer.						
Polaris	R.	12 33 22	20 13.5	07 32.5	54 18.5	11 41 27
η Ursæ maj.	s. p.	12 44 55.5	45 27.5	45 57	46 29	46 58.5
η Bootis	s. p.	12 51 05.5	51 26.5	51 47.5	52 09	52 31
α Arietis	R.	03 40	03 18.5	02 58	02 35.5	1 02 13
α Bootis	s. p.	1 12 19.5	12 40.5	13 01	13 23.0	13 43
γ Ceti		40 18.5	39 59	39 39	39 19	1 38 59.5
β Ursæ min.	R. s. p.	1 52 49	54 06	55 20	56 35	57 52.5
ο Tauri		23 02	22 39	22 19.5	21 57.5	4 21 35.5
ζ Tauri		33 02.5	32 41.5	32 20.0	31 58.5	4 31 37
α Orionis		51 17	50 57.5	50 37	50 17.5	4 49 58
γ Draconis	s. p.	4 55 38	56 10.5	56 42.5	57 15	57 47.5
☾ II.		10 42.0	10 19.0	09 56.5	09 34	5 09 11
μ Geminor.		18 07.5	17 46.5	17 25.5	17 03.5	5 16 41

[1] Through clouds. [2] In original Plj. [3] The original has τ. [4] The record has 5h 20m 29s.5.

Object.		Wire I.	Wire II.	Wire III.	Wire IV.	Wire V.
January 8, 1854. Circle West. Pocket chronometer.						
α Bootis	s. p.	11h . .m . .s	37m 34s	37m 55s	38m 16s.5	11h 38m 37s.5
845 B. A. C.		06 34.5	06 14	05 54.5	05 33.5	12 05 12.5
π Arietis		10 39.5	10 18.5	09 58.5	09 38	12 09 15.5
α Ceti		24 06.5	23 45.5	23 27	23 06.5	12 22 45.5
☾ I.		42 42.5	42 20.5	41 57	41 37.5	12 41 15
Saturn (centre)		02 41.5	02 20.5	01 59	01 39.5	1 01 18
17 Tauri		05 36.5	05 15	04 53	04 31	1 04 08.5
η Tauri		08 12.5	07 50.5	07 29	07 07.5	1 06 45
27 Tauri		09 53.5	09 31.5	09 09.5	08 47.5	1 08 26
January 9, 1854. Circle West. Pocket chronometer.						
γ Pegasi		9 31 42.5	31 23	31 02.5	30 40	9 30 19
α Cassiopeæ	R.	59 08.5	58 34	57 58.5	57 23	9 56 46.5
Polaris	R.	11 09 00	56 12	43 10	30 09.5	10 17 54.5
η Ursæ maj.	s. p.	11 05 45	06 17.5	06 46	07 18	07 49.5
α Arietis		24 39.5	24 18.5	23 58	23 36.5	11 23 13
January 10, 1854. Circle West. Pocket chronometer.						
γ Pegasi		9 27 48.5	27 28	27 07	26 47.5	9 26 27
α Cassiopeæ	R.	55 15	54 41.5	54 05.5	53 30	9 52 52.5
Polaris	R.	11 06 09.5	53 06	39 30	26 11	10 13 22
α Bootis	s. p.	11 29 20.5	29 42	30 02.5	30 24	30 46

Reduction of Preceding Transits.

There being no level readings, the amount of inclination of the transit axis has to be found from the transit observations themselves; the number of unknown quantities in the normal equations, however, could be reduced to three, since the collimation error could be deduced independently. The instrument was adjusted for collimation on November 18, and on December 13, Polaris was observed, reflected, circle east and circle west, from which observation the collimation has been deduced; the result was, however, satisfactorily checked in those sets of observations, including stars above and below the pole. A preliminary reduction was made in order to ascertain an approximate value for the rate of the chronometer; this instrument was considered as a sidereal chronometer with a large rate.

The following notation has been used in the reduction.

a = azimuthal deviation, in seconds of time $\left\{\begin{matrix}+\\-\end{matrix}\right\}$, when instrument is $\left\{\begin{matrix}\text{east}\\\text{west}\end{matrix}\right\}$ of south.

A = azimuthal factor; correction for azimuthal deviation Aa.

b = inclination of axis, in seconds of time $\left\{\begin{matrix}+\\-\end{matrix}\right\}$, when $\left\{\begin{matrix}\text{west}\\\text{east}\end{matrix}\right\}$ end is high.

B = level factor; correction for level Bb.

c = collimation error, in seconds of time; for upper culmination $\left\{\begin{matrix}+\\-\end{matrix}\right\}$ when mean of wires is $\left\{\begin{matrix}\text{east}\\\text{west}\end{matrix}\right\}$ of line of collimation.

C = collimation factor; correction for collimation Cc.

E = error of chronometer $\left\{\begin{matrix}+\\-\end{matrix}\right\}$ when $\left\{\begin{matrix}\text{slow}\\\text{fast}\end{matrix}\right\}$ of sidereal time at an assumed time T.

E_0 = an assumed chronometer error and ε its correction; $E = E_0 + \varepsilon$.

$t_1\ t_2\ t_3 \ldots$ = the observed times of transits of a group of stars, already corrected for rate of chronometer and collimation.

$AR_1 - t_1 = e_1 \quad AR_2 - t_2 = e_2 \quad AR_3 - t_3 = e_3 \ldots\ldots$ and $e_1 - E_0 = n_1 \quad e_2 - E_0 = n_2 \ldots\ldots$

The values a, b and ε can be deduced from the normal equations:

$$\Sigma\,\varepsilon + \Sigma\,Aa + \Sigma\,Bb = \Sigma\,n$$
$$\Sigma\,A\varepsilon + \Sigma\,A^2a + \Sigma\,ABb = \Sigma\,An$$
$$\Sigma\,B\varepsilon + \Sigma\,ABa + \Sigma\,B^2b = \Sigma\,Bn.$$

It is essential, however, that the instrument be not disturbed during the time of the transits of the group of stars.

For the reduction of the incomplete transits and for deducing the collimation error, the equatorial intervals of the wires have been deduced from transits of 18 stars, as follows:—

For circle *east* and *upper* culmination.

I	$-39.^s71$
II	-19.82
III	$-\ 0.22$
IV	$+19.84$
V	$+39.91$

The probable error of each interval is on the average $\pm\ 0.^s07$. From a preliminary reduction of the observations of December 15 and January 9, the daily rate of the chronometer was found $+\ 3^m\ 56.^s0$, or the rate (losing) per minute $+\ 0.^s164$ approximately.

The observations of Polaris, upper culmination reflected, of Dec. 13, 1853, circle east and circle west, give the collimation error $c = -\ 1.^s40$ (for upper culmination and) circle *east*, the observed chronometer times having been corrected for rate, and the equatorial intervals were multiplied by $\sqrt[3]{sec.\ H}$, where H the hour angle. This value of c has been used for the reduction of transits on and after Dec. 13; for Nov. 18, $c = o$, and between this date and Dec. 13 a gradual change was assumed to have taken place.

The immediate purpose of the following reduction is to obtain values for the level and azimuthal deviation, to apply the required corrections to the observed transits of the moon and moon-culminating stars; it is, however, only the difference of these corrections which affects the resulting longitude.

For the first three observations of Nov. 18, 1853, we have no means of ascertaining the above two instrumental corrections; the level and azimuthal factors, however, for the moon and the two stars are nearly equal. After these observations the level and azimuth were changed.

It was found advisable to omit the observations of Polaris *R.* and 51 Cephei *s. p. R.* in the conditional equations of Nov. 18 and 21, since it is probable that the form of the pivots of the axis is very imperfect, or that the instrument was otherwise disturbed.

November 18, 1853. Circle West.

Object.	Mean of wires.	R.	Cc.	t.	Difference.	AR.	Deduced sidereal time of moon's limb.
☾ II. s. p.	$6^h\ 50^m\ 00^s.8$	$0^s.0$	$0^s.0$	$6^h\ 50^m\ 00^s.8$			$17^h\ 57^m\ 43^s.2$
μ Geminor s. p.	7 06 23.0	+2.6	0.0	7 06 25.6	$-0^h\ 16^m\ 24^s.8$	$18^h\ 14^m\ 07^s.1$	17 57 42.3
ε Geminor s. p.	7 27 07.5	+6.1	0.0	7 27 13.6	−0 37 12.8	18 34 56.4	17 57 43.6

The result by ε Gem. has the weight 2; μ Gem. the weight 1; the former star having very nearly the same level and azimuthal factor.

Object.	Mean of wires.	R.	Cc.	t.	AR.	AR−t=e.
Polaris R.	$13^h\ 49^m\ 29^s.8$	$-11^s.6$	$0^s.0$	$13^h\ 49^m\ 18^s.2$	$1^h\ 06^m\ 34^s.7$	
η Urs. maj. s. p.	14 33 12.7	− 4.4	0.0	14 33 08.3	1 41 44.3	$11^h\ 08^m\ 36^s.0$
α Arietis	14 49 44.0	− 1.7	0.0	14 49 42.3	1 58 56.7	11 09 14.4
α Bootis s. p.	15 00 00.4	0.0	0.0	15 00 00.4	2 08 57.6	11 08 57.2
γ Ceti	15 26 34.2	+ 4.4	0.0	15 26 38.6	2 35 44.1	11 09 05.5
Circle East.						
β Urs. min. s. p. R.	15 42 46.2	+ 7.0	0.0	15 42 53.2	2 51 06.7	11 08 13.5

$T = 15^h\ 00^m.0$

$E_o = +\ 11^h\ 08^m\ 40^s.0$

$E = +\ 11\ 10\ 42$

Normal equations.

$$5\,\varepsilon + 5.87\,a + 3.0\,b = +\ 46.6 \qquad a = -\ 100^s$$
$$+\ 5.87\,\varepsilon + 7.32\,a + 5.2\,b = +\ 23.7 \qquad b = +\ 7.1$$
$$+\ 3.0\,\varepsilon + 5.2\,a + 13.0\,b = -\ 63.8 \qquad \varepsilon = +\ 122$$

November 21, 1853. Circle East.

Object.	Mean of wires.	R.	Cc.	t.	AR.
51 Cephei s. p. R.	$7^h\ 09^m\ 31^s.1$	$-22^s.9$	$+2^s.1$	$7^h\ 09^m\ 10^s.3$	$18^h\ 30^m\ 45^s.4$
β Lyræ	7 23 51.5	−18.9	−0.1	7 23 32.5	18 44 39.0
ζ Aquilæ	7 37 55.2	−16.6	−0.1	7 37 38.5	18 58 39.6
δ Geminor s. p.	7 50 50.2	−14.5	+0.1	7 50 35.8	19 11 23.4
δ Aquilæ	7 57 21.7	−13.4	−0.1	7 57 08.2	19 18 05.8
γ Cancri s. p.	9 14 03.0	− 0.9	+0.1	9 14 02.2	20 34 48.9
☾ II. s. p.	9 19 14.1	0.0	+0.1	9 19 14.2	
ι Urs. maj. s. p.	9 28 36.2	+ 1.5	+0.2	9 28 37.9	20 49 10.2
ζ Cygni R.	9 45 31.3	+ 4.3	−0.1	9 45 35.5	21 06 41.7
α Cephei R.	9 54 13.2	+ 5.7	−0.2	9 54 18 7	21 15 03.8
λ Leonis s. p.	10 02 28.2	+ 7.1	+0.1	10 02 35.4	21 23 21.8

$T = 9^h\ 19^m.2$

$E_o = +\ 11^h\ 20^m\ 50^s.0$

$E = +\ 11\ 22\ 02.$

Normal equations.

$$+\ 9\,\varepsilon + 8.57\,a - 2.6\,b = +\ 19.5 \qquad a = -\ 70^s.4$$
$$+\ 8.57\,\varepsilon + 8.2\,a - 2.0\,b = +\ 11.4 \qquad b = +\ 13.6$$
$$-\ 2.6\,\varepsilon - 2.0\,a + 6.3\,b = +\ 37.3 \qquad \varepsilon = +\ 72.5$$

Object.	Mean+R+Cc.	Bb.	Aa.	t.	Difference.	AR.	Deduced sidereal time of moon's limb.
δ Geminor s. p.	$7^h\ 50^m\ 35^s.8$	$-\ 2^s.9$	$-73^s.9$	$7^h\ 49^m\ 19^s.0$	$+1^h\ 28^m\ 37^s.0$	$19^h\ 11^m\ 23^s.4$	$20^h\ 40^m\ 00^s.4$
γ Cancri s. p.	9 14 02.2	− 2.7	−75.3	9 12 44.2	+ 5 11.8	20 34 48.9	20 40 00.7
☾ II. s. p.	9 19 14.2	− 2.9	−75.3	9 17 56.0			20 40 00.7
(ζ Cygni R.)	9 45 35.5	−10.2	−60.5	9 44 24.8	− 26 28.8	21 06 41.7	(20 40 12.9)
λ Leonis s. p.	10 02 35.4	− 3.1	−75.3	10 01 17.0	− 43 21.0	21 23 21.8	20 40 00.8

Omitting ζ Cygni, R., the deduced sidereal time of the ☾'s IId limb becomes $20^h\ 40^m\ 00^s.7$.

November 23. Circle East.

Object.	Mean of wires.	R.	Cc.	Mean + R + Cc.	AR.	ε.
η Draconis R.	$4^h\ 55^m\ 08^s.0$	$-20^s.5$	$-0^s.4$	$4^h\ 54^m\ 47^s.1$	$16^h\ 21^m\ 58.^s6$	$11^h\ 27^m\ 11^s.5$
α Tauri s. p.	5 00 29.5	—19.6	+0.2	5 00 10.1	16 27 32.6	11 27 22.5
α Aurig. s. p.	5 39 04.0	—13.3	+0.3	5 38 51.0	17 05 54.4	11 27 03.4
γ Drac. R.	6 26 01.9	— 5.6	—0.3	6 25 56.0	17 53 10.4	11 27 14.4
α Lyræ	7 04 04.3	+ 0.7	—0.3	7 04 04.7	18 31 57.3	11 27 52.6
β Lyræ	7 16 48.2	+ 2.8	—0.2	7 16 50.8	18 44 39.0	11 27 48.2
ζ Aquilæ	7 30 56.9	+ 5.1	—0.2	7 31 01.8	18 58 39.6	11 27 37.8
δ Gemi. s. p.	7 43 58.1	+ 7.2	+0.2	7 44 05.5	19 11 23.5	11 27 18.0

The normal equations give: $a = -34^s.4$

$T = 7^h\ 00^m.0$ $b = +\ 1.2$

$E_0 = +\ 11^h\ 27^m\ 30^s$ $\varepsilon = +\ 27$

Object.	Mean of wires.	R.	Cc.	Bb.	Aa.	t.	Difference.	AR.	Deduced sid. time of moon's limb.
α Leonis	$22^h\ 30^m\ 24^s.9$	$-8^s.0$	$-0.^s2$	$+0^s.5$	$-32^s.3$	$22^h\ 29^m\ 44^s.9$	$+48^m\ 50^s.5$	$10^h\ 00^m\ 34^s.2$	$10^h\ 49^m\ 24^s.7$
γ Leonis	22 41 38.3	—6.2	—0.2	+0.7	—31.0	22 41 01.6	+37 33.8	10 11 53.6	10 49 27.4
☾ II.	23 19 07.1	0.0	—0.2	+0.5	—32.0	23 18 35.4			10 49 25.0
χ Leonis	23 27 10.7	+1.3	—0.2	+0.4	—32.3	23 26 39.9	— 8 04.5	10 57 27.4	10 49 22.9

The mean from the three stars has been adopted.

For the following observations on Dec. 8, Dec. 9, and Dec. 12, the azimuth error has been assumed zero, as it nearly results from the mean found on December 13, 14, and 15; the level error is — 2.8, as found on the 13th and the two following days. The difference in the values of A on Dec. 8, 9, and 12, is in maximo but 0.1.

December 8, 1853. Circle East.

Object.	Mean of wires.	R.	Aa.	Bb.	Cc.	t.	Difference.	AR.	Deduced sid. time of moon's limb.
ι Piscium	$11^h\ 04^m\ 34^s.8$	$-8^s.3$	$0^s.0$	$-0^s.8$	$-1^s.1$	$11^h\ 04^m\ 24^s.6$	$+51^m\ 05^s.3$	$23^h\ 32^m\ 25^s.4$	$0^h\ 23^m\ 30^s.7$
(α Andro.)	11 32 31.1	—3.8	0.0	—2.0	—1.3	11 32 24.0	+23 05.9	0 00 49.9	(0 23 55.8)
(γ Pegasi)	11 37 37.5	—3.0	0.0	—1.4	—1.1	11 37 32.0	+17 57.9	0 05 42.3	(0 23 40.2)
☾ I.	11 55 31.6	0.0	0.0	—0.6	—1.1	11 55 29.9			0 23 31.5
δ Piscium	12 13 02.4	+2.9	0.0	—0.8	—1.1	12 13 03.4	—17 33.5	0 41 05.9	0 23 32.4

Excluding the results from α Androm. and γ Pegasi, the observed AR. of the moon becomes $0^h\ 23^m\ 31^s.5$.

December 9, 1853. Circle East.

Object.	Mean of wires.	R.	Aa.	Bb.	Cc.	t.	Difference.	AR.	Deduced sid. time of moon's limb.
α Andro.	$11^h\ 28^m\ 36^s.9$	$-11^s.3$	$0^s.0$	$-2^s.0$	$-1^s.3$	$11^h\ 28^m\ 22^s.3$	$+1^h\ 09^m\ 13^s.9$	$0^h\ 00^m\ 49^s.9$	$1^h\ 09^m\ 63^s.8$
γ Pegasi	11 33 42.8	—10.5	0.0	—1.4	—1.2	11 33 29.7	+1 04 06.5	0 05 42.3	1 09 48.8
☾ I.	12 37 38.2	0.0	0.0	—0.8	—1.2	12 37 36.2			?(1 09 53.8)

Moon seen through clouds.

Giving the result by γ Pegasi the weight two, the observed AR of the moon results as above; it is, however, preferable to reject the result altogether, on account of the great difference in the results by the two stars.

December 12, 1853. Circle East.

Object.	Mean of wires.	*R.*	*Aa.*	*Bb.*	*Cc.*	*t.*	Difference.	*AR.*	Deduced sid. time of moon's limb.
δ Arietis	2h 19m 02s.9	—4s.3	0s.0	—1s.4	—1s.4	2h 18m 55s.8	+26m 16s.1	3h 03m 17s.0	3h 29m 33s.1
☽ I.	2 45 14.6	0.0	0.0	—1.4	—1.3	2 45 11.9			3 29 35.6
η Tauri	2 54 22.7	+1.5	0.0	—1.7	—1.3	2 54 21.2	—09 09.3	3 38 48.7	3 29 39.4
27 Tauri	2 56 03.7	+1.8	0.0	—1.7	—1.4	2 56 02.4	—10 50.5	3 40 29.1	3 29 38.6
A′ Tauri	3 11 38.6	+4.3	0.0	—1.7	—1.4	3 11 39.8	—26 27.9	3 56 04.1	3 29 36.2

δ Arietis is nearer to the moon in reference to declination than any of the other stars, and since they differ considerably in their value for the ☾'s sidereal time, it seemed to be preferable to combine the results from η, 27, and A′ Tauri into one, and take the mean between it and that obtained by δ Arietis. $E_o = +\ 12^h\ 44^m\ 24^s.9$.

December 13, 1853. Circle West.

Object.	Mean of wires.	*R.*	*Cc.*	Mean + *R* + *Cc.*	*AR.*
Polaris R.	12h 15m 44s.0	—17s.1	+54s.6	12h 16m 21s.5	1h 06m 19s.7
α Arietis R.	1 10 45.0	— 8.1	+ 1.5	13 10 38.4	1 58 56.6
α Bootis s. p.	1 20 46.9	— 6.4	— 1.5	13 20 39.0	2 08 58.2
γ Ceti	1 47 30.3	— 2.0	+ 1.4	13 47 29.7	2 35 44.1
β Urs. min. s. p. R.	2 02 56.1	+ 0.5	— 5.3	14 02 51.3	2 51 07.6
α Coron. s. p.	2 40 03.7	+ 6.6	— 1.5	14 40 38.8	3 28 28.1
η Tauri	2 50 22.3	+ 8.3	+ 1.5	14 50 32.1	3 38 48.7
27 Tauri	2 52 02.4	+ 8.5	+ 1.5	14 52 12.4	3 40 29.1
A′ Tauri	3 07 33.7	+11.1	+ 1.5	15 07 46.3	3 56 04.1
☾ I.	3 30 37.5	+14.9	+ 1.5	15 30 53.9	

$T = 14^h\ 00^m.0$ $E_o = +\ 12^h\ 48^m\ 20^s$

The above data were used in three different forms: 1st, omitting Polaris; 2d, omitting Polaris and β Urs. min.; and last, taking all the stars. The first hypothesis gave apparently the best results, viz :—

Normal equations:

$$+8\ \varepsilon + 8.55\ a + 4.3\ b = -51.5 \qquad a = +26^s.4$$
$$+8.55\ \varepsilon + 9.3\ a + 6.5\ b = -55.8 \qquad b = -2.8$$
$$+4.3\ \varepsilon + 6.5\ a + 13.3\ b = -8.5 \qquad \varepsilon = -33.1$$
$$E = +\ 12^h\ 47^m\ 47^s$$

Object.	*Bb.*	*Aa.*	*t.*	Difference.	*AR.*	Observed sid. time of moon's limb.
η Tauri	—1s.7	+24s.0	14h 50m 54s.4	+40m 22s.1	3h 38m 48s.7	4h 19m 10s.8
27 Tauri	—1.7	+24.0	14 52 34.7	+38 41.8	3 40 29.1	4 19 10.9
A′ Tauri	—1.7	+24.3	15 08 08.9	+23 07.6	3 56 04.1	4 19 11.7
☽ I.	—1.7	+24.3	15 31 16.5			4 19 11.1

The mean result from the three stars has been adopted.

December 14, 1853. Circle West.

Object.	Mean of wires.	R.	Cc.	Mean + R + Cc.	AR.
ε Urs. min. s. p. R.	4h 03m 01s.7	— 1s.9	—10s.4	16h 08m 49s.4	5h 00m 55s.9
☾ I.	4 18 17.9	— 0.4	+ 1.5	16 18 19.0	
☾ II.	4 20 30.1	0.0	+ 1.5	16 20 31.6	
o Tauri	4 26 12.8	+ 0.9	+ 1.5	16 26 15.2	5 18 52.2
δ Orionis	4 31 56.6	+ 1.9	+ 1.4	16 31 59.9	5 24 33.2
ζ Tauri	4 36 14.8	+ 2.6	+ 1.5	16 36 18.9	5 28 55.4
α Orionis	4 54 34.4	+ 5.6	+ 1.4	16 54 41.4	5 47 16.2
μ Geminor	5 21 22.5	+10.0	+ 1.4	17 21 34.0	6 14 07.7

T = 16h 20m.5 E_0 = + 12h 52m 40s

The normal equations: + 6 ε + 7.1 a + 9.3 b = — 58.2 give a = — 5s.0
+ 7.1 ε + 10.2 a + 18.3 b = — 102.0 b = — 3.3
+ 9.3 ε + 18.3 a + 50.3 b = — 245.1 ε = + 1.3

Object.	Bb.	Aa.	t.	Differences. (Very near full moon.) I.	Differences. (Very near full moon.) II.	AR.	Deduced sid. time of moon's limb. I.	Deduced sid. time of moon's limb. II.
☾ I.	—2s.0	—4s.5	16h 18m 12s.5				5h 10m 53s.8	
☾ II.	—2.0	—4.5	16 20 25.1					5h 13m 06s.4
o Tauri	—2.0	—4.5	16 26 08.7	—0h 7m 56s.2	—0h 5m 43s.6	5h 18m 52s.2	5 10 56.0	5 13 08.6
δ Orionis	—0.7	—5.0	16 31 54.2	—0 13 41.7	—0 11 29.1	5 24 33.2	5 10 51.9	5 13 04.1
ζ Tauri	—2.0	—4.5	16 36 12.4	—0 17 59.9	—0 15 47.3	5 28 55.4	5 10 55.5	5 13 08.1
α Orionis	—1.0	—5.0	16 54 35.4	—0 36 22.9	—0 34 10.3	5 47 16.2	5 10 53.3	5 13 05.9
μ Geminor	—2.0	—4.5	17 21 27.5	—1 03 15.0	—1 01 02.4	6 14 07.7	5 10 52.7	5 13 05.3

December 15, 1853. Circle West.

Object.	Mean of wires.	R.	Cc.	Mean + R + Cc.	AR.
Polaris R.	12h 07m 22s.7	—24s.7	+54s.6	12h 07m 52s.6	1h 06m 18s.4
η Urs. maj. s. p.	12 45 57 5	—18.3	— 2.2	12 45 37.0	1 41 45.1
η Bootis s. p.	12 51 47.9	—17.5	— 1.4	12 51 29.0	1 47 42.2
α Arietis R.	1 02 57.0	—15.6	+ 1.5	13 02 42.9	1 58 56.6
α Bootis s. p.	1 13 01.4	—13.9	— 1.5	13 12 46.0	2 08 58.3
γ Ceti	1 39 39.0	— 9.6	+ 1.4	13 39 30.8	2 35 44.1
β Urs. min. s. p. R.	1 55 20.5	— 7.0	— 5.3	13 55 08.2	2 51 07.7
o Tauri	4 22 18.7	+17.1	+ 1.5	16 22 37.3	5 18 52.3
ζ Tauri	4 32 19.9	+18.9	+ 1.5	16 32 40 3	5 28 55.4
α Orionis	4 50 37.4	+21.8	+ 1.4	16 51 00.6	5 47 16.2
γ Draconis s. p.	4 56 42.7	+22.7	— 2.2	16 57 03.2	5 53 10.3
☾ II.	5 09 56.5	+24.9	+ 1.5	17 10 22.9	
μ Geminor	5 17 24.8	+26.1	+ 1.5	17 17 52.4	6 14 07.8

T = 14h 38m.0 E_0 = + 12h 56m 15s

A preliminary discussion showed that the result from Polaris was accordant with the results from the other stars; the whole group gave the following normal equations :—

+ 12 ε + 10.87 a — 35.65 b = + 94.1 a = — 22s.9 E = + 12h 56m 37s.1
+ 10.87 ε + 13 9 a + 38.4 b = — 168.1 b = — 2.26
— 35.65 ε + 38.4 a + 1497.5 b = — 5072.0 ε = + 22.1

Object.	*Bb.*	*Aa.*	*t.*	Difference.	*AR.*	Deduced sidereal time of moon's limb.
o Tauri	—1ˢ.4	—20ˢ.6	16ʰ 22ᵐ 15ˢ.3	+47ᵐ 45ˢ.4	5ʰ 18ᵐ 52ˢ.3	6ʰ 06ᵐ 37ˢ.7
ζ Tauri	—1.4	—20.6	16 32 18.3	+37 42.4	5 28 55.4	6 06 37.8
α Orionis	—0.7	—22.9	16 50 37.0	+19 23.7	5 47 16.2	6 06 39.9
(γ Draconis s. p.)	+2.3	—27.5	16 56 38.0	+13 22.7	5 53 10.3	(6 06 33.0)
☾ II.	—1.6	—20.6	17 10 00.7			6 06 38.4
μ Geminor	—1.4	—20.6	17 17 30.4	— 7 29.7	6 14 07.8	6 06 38.1

Excluding γ Draconis, we obtain from the mean of four stars the deduced *AR* of the moon as above.

January 8, 1854. Circle West.

Object.	Mean of wires.	*R.*	*Cc.*	*Aa.*[1]	*M+R+Cc+Aa.*	*AR.*
α Bootis s. p.	11ʰ 37ᵐ 55ˢ.2	—10ˢ.5	—1ˢ.5	+24ˢ.9	11ʰ 38ᵐ 08ˢ.1	2ʰ 08ᵐ 58ˢ.9
845 B. A. C.	12 05 53.8	— 5.9	+1.4	+24.9	12 06 14.2	2 37 02.9
π Arietis	12 09 58.0	— 5.2	+1.4	+22.4	12 10 16.6	2 41 08.6
α Ceti	12 23 26.2	— 3.1	+1.4	+24.9	12 23 49.4	2 54 38.8
☾ I.	12 41 58.5	0.0	+1.4	+24.9	12 42 24.8	
Saturn centre	1 01 59.7	+ 3.3	+1.4	+24.9	13 02 29.3	3 33 19.6
17 Tauri	1 04 52.8	+ 3.8	+1.5	+24.9	13 05 23.0	3 36 12.7
η Tauri	1 07 28.9	+ 4.2	+1.5	+24.9	13 07 59.5	3 38 48.6
27 Tauri	1 09 09.6	+ 4.5	+1.5	+24.9	13 09 40.5	3 40 29.1

T = 12ʰ 42ᵐ.0 E_o = + 14ʰ 30ᵐ 50ˢ

Normal equations: $8\,\epsilon + 3.3\,b = -1.4$ $b = -1.3$

$3.3\,\epsilon + 1.9\,b = -1.27$ $\epsilon = +0.4$

Object.	*Bb.*	*t.*	Difference.	Deduced sidereal time of moon's limb.
845 B. A. C.	—0ˢ.5	12ʰ 06ᵐ 13ˢ.7	+0ʰ 36ᵐ 10ˢ.5	3ʰ 13ᵐ 13ˢ.4
π Arietis	—0.6	12 10 16.0	+ 32 08.2	3 13 16.8
α Ceti	—0.4	12 23 49.0	+ 18 35.2	3 13 14.0
☾ I.	—0.6	12 42 24.2		3 13 14.5
Saturn centre	—0.6	13 02 28.7	— 20 04.5	3 13 15.1
17 Tauri	—0.8	13 05 22.2	— 22 58.0	3 13 14.7
η Tauri	—0.8	13 07 58.7	— 25 34.5	3 13 14.1
27 Tauri	—0.8	13 09 39.7	— 27 15.5	3 13 13.6

January 9, 1854. Circle West.

Object.	Mean of wires.	*R.*	*Cc.*	*M+R+Cc.*	*AR.*
γ Pegasi	9ʰ 31ᵐ 01ˢ.4	—9ˢ.7	+ 1ˢ.4	9ʰ 30ᵐ 53ˢ.1	0ʰ 05ᵐ 42ˢ.0
α Cassiop. R.	9 57 58.1	—5.2	+ 2.4	9 57 55.3	0 32 13.3
Polaris R.	10 43 17.2	+2.1	+54.6	10 44 13.9	1 05 58.3
η Urs. maj. s. p.	11 06 47.2	+6.0	— 2.2	11 06 51.0	1 41 46.2
α Arietis	11 23 57.1	+8.8	+ 1.5	11 24 07.4	1 58 56.3

T = 10ʰ 30ᵐ E_o = + 14ʰ 34ᵐ 50ˢ The normal equations give $a = +38^s.9$

$b = +20.0$

$\epsilon = -24.7$

Omitting Polaris, ε would be = — 35.8

[1] The azimuthal deviation cannot be found from the above observations. The mean *a* has, therefore, been used, as found on the 9th and 10th, viz: $a = +24''.9$.

January 10, 1854. Circle West.

Object.	Mean of wires.	R.	Cc.	M+R+Cc.	AR.
γ Pegasi	$9^h\ 27^m\ 07^s.6$	$-10^s.3$	$+\ 1^s.4$	$9^h\ 26^m\ 58^s.7$	$0^h\ 05^m\ 42^s.0$
α Cassiop. R.	9 54 04.9	— 5.8	+ 2.4	9 54 01.5	0 32 13.3
Polaris R.	10 39 39.7	+ 1.5	+54.6	10 40 35.8	1 05 57 3
α Bootis s. p.	11 30 03.0	+ 9.8	— 1.5	11 30 11.3	2 08 59.1

$T = 10^h\ 30^m$ $E_o = +\ 14^h\ 38^m\ 40^s$ The normal equations give $a = +\ 10^s.9$
$b = +\ 20.6$
$\varepsilon = -\ 3.5$

RECAPITULATION OF THE DEDUCED SIDEREAL TIMES OF THE MOON'S LIMB.

1853.	Nov. 18	☾ II. s. p.	$17^h\ 57^m\ 43^s.2$	1853.	Dec. 13	☾ I.	$4^h\ 19^m\ 11^s.1$
	" 21	☾ II. s. p.	20 40 00.7		" 14	☾ I.	5 10 53.8
	" 23	☾ II.	10 49 25.0		" 14	☾ II.	5 13 06.4
	Dec. 8	☾ I.	0 23 31.5		" 15	☾ II.	6 06 38.4
	" 9	☾ I.	(1 09 53.8)?	1854.	Jan. 8	☾ I.	3 13 14.5
	" 12	☾ I.	3 29 35.6				

The longitude is deduced from the above values by a method received from Prof. Peirce in 1851, an account of which is given in Coast Survey Report for 1858, Appendix No. 21, p. 186.

From the Greenwich observations[1] we have the following corrections to the tabular places of the moon's right ascension, as given in the Greenwich Nautical Almanac:—

		From transit observations.	From altazimuth observations.	Mean adopted.
1853.	November 18 . . .	$-0^s.36$	$-0^s.58$	$-0^s.47$
	" 21 . . .	—0.24		—0.24
	" 23 . . .	—0.10		—0.10
	December 8 . . .	—0.70	—0.99	—0.84
	" 9 . . .	—0.77		—0.77
	" 12 . . .	—0.22	—0.10	—0.15
	" 13 . . .		+0.02	+0.02
	" 14 . . .		—0.64	—0.64
	" 15 . . .		—0.54	—0.54
1854.	January 8 . . .	—0.36	—0.78	—0.57

The weights assigned to the moon culminations are approximations; the greater the number and the better the agreement of the results from the moon culminating stars the greater the weight. The result deduced for December 9 is unreliable, and has been rejected; the result for December 8 is not much better, but has been worked up along with the rest.

[1] Astronomical and Magnetic and Meteorological Observations at the Royal Observatory, Greenwich. Volumes for 1853 and 1854. London, 1855 and 1856.

REDUCTION OF THE LONGITUDE OF VAN RENSSELAER HARBOR OBSERVATORY.

From observations of the moon and the moon culminating stars.

	1853. ☾ II. s. p. November 18.	☾ II. s. p. November 21.	☾ II. November 23.	☾ I. December 8.	☾ I. December 12.
Approx. sid. time of obs'n.	$17^h\ 58^m$	$20^h\ 40^m$	$10^h\ 49^m$	$0^h\ 24^m$	$3^h\ 30^m$
" Greenwich m. t.	6 50	9 20	23 19	11 57	14 46
Moon's declination	+25° 09′.5	+22° 58′.8	+13° 19′.6	—2° 37′.8	+17° 31′.8
" semidiameter	14′ 44″.7	14′ 58″.1	15′ 26″.6	15′ 16″.2	14′ 47″.2
Semidiameter × sec. D.	— 65^s.16	— 65^s.03	— 63^s.48	+ 61^s.14	+ 62^s.03
Sid. t. of transit of ☾'s limb	$17^h\ 57^m\ 43^s.2$	$20^h\ 40^m\ 00^s.7$	$10^h\ 49^m\ 25^s.0$	$0^h\ 23^m\ 31^s.5$	$3^h\ 29^m\ 35^s.6$
Observed AR of centre	17 56 38.0	20 38 55.7	10 48 21.5	0 24 32.6	3 30 37.6
Corr'd tab. AR of prec. full hour at Greenwich	17 54 45.4	20 38 11.9	10 47 40.7	0 22 37.2	3 29 02.4
Difference	1 52.6	43.8	40.8	1 55.4	1 35.2
Hourly motion	2 10.06	2 08.64	2 02.45	1 53.65	1 58.02
Greenwich mean time	6 51 58	9 20 25	23 19 59	12 00 53	14 48 26
Corresp'g G. sid. time	22 42 51	25 23 33	15 33 18	5 11 28	8 15 15
Longitude W. of Green'h	4 45 08	4 43 32	4 43 53	4 47 57	4 45 39
Weight	1	3	2	1	1

	1853. ☾ I. December 13.	☾ I. December 14.	☾ II. December 14.	☾ II. December 15.	1854. ☾ I. January 8.
Approx. sid. time of obs'n.	$4^h\ 19^m$	$5^h\ 11^m$	$5^h\ 13^m$	$6^h\ 07^m$	$3^h\ 13^m$
" Greenwich m. t.	15 31	16 19	16 21	17 11	12 43
Moon's declination	+21° 07′.7	+23° 46′.9	+23° 47′.0	+25° 19′.4	+16° 13′.3
" semidiameter	14′ 44″.6	14′ 43″.7	14′ 43″.7	14′ 44″.4	14′ 50″.6
Semidiameter × sec. D.	+ 58^s.97	+ 58^s.91	— 58^s.91	— 58^s.96	+ 59^s.37
Sid. t. of transit of ☾'s limb	$4^h\ 19^m\ 11^s.1$	$5^h\ 10^m\ 53^s.8$	$5^h\ 13^m\ 06^s.4$	$6^h\ 06^m\ 38^s.4$	$3^h\ 13^m\ 14^s.5$
Observed AR of centre	4 20 14.3	5 11 58.2	5 12 02.0	6 05 33.2	3 14 16.3
Corr'd tab. AR of prec. full hour at Greenwich	4 19 08.9	5 11 16.6	5 11 16.6	6 05 08.0	3 12 54.5
Difference	1 05.4	41.6	45.4	25.2	1 21.8
Hourly motion	2 02.87	2 07.52	2 07.52	2 10.82	1 56.53
Greenwich mean time	15 31 57	16 19 35	16 21 22	17 11 33	12 42 08
Corresp'g G. sid. time	9 02 50	9 54 32	9 56 20	10 50 36	7 55 04
Longitude W. of Green'h	4 43 39	4 43 38	4 43 14	4 43 58	4 41 50
Weight	3	$\frac{3}{2}$	$\frac{3}{2}$	3	3

RECAPITULATION OF RESULTS, FROM MOON CULMINATIONS, OF THE LONGITUDE OF VAN RENSSELAER HARBOR OBSERVATORY.

	Moon's limb.	Longitude W. of Greenwich.	W.
1853. November 18 . . .	☾ II. s. p.	$4^h\ 45^m\ 08^s$	1
" 21 . . .	☾ II. s. p.	4 43 32	3
" 23 . . .	☾ II.	4 43 53	2
December 8 . . .	☾ I.	4 47 57?	1
" 12 . . .	☾ I.	4 45 39	1
" 13 . . .	☾ I.	4 43 39	3
" 14 . . .	☾ I.	4 43 38	1.5
" 14 . . .	☾ II.	4 43 14	1.5
" 15 . . .	☾ II.	4 43 58	3
1854. January 8 . . .	☾ I.	4 41 50	3

The value of December 8 must be rejected on the ground of imperfect transits; it is also thrown out by Peirce's Criterion; if included it would make the final result 13^s greater.

The weighted mean from nine observations is $4^h\ 43^m\ 34^s \pm 13^s$. If we combine the results according to the moon's limb, we find:—

From observations of ☾ I.	$4^h\ 43^m\ 14^s$	weight 8.5
" " ☾ II.	4 43 50	" 10.5
Mean	4 43 32	

which last value I have adopted.

Record and Reduction of the Occultations and Eclipse, observed at Van Rensselaer Harbor.

The observations of occultations and of an eclipse were made at the Winter Quarters in latitude 78° 37′ 04″, and in approximate west longitude $4^h\ 43^m\ 32^s$.

In the following record, the times are given by chronometer, uncorrected for error and rate, in the two accounts of it in Appendix No. IX., second volume of the Narrative, pages 398 and 399, and in No. 1017 of the Astronomische Nachrichten, pages 135 and 136, the time is mean local time, as made out by Mr. Sonntag.

Occultation of Saturn. December 12, 1853.

Immersion at	$7^h\ 03^m\ 11^s.6$	Pocket chronometer.	A. Sonntag, observer.
"	7 28 49.0	Chronometer No. 2143.	Dr. Hayes, "
		1^s before the complete disappearance.	
Emersion at	7 36 50	Pocket chronometer.	A. Sonntag, observer.
		Perhaps 10^s too late.	

Note.—Moon's limb much undulating. The telescopes were one of English make and one by Fraunhofer, each of thirty-inch focal length. At immersion the time was noted when the last point of Saturn's ring disappeared behind the moon's limb; at the emersion, the time is given when the last point of the ring parted from the moon's limb. Chronometer comparisons :—

Pocket chronometer	$6^h\ 21^m\ 19^s.3$	No. 2143	$6^h\ 47^m$	All mean time chronometers.
	22 36.0	" 370	40	
	24 34.0	" 2721	19	
	26 30.7	" 264	29	

Occultation of Saturn. January 8, 1854.

Immersion at	$10^h\ 10^m\ 30^s$	Pocket chronometer.	A. Sonntag, observer.
		Doubtful, perhaps obscured by a cloud.	
Emersion at	11 07 06.5	Pocket chronometer.	A. Sonntag, observer.
		Moment when the last point of Saturn's ring parted from the moon's limb.	

For points of contact see note to the occultation of the 12th of December. Chronometer comparison

Pocket chronometer $10^h\ 18^m\ 30^s.0$ No. 2143 $10^h\ 45^m$

Occultation of Saturn. February (4) 5, 1854.

Immersion at	$4^h\ 25^m\ 10^s.5$	Pocket chronometer.	A. Sonntag, observer.
" at	4 52 55.0	No. 2143.	Dr. Kane, "
		Disappearance of last point of ring.	
Emersion at	5 23 09.0	Pocket chronometer.	A. Sonntag, observer.
		Saturn's centre.	
" at	5 51 13.0	No. 2143.	Dr. Kane, observer.
		Last contact of ring.	The moon's limb was much undulating.

Chronometer comparisons :—

Pocket chronometer	$4^h\ 33^m\ 17^s.2$	No. 2143	$5^h\ 01^m$
	34 48.4	" 370	4 58
	36 01.4	" 2721	29
	37 17.9	" 264	40

The sky was very clear. Thermometer at immersion —53° (corrected temp. = —58°.2), at the emersion —52° (corrected temp. = —54°.6).

Occultation of Mars. February 13, 1854.

Immersion, first contact at	$1^h\ 04^m\ 59^s.0$	Pocket chronometer.	A. Sonntag, observer.
" second " at	1 06 01.5	" " (Disappearance.)	" "
" " " at	1 33 47.0	No. 2143. (Disappearance.)	Dr. Kane, observer.
Emersion, last contact at	1 36 05.5	Pocket chronometer.	A. Sonntag, observer.

Chronometer comparisons :—

Pocket chronometer	$1^h\ 14^m\ 01^s.2$	No. 2143	$1^h\ 42^m$
	15 51.2	" 370	40
	16 20.8	" 2721	9
	17 18.0	" 264	20

Note.—Moon near the horizon, limb much undulating. Immersion reliable, emersion doubtful; perhaps too late. The planet reappeared at a different place than expected.

The observations for time, for the above occultations, were made with the eighteen inch transit instrument.

Observation of the solar eclipse. May 15, 1855.

The original entry of the observations of this eclipse I could not find: the following has been copied from the published account in the Narrative:—

Mean local time of beginning	$9^h\ 13^m\ 41^s$	Dr. Kane, observer.
	38	A. Sonntag, "
" " " ending	10 55 44	Dr. Kane, "
	52	A. Sonntag, "

Altitude of the sun at beginning 10° 17′, at ending 8°. The time was obtained from observations of equal altitudes of the sun.

Reduction of the preceding Observations for Longitude.

Converting the chronometer error on sidereal time to its equivalent on mean time, we have, from the preceding transit reductions, the following results:—

1853. December 8	$7^h\ 13^m$	$E = -4^h\ 42^m\ 24^s.8$	$22^s.2$
9	7 54	—4 42 17.9	
12	10 02	—4 42 23.9	
13	9 17	—4 42 48.9	
14	11 38	—4 42 16.6	
15	9 56	—4 42 00.5	
Mean, December 13.5		$E = -4\ 42\ 22.1 \pm 5^s$	

The differences in the values of E are due to the imperfect transits arising from the difficulty of obtaining a reliable azimuthal determination, and since the rate of the chronometer has been found by frequent comparisons with the other mean time chronometers to be uniform, I have preferred to use the mean E from the

several determinations. The next reliable time observations are on February 20, 1854, which gave $E = -4^h\ 42^m\ 51^s.4$ at $7^h\ 56^m$ (mean time); the daily rate is accordingly $-0^s.42$ (gaining), and the chronometer error on mean time for the several occultations becomes:—

1853.	December 12, 14^h	$E = -4^h\ 42^m\ 21^s.7$	Occultation of Saturn.
1854.	January 8, 18	$-4\ 42\ 33.3$	" "
"	February 4–5, 1	$-4\ 42\ 44.8$	" "
"	" 13, 20	$-4\ 42\ 48.2$	" of Mars.

That the rate of the pocket chronometer during the above times was uniform is proved by the comparisons with the other chronometers; between December 12 and January 8, 2143 had a gaining rate on the pocket chronometer of $1^s.9$, between the latter date and February 5 it was $2^s.3$, and between the last date and February 13 it was $2^s.2$. The true rate of 2143 is, therefore, $-2^s.2 - 0^s.4 = -2^s.6$.

The following table contains the observed times of the several phases of the occultations of Saturn and ring:—

Van Rensselaer mean time.	December 12, 1853.	January 8, 1854.	February 4–5, 1854.
Immersion, contact of last point of ring	$14^h\ 20^m\ 48^s.8$	$17^h\ 27^m\ 56^s.7$	$4^d\ 23^h\ 42^m\ 23^s.2$
Emersion, centre			$5\ 0\ 40\ 20.8$
" last contact of ring	$14\ 54\ 18.3$	$18\ 24\ 33.2$	$0\ 40\ 42.0$

The method of reduction used is that of finding the time of true conjunction in right ascension, and the notation the same as given in vol. II. of Sawitsch's Treatise on Practical Astronomy (German edition, by Dr. W. C. Goetze, Hamburg, 1851). Hansen's interpolation formula was used. The tabular Nautical Almanac places and data have been corrected, when practicable, from the Greenwich observations.

Longitude from the Observations of the Occultation of Saturn's Ring.

December 12, 1853.

Immersion, last contact of ring	$7^h\ 48^m\ 20^s.0$	Sidereal time at Van Rensselaer	or $19^h\ 04^m\ 20^s.8$ / $19\ 37\ 50.3$ — Approx. Greenwich mean time.
Emersion, " "	$8\ 21\ 55.0$		

From the Greenwich Nautical Almanac, as corrected from the Greenwich observations:—

At immersion, α ☾ . . . $3^h\ 39^m\ 02^s.59$
At emersion . . . . . $3\ 40\ 08.92$
(Correction to Nautical Almanac $-0^s.22$)
At immerson, δ ☾ . . . $+18°\ 12'\ 55''.1$
At emersion . . . . . $18\ 18\ 08.9$
(Correction to Nautical Almanac $-5''.0$)
At immersion, horizontal parallax ☾ $54'\ 07''.1$
At emersion . . . . . $54\ 06.8$
(Correction $+0''.3$ according to Adams.)
At immersion, semidiameter ☾ . . $14'\ 45''.5$
At emersion . . . . . $14\ 45.4$
(Correction $-1''.1$ according to Oudeman's Astronomische Nachr. No. 1202.)

At immersion, α ♄ . . $3^h\ 39^m\ 09^s.11$
At emersion . . . . . $3\ 39\ 08.71$
(Correction to Nautical Almanac $+0^s.15$.)
At immersion δ ♄ . . $+17°\ 14'\ 26''.3$
At emersion . . . . . $17\ 14\ 25.2$
(Correction to Nautical Almanac $-8''.9$.)

Horizontal parallax ♄ . . . $1''.0$
Semidiameter ♄ . . . . $9''.2+1''.0$

Mean time of ☌, Greenwich $19^h\ 07^m\ 39^s.3$

Immersion.		Emersion.	
☾'s horizontal paral. at Van Rensselaer	53′ 56″.7	☾'s horizontal paral. at Van Rensselaer	53′ 56″.4
Relative parallax π	53 55.7	Relative parallax π	53 55.4
$\alpha - s$	—62° 19 21.1	$\alpha - s$	—70° 26 31.5
$\alpha' - \alpha = p =$	— 10 00.09	$\alpha' - \alpha = p =$	— 10 38.50
$\delta' - \delta = q =$	— 48 57.19	$\delta' - \delta = q =$	— 49 20.16
Augmented semidiameter ☾ .	890.9	Augmented semidiameter ☾ .	890.5

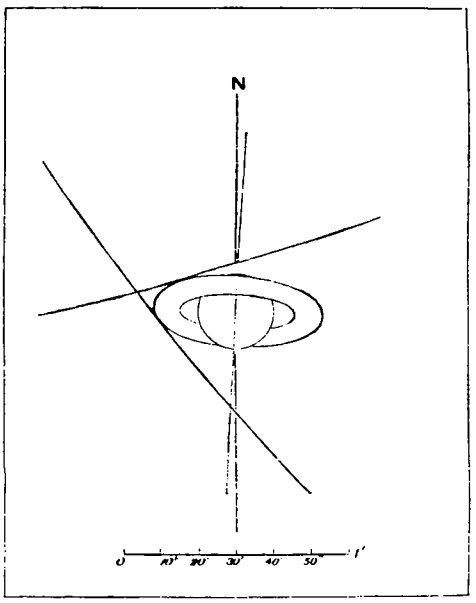
The following quantities were computed for the purpose of plotting the phenomenon to obtain the points of contact on the ring, and the required radial correction to the moon's semidiameter to refer the point on the ring to the centre of Saturn.

Approximate α ☾ at immersion	$3^h\ 38^m\ 22^s.58$	At emersion	$3^h\ 39^m\ 26^s.35$
" α ♄ "	3 39 09.11	"	3 39 08.71

	At immersion.	At emersion.
Relative approximate difference in AR (reduced to a great circle)	—11′ 06″.3	+ 4′ 12″.5
" " " in declination	+ 9 31.6	+14 23.5

Geocentric elements of Saturn's ring :—

$p = -2°\ 38'$	$a' =$ 30″.3	From the Greenwich N. A.
$a =$ 45″.6	$b' = -12.3$	
$b =$ —18.6	Southern surface visible.	



By means of the above numbers, the moon's path relative to Saturn was plotted, and the correction to refer the points of contact to the centre was obtained graphically. See above diagram, showing the position of the planet and ring, and contacts of the moon's limb.

Reduction to centre . .	—17″.5	Reduction to centre . .	+11″.5
$k'=$	873.4	$k'=$	902.0
$k'+b'=$	+1445.0	$k'+b'=$	+1765.5
$k'-b'=$	+ 301.8	$k'-b'=$	+ 38.5
$d'=$	+17° 19′ 12″.1	$d'=$	+17° 21′ 37″.0
$a'+p=a=$	+90.65	$a'+p=a=$	—911.66
$m-n=$	118ˢ.09	$m-n=$	118ˢ.14
Reduction to time of true ♂ .	+3 04.2	Reduction to time of true ♂ .	—30ᵐ 52ˢ.0
t	14 20 48.8	t	14 54 18.3
τ	14ʰ 23ᵐ 53ˢ.0	τ	14ʰ 23ᵐ 26ˢ.3
$\psi'=40°\ 52'.7$		$\psi'=106°\ 48'.0$	

Time of true ♂ in Van Rensselaer mean time 14ʰ 23ᵐ 53ˢ.0 + 1.84 dB from immersion.
14 23 26.3 —7.05 dB from emersion.

$dB=-3''.0$ Hence longitude of Van Rensselaer Harbor from immersion 4ʰ 43ᵐ 51ˢ.8
from emersion 4 43 51.8

Longitude from the Observations of the Occultation of Saturn's Ring.

January 8, 1854.

Immersion, last contact of ring 12ʰ 42ᵐ 25ˢ.7 } Sidereal time or 22ʰ 11ᵐ 28ˢ.7 } Approx. Greenwich mean time.
Emersion, " " 13 39 11 5 } at Van Rensselaer 23 08 05.2 }

From the Greenwich Nautical Almanac, as corrected by the Greenwich observations:—

At immersion, α ☾ . . .	3ʰ 32ᵐ 49ˢ.40	At immersion, α ♄ . . .	3ʰ 33ᵐ 16ˢ.75
At emersion	3 34 40.95	At emersion	3 33 16.45
(Correction to Nautical Almanac—0ˢ.36.)		(Correction to Nautical Almanac +0ˢ.18.)	
At immersion, δ ☾ . . .	+17° 47′ 21″.3	At immersion, δ ♄ . . .	+17° 00′ 34″.3
At emersion	17 56 22.2	At emersion	17 00 33.9
(Correction to Nautical Almanac—10″.0.)		(Correction to Nautical Almanac —9″.0.)	
At immersion, horizontal parallax ☾	54′ 14″.9		
At emersion	54 14.3	Horizontal parallax ♄ . . .	1″.0
(Correction —0″.1 according to Adams.)		Semidiameter ♄ . . .	8″.9+1″.0
At immersion, semidiameter ☾ . .	14′ 47″.6		
At emersion	14 47.4	Mean time of ♂, Greenwich .	22ʰ 25ᵐ 18ˢ.9
(Correction —1″.1 according to Oudeman.)			

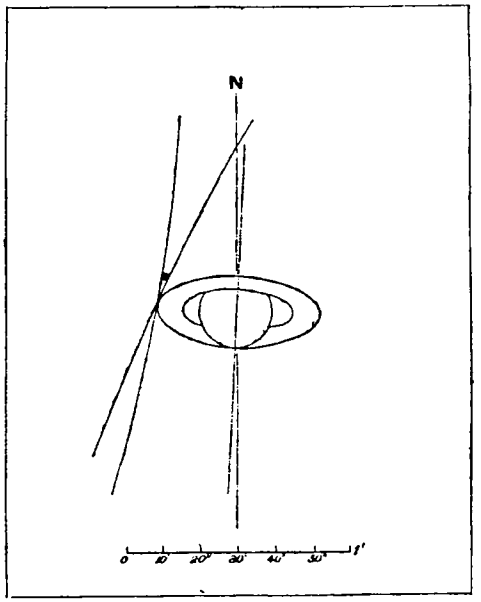
Immersion.		Emersion.	
☾'s horizontal paral. at Van Rensselaer	54′ 04″.5	☾'s horizontal paral. at Van Rensselaer	54′ 03″.9
Relative parallax $\pi=$ . .	54 03.5	Relative parallax $\pi=$ . .	54 02.9
$\alpha-s=$	—137° 24 04.5	$\alpha-s=$	—151° 07 39
$\alpha'-\alpha=p=$	— 7 36.83	$\alpha'-\alpha=p=$	— 5 25.96
$\delta'-\delta=q=$	— 52 59.54	$\delta'-\delta=q=$	— 53 24.21
Augmented semidiameter ☾ .	889.7	Augmented semidiameter ☾ .	889.2

For the construction of the diagram the following quantities were used:—

Apparent α ☾ at immersion	3ʰ 32ᵐ 18ˢ.94	At emersion 3ʰ 34ᵐ 19ˢ.22
Relative apparent difference in AR (reduced) .	—13′ 49″.4	+15′ 00″.0
" " " in declination .	— 6 12.5	+ 2 24.2

Geocentric elements of Saturn's ring:—

$p=-2°\ 26'$	$a'=$ 29.″4
$a=$ 44″.3	$b'=-12.0$
$b=-17\ 9$	Southern surface visible.



The radial correction, obtained graphically, see diagram, is, therefore,

Reduction to centre . .	—20″.0	Reduction to centre . .	+ 21″.0
$k'=$	869.7	k'	910.2
$k'+b'=$	+ 497.2	$k'+b'$	+1054.3
$k'-b'=$	+1242.2	$k'-b'$	+ 766.1
d'	+16° 57′ 28.0	d'	+17° 01′ 46.0
$a'+p=a$	+364.78	$a'+p=a$	—1265.89
$m-n$	$117^s.78$	$m-n$	$117^s.83$
Reduction to time of true δ .	$+12^m$ 23.3	Reduction to time of true δ .	-42^m 58.4
t	17^h 27 56.7	t	18^h 24 33.2
τ	17 40 20.0	τ	17 41 34.8
$\psi'=334°$ 38′ 20″		$\psi'=170°$ 53′ 02″	

Time of true δ in Van Rensselaer time 17^h 40^m $20^s.0 - 1.01\ dB$
17 41 34.8 $- 0.34\ dB$ Hence $dB = -112$.

Longitude of Van Rensselaer from immersion and emersion 4^h 43^m 06^s; but since the immersion is marked doubtful, I give the weight one-half to the above result, and combine it with the uncorrected result from the emersion, viz: 4^h 43^m $44^s.1$. The resulting longitude becomes 4^h 43^m 31^s.

LONGITUDE FROM THE OBSERVATIONS OF THE OCCULTATION OF SATURN'S RING AND CENTRE.

February 4–5, 1854.

Immersion, last contact of ring	20^h 44^m $20^s.8$	Sidereal time at Van Rensselaer	or 5^d 4^h 25^m $55^s.2$ Approximate
Emersion, centre . . .	21 42 27.8		5 23 52.8 Greenwich
" last contact of ring	21 42 49.1		5 24 14.0 mean time.

From the Greenwich Nautical Almanac, as corrected by the Greenwich observations :—

At immersion, α ☾ . . .	$3^h\ 30^m\ 51^s.73$
At emersion (*C*) . . .	3 32 46.79
" (*R*) . . .	3 32 47.50
(Correction to Nautical Almanac $-0^s.35$.)	
At immersion, δ ☾ . . .	$+17°\ 51'\ 04''.3$
At emersion (*C*) . . .	18 00 24.4
" (*R*) . . .	18 00 27.9
(Correction to Nautical Almanac $-5''.5$.)	
At immersion, horizontal parallax ☾	$54'\ 34''.4$
At emersion (*C*)	54 33.4
" (*R*)	54 33.4
(Correction $+1''.0$ according to Adams.)	
At immersion, semidiameter ☾ . .	$14'\ 52''.5$
At emersion (*C*)	14 52.3
" (*R*)	14 52.3
(Correction $-1''.1$ according to Oudeman.)	

At immersion, α ♄ . . .	$3^h\ 32^m\ 30^s.91$
At emersion (*C*) . . .	3 32 31.09
" (*R*) . . .	3 32 31.09
(Correction to Nautical Almanac $+0^s.25$.)	
At immersion, δ ♄ . . .	$+17°\ 05'\ 46''.4$
At emersion (*C*) . . .	17 05 47.7
" (*R*) . . .	17 05 47.7
(Correction to Nautical Almanac $-8''.6$.)	
Horizontal parallax ♄ . . .	$1.''0$
Semidiameter ♄	8.4 + 1.2
Greenwich mean time of δ	$5^d\ 5^h\ 15^m\ 57^s.5$

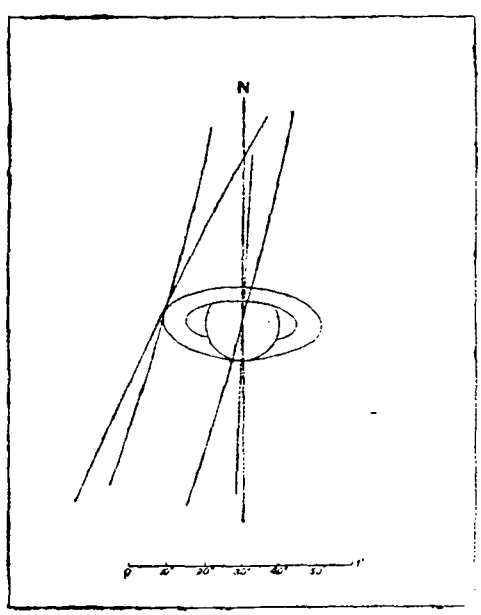
	Immersion (*R*).	Emersion (*C*).	Emersion (*R*).
☾'s horizontal paral. at Van Rensselaer	$54'\ 23''.9$	$54'\ 22''.9$	$54'\ 22''.9$
Relative parallax π	54 22.9	54 21.9	54 21.9
α—s	$-258°\ 22\ 16.5$	$-272°\ 25\ 15$	$-272°\ 30\ 24$
α′—α=p	$+\ 11\ 06.42$	$+\ 11\ 20.72$	$+\ 11\ 20.68$
δ′—δ=q	$-\ 51\ 36.75$	$-\ 50\ 46.80$	$-\ 50\ 46.56$
Augmented semidiameter ☾ . . .	896.1	896.6	896.6

For the construction of the diagram the following quantities were used:—

Apparent α ☾ at immersion	$3^h\ 31^m\ 36^s.16$	At emersion (*C*) $3^h\ 33^m\ 32^s.17$	(*R*) $3^h\ 33^m\ 32^s.88$
Relative app. dif. in AR (red.)	$-13'\ 05''.1$	$+14'\ 35''.5$	$+14'\ 45''.7$
" " in declination	$-\ 6\ 18.9$	$+\ 3\ 49.9$	$+\ 3\ 53.6$

Geocentric elements of Saturn's ring :—

$p = -2°\ 24'$	$a' = 28.0$
$a = 42.1$	$b' = -11.5$
$b = -17.1$	Southern surface visible.



The radial correction, obtained graphically, is as follows:—

Reduction to centre . . .	—19″.5	0″.0	+20″.5
k'	876.6	896.6	917.1
$k'+b'$	497.7	1126.5	1150.7
$k'-b'$	1255.5	666.7	683.5
d'	+17° 02′ 37.0	+17° 07′ 42.6	+17° 07′ 44.5
$a'+p=a$	+1493.21	—226.13	—247.33
$m-n$	118ˢ.91	118ˢ.98	118ˢ.98
Reduced to time of true ♂ .	+50ᵐ 13.8	—7ᵐ 36.2	—8ᵐ 18.9
t	4ᵈ 23ʰ 42 23.2	5ᵈ 0ʰ 40 20.8	5ᵈ 0ʰ 40 42.0
τ	5 0 30 37.0	5 0 32 44.6	5 0 32 23.1
ψ'	334° 23′ 25″	165° 08′ 32″	165° 14′ 32″

Time of true ♂ in Van Rensselaer mean time 5ᵈ 0ʰ 32ᵐ 37ˢ.0 —1.01 dB $dB=+7.1$

0 32 44.6 —0.56 dB }
0 32 23.1 —0.56 dB }

Hence longitude of Van Rensselaer from immersion 4ʰ 43ᵐ 27ˢ.6

emersion (C) 4 43 16.9 } 27ˢ.6
" (R) 4 43 38.4 }

Resulting longitude 4 43 27.6

LONGITUDE FROM THE OBSERVATIONS OF THE OCCULTATION OF MARS.

February 13, 1854.

Immersion, first contact	20ʰ 22ᵐ 10ˢ.8 mean time.	17ʰ 59ᵐ 04ˢ.4 sid. time.
" second "	20 23 06.6 "	18 00 00.4 "
Emersion, last "	20 53 17.3 "	18 30 16.1 "
Approx. Greenwich mean time, phase (1)	14ᵈ 1 05 42.8	
" (2)	1 06 38.6	
" (3)	1 36 49.3	

From the Greenwich Nautical Almanac, as corrected from the Greenwich observations:—

At immersion (1), α ☾ . . 11ʰ 02ᵐ 21ˢ.84
" (2) . . 11 02 23.65
At emersion (3) . . 11 03 24.21
(Correction to Nautical Almanac —0ˢ.28)
At immersion (1), δ ☾ . . +11° 34′ 05″.8
" (2) . . 11 33 54.4
At emersion (3) . . 11 27 32.9
(Correction to Nautical Almanac +0″.4.)
At immersion (1), horizontal paral. ☾ 56′ 12″.6
" (2) . . . 56 12.7
At emersion (3) . . . 56 13.2
(Adams' correction +0″.5.)
At immersion (1), semidiameter ☾ . 15′ 19″.3
" (2) . . . 15 19.3
At emersion (3) . . . 15 19.4
(Correction to Nautical Almanac —0″.3
+ Oudeman's correction —1″.1.)

At immersion (1), α ♂ . . 11ʰ 02ᵐ 32ˢ.24
" (2) . . 11 02 32.20
At emersion (3) . . 11 02 30.65
(Correction to Nautical Almanac +1ˢ.56.)
At immersion (1), δ ♂ . . +10° 47′ 54″.7
" (2) . . 10 47 55.0
At emersion (3) . . 10 48 05.5
(Correction to Nautical Almanac —17″.4.)
Horizontal parallax ♂ . . 12″.3
Semidiameter ♂ . . 6″.4+1″.8=8″.2

Reduction of observation of immersion, first and second contact :—

I.		II.	
Horizontal paral. at V. R.	56′ 01″.8	Horizontal paral. at V. R.	56′ 01″.9
Relative parallax π	55 49.5	Relative parallax π	55 49.6
$\alpha - s =$	—104° 10 39	$\alpha - s =$	—104° 24 12
$\alpha' - \alpha = p =$	—10 57.8	$\alpha' - \alpha = p =$	—10 57.2
$\delta' - \delta = q =$	—54 16.4	$\delta' - \delta = q =$	—54 16.9
Augmented semidiameter ☾	921.4	Augmented semidiameter ☾	921.4
$k' =$	929.6	$k' =$	913.2
$k' + b' =$	+ 444.3	$k' + b' =$	+ 415.6
$k' - b' =$	+1414.9	$k' - b' =$	+1410.8
$a' + p = a =$	+ 149.13	$a' + p = a =$	+ 122.15
$m - n =$	1759.6	$m - n$	1759.6
Reduction to time of true ☉	+5^m 05^s.1	Reduction to time of true ☉	+4^m 09^s.9
$t =$	20^h 22 10.8	t	20^h 23 06.6
$\tau =$	20 27 15.9	τ	20 27 16.5
($\psi' = 328° 32'$)		($\psi' = 326° 59'$)	

Reduction of observation of last contact—emersion (marked doubtful) :—

☾'s horizontal par. at Van Rensselaer	56′ 02″.4	$a' + p = a =$	—842″.19
Relative parallax π	55 50.1	$m - n =$	1759.5
$\alpha - s$	—111° 42 55.5	Reduction to time of true ☉	—28^m 43^s.1
$\alpha' - \alpha = p =$	—10 29.98	$t =$	20^h 53 17.3
$\delta' - \delta = q =$	—54 33.0	$\tau =$	20 24 34.2
Augmented semidiameter ☾	15 21.1	($\psi' = 257° 02'$)	
$k' =$	929.3		
$k' + b' =$	+ 23.7		
$k' - b' =$	+1834.9	Greenwich time of ☉	1^h 10^m 45^s.0

For the time of the true conjunction in Van Rensselaer time, we have from the mean of the two phases of the immersion and from the emersion—

$$20^h\ 27^m\ 16^s.2 + 2.46\ dr - 0.02\ dR + 1.31\ dB$$
$$20\ \ 24\ \ 34.2 - 9.28\ dr - 9.28\ dR + 9.04\ dB$$

and omitting dr and dR, we find by subtraction $dB = +21''$, and the resulting longitude—

From immersion	(1)	+4^h	43^m	02^s.5		
" "	(2)	4	43	00.2		Mean 4^h 43^m 01^s.2.
" emersion	(3)	4	43	01.0		

LONGITUDE FROM THE OBSERVATIONS OF THE SOLAR ECLIPSE OF MAY 15, 1855.

Observations at Van Rensselaer Harbor :—

Immersion, first contact	9^h	13^m	39^s.5	mean time.	12^h	46^m	32^s.7	sid. time.
Emersion, last contact	10	55	48.0	" "	14	28	58.0	" "
Approximate Greenwich mean time, immersion	13	57	11.5					
" " " emersion	15	39	20.0					

From the Greenwich Nautical Almanac, as corrected from the Greenwich observations :—

At immersion, α ☾	$3^h\ 27^m\ 18.^s79$	At immersion, α ☉	$3^h\ 28^m\ 59.^s69$
At emersion	3 31 05.89	At emersion	3 29 16.60
(Correction to Nautical Almanac	$-0^s.67$)	(Correction to Nautical Almanac	$+0.^s23$)
At immersion, δ ☾	+19° 56′ 09″.2	At immersion, δ ☉	+18° 56′ 19″.5
At emersion	20 14 45.7	At emersion	18 57 19.7
(Correction to Nautical Almanac	—0″.1)	(Correction to Nautical Almanac	—0″.8)
At immersion, horizontal parallax ☾	57′ 09″.1	Semidiameter ☉	15′ 50″.4
At emersion " "	57 06.6	Horizontal parallax ☉	8″.48
(Adams' correction	—3″.8)		
At immersion, semidiameter ☾	15′ 35″.0		
At emersion "	15 34.3		
(Oudeman's correction	—2″.3)		

Observations at Dorpat, Russia :—
See No. 966 of the Astronomische Nachrichten.

Commencement and middle of eclipse before sunrise, end of the eclipse was observed as follows:—

Mädler, with the great refractor	$20^h\ 01^m\ 19.1^s$	sidereal time.
Clausen, with a five foot telescope	20.6	
Lais, with a two foot telescope	21.9	

Strong undulations of the sun's limb, at 5° altitude, caused a perceptible uncertainty. [M.]

Giving the weights 3, 2, 1, to the above observed times, the adopted sidereal time at Dorpat is $20^h\ 01^m\ 20^s.1$.

Latitude of the Dorpat Observatory	+58° 22′ 47″.1	From Dr. Gould's table in the American Eph. & Nautical Almanac.
Longitude " "	—26 43 38.4	
" " "	$-1^h\ 46^m\ 54^s.6$	

Dorpat mean time of end	$16^h\ 28^m\ 19^s.6$
Approximate Greenwich mean time	14 41 25.0

The corrected data from the Nautical Almanac are :—

α ☾	$3^h\ 28^m\ 57^s.08$	δ ☾	+20° 04′ 15″.2
α ☉	3 29 07.05	δ ☉	+18 56 45.7
Horizontal parallax ☾	57′ 08″.0	Horizontal parallax ☉	8″.48
Semidiameter ☾	15 34.6	Semidiameter ☉	15′ 50″.3

Reduction of the observation of the commencement of the eclipse at Van Rensselaer :—

Horizontal par. ☾ at Van Rensselaer	56′ 58″.12		
Relative parallax π =	56 49.64		
$\frac{\alpha ☾ - \alpha ☉}{401}$ =	$-0^s.25$	$\frac{\delta ☾ - \delta ☉}{401} = +9''.0$	
$a - s = -9^h\ 19^m\ 14^s.2$			
$= -139°\ 48'\ 33''$			
$a' - a = p = -463''.67$		$\eta = 98°\ 48'\ 31''$	
$\delta' - \delta = q = -3328.30$			
Augmented semidiameter ☾	$= 937''.85$	$k' = r ☾ + r ☉ = 1888''.25$	
$\delta' = \delta + q =$	19° 00′ 40″.9		
$\delta' - D = b' =$	4 21.4	$\frac{\delta' + D}{2} = d' = +18°\ 58'\ 30''.2$	
$k' + b' =$	2149.65		
$k' - b' =$	1626.85	δ Greenwich	$14^h\ 46^m\ 17^s.0$
$a' + p = a =$	+1513.85	Hourly motion ☾	1999″.65
Reduction to true δ	$+49^m\ 03^s.6$	" " ☉	148.20
t, or observed time	9 13 39.5	$\psi' = 7°\ 57'\ 23''$	
τ	10 02 43.1		

Reduction of the observations of the end of the eclipse at Van Rensselaer :—

Horizontal par. ☾ at Van Rensselaer	$=56'\ 55''.62$		
Relative parallax $\pi =$	$56\ 47.14$		
Correction to α	$+0^s.27$	Correction to δ	$+11''.6$
$\alpha - s =$	$=-10^h\ 57^m\ 51^s.8$		
$\alpha' - \alpha = p =$	$-192''.49$		
$\delta' - \delta = q =$	-3367.19	$\eta = 101°\ 03'\ 02''$	
Augmented semidiameter ☾	$936''.65$	$k' = 1886''.95$	
$\delta' = \delta + q =$	$+19°\ 18'\ 38''.5$	$\frac{\delta' + D}{2} = d' = +\ 19°\ 07'\ 59.''1$	
$\delta' - D = b' =$	$+21\ 18.8$		
$k' + b' =$	$+3165.75$		
$k' - b' =$	$+608.15$		
$a' + p = a =$	-1661.16	$m - n = 1853''.99$	
Reduction to true δ	$-53^m\ 45^s.6$	$\psi' = 137°\ 20'\ 6''$	
t, or observed time	$10^h\ 55\ 48.0$		
τ	$10\ 02\ 02.4$		

Reduction of the observations of the end of the eclipse at Dorpat :—

$\varphi' = 58°\ 12'\ 31''.2$			
Horizontal par. ☾ at Dorpat	$=56'\ 59''.73$		
Relative parallax π	$=56\ 51.25$		
Correction to α	$0^s.00$	Correction to δ	$+10''.1$
$\alpha - s =$	$-16^h\ 32^m\ 23^s.0$		
$\alpha' - \alpha = p =$	$+1769''.08$		
$\delta' - \delta = q =$	-2960.85	$\eta = 103°\ 09'\ 13''$	
Augmented semidiameter ☾	$=936''.13$	$k' = 1886''.43$	
$\delta' = \delta + q =$	$19°\ 14'\ 54''.4$	$\frac{\delta' + D}{2} = d' = +\ 19°\ 05'\ 50''$	
$\delta' - D = b' =$	$+18\ 08.7$		
$k' + b' =$	$+2975.13$		
$k' - b' =$	$+797.73$		
$a' + p = a =$	$+138.8$	$m - n = 1852''.65$	
Reduction to true δ	$+4^m\ 29^s.7$	$\psi' = 144°\ 45'\ 8''$	
t, or observed time	$16^h\ 28\ 19.6$		
τ	$16\ 22\ 49.3$		

We have, therefore, the following expressions for the time of true conjunction in—

Van Rensselaer mean time	$10^h\ 02^m\ 43^s.1 + 2.08\,dr + 2.08\,dR + 0.29\,dB$	(phase 1)
" "	$10\ 02\ 02.4 - 2.88\,dr - 2.88\,dR - 1.90\,dB$	(" 2)
Dorpat "	$16\ 32\ 49.3 - 2.51\,dr - 2.51\,dR - 1.45\,dB$	(" 2)

Neglecting the smaller terms dr and dR, we find, from the Dorpat observations, $dB = -15''.3$; and substituting this value in the two preceding equations, we obtain the longitude of Van Rensselaer harbor—

From the commencement of the eclipse	$+4^h\ 43^m\ 33^s.9 - 0.29\,dB =$	$+4^h\ 43^m\ 38^s.3$
" end " "	$+4\ 44\ 14.6 + 1.90\,dB =$	$+4\ 43\ 45.5$
Adopted longitude, mean value		$+4\ 43\ 41.9$

Recapitulation of results for longitude of Van Rensselaer Harbor by occultations of planets and a solar eclipse:—

Occultation of Saturn	December 12, 1853	$4^h\ 43^m\ 51^s.8$
" "	January 8, 1854	4 43 31.0
" "	February 4–5, 1854	4 43 27.6
" of Mars	February 13, 1854	4 43 01.2
Eclipse of the sun	May 15, 1855	4 43 41.9
Mean		4 43 30.7 ± 6^s

Resulting longitude from 9 moon culminations, 1853–54	$4^h\ 43^m\ 32.^s0 \pm 13^s$
" " " 4 occultations and one eclipse, 1853–4–5	4 43 30.7 ± 6
Final longitude of Fern Rock Observatory and Van Rensselaer Harbor winter quarters, adopted	$4^h\ 43^m\ 31^s \pm 7^s$ W. of Greenw.
	$= 70°\ 52'\ 45''\ \pm 1\frac{3}{4}'$

The approximate longitude adopted by Mr. Sonntag, as given in the Narrative, page 398, Appendix No. IX, vol. II, is $4^h\ 42^m\ 40^s$, or 70° 40′ 00″; in my reduction of the magnetic observations of the expedition, this approximate result was retained, it should therefore be increased by 51^s, or 12′ 45″; in my reduction of the meteorological observations, I have adopted a value resulting from a preliminary reduction of the moon culminations, viz.: $4^h\ 43^m\ 32^s$, or 70° 53′.

If we compare any of the separate results for longitude with the final value, and, in considering the probable errors, it should be remembered that one degree of longitude in the parallel (78° 37′) of Van Rensselaer is but 11.88 nautical miles, thus the above uncertainty of 7^s, in the final result for longitude, is but half a mile of linear measure.

The following pages contain the record and reduction of some astronomical observations obtained on the coast of Greenland by the expedition, in 1853, when on the way to Van Rensselaer Harbor. The names of these stations are as follows:—

1. Fiskernaes, flagstaff near the Governor's house.
2. " small island, on the northern side of the harbor.
3. Pröven, place near the Governor's house.
4. Upernavik, garden near the Governor's house.
5. Fog Inlet, or Refuge Harbor, southwest end of inner harbor.
6. " " hill to the northward of the harbor.
7. Bedevilled Reach, afterwards called Cape Inglefield.
8. Marshall Bay.

Fiskernaes, June 30, 1853. Station, flagstaff near the Governor's house.

Observations with the sextant of the sun's altitude near the meridian, for latitude.

Chronometer time.	Double altitude.	Chronometer time.	Double altitude.
⊙ 4h 06m 40s	98° 25′ 40″	⊙̄ 4h 18m 30s	98° 41′ 40″
7 40	22 10	20 29	32 55
9 15	16 30	21 37	27 55
⊙̄ 4 12 32	99 06 40	⊙ 4 23 49	97 14 30
13 50	01 20	25 20	7 25
15 00	98 56 20	26 49	96 59 55

Index error —1′ 50″. Temperature 41° F. Aneroid barometer 30.15 inches.

REDUCTION.

Chronometer time of observation ⊙	4h 10m 49s.5	4h 22m 45s.6
[1] Chronometer error	—3 21 45.6	—3 21 45.6
Mean time of observation	0 49 03.9	1 01 00.0
Apparent time of observation	0 45 46.6	0 57 42.7
P	11° 28′ 31″	14° 28′ 03″
Apparent altitude	49° 21′ 38″.3	48° 56′ 16″.6
A	49 20 52.5	48 55 30.1
⊙'s declination	+23 10 22.9	+23 10 20.9
Meridional arc	66° 24′ 20″	66° 09′ 08″
Meridional arc + latitude	129 29 37	129 14 07
Latitude	63 05 17	63 04 59

Mean 63° 05′ 08″

Observations of double altitudes of the sun for time.

Chronometer time.	Double altitude.	Chronometer time.	Double altitude.
⊙̄ 7h 45m 23s	63° 54′ 40″	⊙̄ 7h 54m 24s	61° 55′ 10″
46 22	42 45	55 23	41 20
47 06	33 00	56 16	30 35
⊙ 7 48 53	62 06 10	⊙ 7 58 53	59 53 25
49 49	61 53 55	8 00 26	32 10
51 19	61 34 20	01 39	15 55

Index error of sextant —7′ 55″. Temperature 45° F. Aneroid barometer 30.10 inches.

REDUCTION.

⊙'s apparent altitude	31° 27′ 41″.6	30° 23′ 00″.4
A	31 26 11.9	30 21 30.8
⊙'s Δ	66 50 11.9	66 50 13.9
Latitude	63 05 (08)	63 05 (08)
Hour angle	4h 23m 04s.3	4h 32m 44s.0
Equation of time	+ 3 19.5	+ 3 19.8
Mean time of observation	4 26 23.8	4 36 03.8
Chronometer time of observation	7 48 08.6	7 57 50.2
Chronometer error	—3 21 44.8	3 21 46 4
Mean	—3 21 45.6	

Chronometer error on Greenwich mean time . + 24.4 bro't up by rate from N. York.

Approximate longitude of Fiskernaes . . 3h 22m 10s = 50° 32½′ W. of Greenwich.

[1] See following observations and reductions.

Fiskernaes, July 1, 1853. Station on small island on the northern side of the harbor.
Observations of double altitudes of the sun with the sextant, for latitude.

	Chronometer time.	Double altitude.		Chronometer time.	Double altitude.
⊙	$5^h\ 18^m\ 15^s$	91° 59′ 10″	⊙	$5^h\ 29^m\ 30^s$	89° 16′ 05″
	19 25	49 00		30 31	08 00
	20 34	39 25		31 15	01 05
⊙	5 23 14	?91 14 35	⊙	5 35 47	89 21 15
	24 11	04 40		36 29	15 05
	25 07	89 56 30		37 07	8 50

Index error of sextant —8′ 45″. Temperature about 43° F. Aneroid barometer 30.05 inches.

REDUCTION.

⊙'s apparent altitude	45° 32′ 49″	44° 40′ 14″	
A	45 31 56	44 39 20	
Chronometer time	$5^h\ 21^m\ 47^s.7$	$5^h\ 33^m\ 26^s.5$	
Chronometer error	—3 21 45.6	—3 21 45.6	Assumed.
Mean time of observation	2 00 02.1	2 11 40.9	
Apparent time	1 56 32.1	2 08 10.8	
Meridional arc	63° 57′ 06″	63° 15′ 45″	
Meridional arc + latitude	127 00 06	126 18 25	
Latitude	63 03 00	63 02 40	Mean 63° 02′ 50″

(This result is only approximate.)

Prören, July 19, 1853. Station near the house of the Governor.
Observations of the sun's altitude for time.

	Chronometer time.	Double altitude.		Chronometer time.	Double altitude.
⊙	$1^h\ 54^m\ 43^s$	71° 28′ 10″	⊙	$2^h\ 5^m\ 26^s$	73° 21′ 50″
	56 10	35 45		6 41	28 05
	57 31	42 00		7 37	32 05
⊙	1 59 33	72 54 55	⊙	2 9 56	72 38 50
	2 01 00	73 01 40		11 19	45 20
	2 43	09 10		12 32	51 00

Index error of sextant —3′ 0″. Approximate temp. 40° F. Approximate bar. 29.5 inches.
Approximate longitude 55° 25′ W. of Greenwich.

REDUCTION.

⊙'s apparent altitude	36° 10′ 48″.3	36° 34′ 35″.8	
A	36 09 34.9	36 33 22.5	
Δ	69 10 20	69 10 23	
Latitude (approx.)	72 23 00	72 23 00	
Hour angle	24^h —$1^h\ 49^m\ 33^s.9$	24^h —$1^h\ 39^m\ 17^s.0$	
Equation of time	5 56.7	5 56.8	
Mean time of observation	22 16 22.8	22 26 39.8	
Chronometer time	25 58 36.6	26 08 55.2	
Chronometer error	—3 42 13.8	—3 42 15.4	Mean —$3^h\ 42^m\ 14^s.6$

The longitude is probably greater than the above value, assumed $3^h\ 42^m\ 30^s$ or 55° 37′.5.

? Probably 90° 12′ 35″.

Pröven, July 19, 1853. Place near the Governor's house.
Circum-meridian altitudes of the sun, for latitude.

Chronometer time.	Double altitude.	Chronometer time.	Double altitude.
⊙ 3h 27m 5s	77° 13′ 5″	⊙ 3h 49m 2s	77° 23′ 30″
29 5	15 25	52 10	22 55
30 55	16 25	54 0	22 30
⊙ 3 33 14	76 15 20	⊙ 3 57 38	77 20 50
34 42	15 50	58 55	20 15
36 50	16 40	4 01 00	19 10
⊙ 3 40 0	76 18 5	⊙ 4 3 10	76 14 00
42 40	19 10	4 49	13 5
44 47	19 30	6 16	11 20

Index error of sextant. — 3′ 10″. Approximate temp. 42° F. Approximate bar. 29.6. inches.

REDUCTION.

⊙'s apparent altitude	38° 24′ 41″	38° 25′ 10″	
Chronometer time	3h 33m 52s.0	4h 00m 06s.0	
Mean time of observation	23 51 37	0 17 51	
Apparent time	23 45 41	0 11 55	
k	404.2	280.3	
x	145.9	101.2	
$A + x$	38° 26′ 00″	38° 25′ 44″	
⊙'s declination	20 48 55	20 48 44	
Latitude	72 22 55	72 23 00	Mean 72° 22′ 58″

Upernavik,[1] July 22, 1853. Station in garden near the Governor's house.
Sextant. Circum-meridian altitudes of the sun, for latitude.

Chronometer time.	Double altitude.	Chronometer time.	Double altitude.
⊙ 3h 47m 50s	75° 25′ 30″	⊙ 3h 57m 00s	75° 24′ 10″
49 13	26 10	57 45	24 30
50 45	25 30	58 25	24 20
⊙ 3 52 10	74 22 10	⊙ 3 59 22	74 20 10
53 20	22 10	4 0 10	19 30
54 30	22 50	1 00	19 20

Index error — 3′ 31″. (No record of time observations.)

The observations are uncertain, on account of the imperfect image reflected from the artificial horizon, the molasses being covered with a film. (A set of observations for azimuth of Sanderson's Hope is here omitted for want of time observations.) Approximate temperature 39° Fah., barometer 29.5 inches. Mr. Sonntag

[1] Position according to Capt. Inglefield: Lat. 72° 46′ 51″. Long. 56° 02′ 46″ W. of Greenwich.

obtained the result for latitude 72° 50′; a better observation August 26, 1855, by means of a mercurial horizon, gave 72° 46′.2.

Fog Inlet, or *Refuge Harbor*,[1] August 10, 1853. Station on southwest end of inner harbor.
Approximate latitude 78° 31′. Approximate longitude 73° 50′.
Observations with the sextant of the sun's altitude, for time.

Chronometer time.	Double altitude.	Chronometer time.	Double altitude.
⊙̄ 6h 48m 46s	51° 22′ 40″	⊙̲ 6h 58m 11s	49° 45′ 40″
49 42	16 20	59 28	41 00
51 37	10 20	7 00 29	37 50
⊙̲ 6 53 20	50 01 50	⊙̄ 7 01 49	50 37 10
55 27	49 54 50	3 13	31 50
56 38	50 50	4 25	27 30

Index error —4′ 50″. Approximate temperature 32° F. Approximate barometer 29.7 inches.

Chronometer time.	Double altitude.	Chronometer time.	Double altitude.
⊙̄ 10h 49m 30s	31° 04′ 20″	⊙̲ 10h 54m 25s	29° 32′ 15″
50 37	30 57 30	55 36	24 15
51 34	52 20	57 23	15 00

Index error —5′ 5″.

REDUCTION.

Apparent altitude	25° 20′ 27″	25° 05′ 50″	15° 08′ 01″
A	25 18 28	25 03 50	15 04 30
Δ	74 32 38	74 32 42	74 35 35
Latitude approximate	78 31 00	78 31 00	78 31 00
Hour angle	29 55 00	32 08 18	90 04 50
Equation of time	+ 5m 02s.1	+ 5m 02s.1	+ 5m 00s.8
Mean time of observation	2h 04m 42s.1	2h 13m 35s.3	6h 05m 20s.1
Chronometer time	6 52 35.0	7 01 15.8	10 53 10.8
Chronometer error	—4 47 52.9	—4 47 40.5	—4 47 50.7
Mean error		—4 47 48	

[1] Number LXXXII of Dr. Kane's map, vol. I of Narrative.

Fog Inlet, or *Refuge Harbor*, August 11, 1853. Station on hill to the northward of the harbor.
Observations with the theodolite, of circum-meridian altitudes of the sun, for latitude.

Circle west.	Chronometer.	Level.	Vertical circle.	Circle east.	Chronometer.	Level.	Vertical circle.
$\overline{\odot}$	$4^h\ 18^m\ 17$	N. 12.2	207° 6′ 10″	$\odot$	$4^h\ 44^m\ 2^s$	N. 13.9	63° 20′ 50″
		S. 11.0	5 55			S. 8.2	20 55
			5 55				21 10
			6 15				21 5
$\overline{\odot}$	4 21 17	12.0	207 8 00	$\overline{\odot}$	4 47 47	9.2	63 20 35
		11.3	7 40			13.4	55
			7 50				50
			7 55				50
$\underline{\odot}$	4 24 08	11.0	206 37 00	$\overline{\odot}$	4 53 19	11.8	63 21 10
		12.2	36 35			11.0	30
			35				30
			50	Circle west.			20
$\underline{\odot}$	4 27 06	10.8	206 38 15	$\overline{\odot}$	4 58 41	12.0	207 14 30
		12.9	37 55			11.0	5
			37 55				5
			38 10				15
Circle east. $\underline{\odot}$	4 35 08	11.2	63 54 0	$\underline{\odot}$	5 01 52	11.8	206 42 25
		11.8	5			12.0	41 55
			10				42 00
			5				42 10
$\underline{\odot}$	4 38 16	9.5	63 53 35	Circle east. $\underline{\odot}$	5 07 6	11.8	63 54 20
		13.2	40			11.0	54 30
			45				35
			50				35

Approximate temperature 35° F. Approximate barometer 29.7 inches.

Reduction.

Combining the first four observations with the following four observations, we obtain the readings for ⊙ W. and ⊙ E.; the last four observations furnish similar quantities, but the resulting latitude from the first combination has the weight 2, from the last combination the weight 1.

⊙ W.	$4^h\ 22^m\ 42^s$	206° 52′ 11″		⊙ W.	$5^h\ 00^m\ 16^s$	206° 58′ 10″	
⊙ E.	4 41 18	63 37 25		⊙ E.	5 00 12	63 37 56	
⊙	4 32 00	63 22 37		⊙	5 00 14	63 19 53	
⊙'s apparent altitude		26° 37′ 23″			26° 40′ 07″		
Chronometer time		$4^h\ 32^m\ 00^s$			$5^h\ 00^m\ 14^s$	Chronometer error as before.	
Mean time		23 44 12			0 12 26		
Hour angle		20 45			7 34		
x		181″.5			24″.1		
$A + x$		26° 38′ 33″			26° 38′ 40″		
Declination		15 11 22			15 11 00		
Latitude		78 32 49			78 32 20		
Resulting latitude		78 32 39					

Bedevilled Reach (station afterwards called Cape Inglefield), August 12, 1853.
Observations with the theodolite, circum-meridian altitudes of the sun, for latitude.

Circle west.	Chronometer.	Level.	Reading.	Circle west.	Chronometer.	Level.	Reading.
⊙	4^h 53^m 32^s	N. 10.0	206° 45′ 50″	⊙	5^h 10^m 52^s	10.0	206° 42′ 25″
		S. 11.5	25			11.0	41 50
			30				42 00
			45				42 10
⊙	4 57 32	12.2	207 17 55	⊙	5 14 37	10.3	207 13 5
		9.2	45			10.3	12 50
			35				12 30
			50				13 00
Circle east.				Circle east.			
⊙	5 02 02	6.2	64 05 10	⊙	5 19 36	15.8	64 10 10
		14.8	30			4.2	30
			30				20
			25				25
⊙	5 05 24	15.3	64 37 0	⊙	5 23 07	8.0	64 44 5
		5.0	5			12.4	20
			10				20
			10				20

Approximate long. 72½° W. of Gr. Approximate temp. 33° F. Approximate bar. 29.7 inches.

REDUCTION.

⊙ W.	4^h 55^m 32^s	207° 01′ 44″	⊙ W.	5^h 12^m 44^s	206° 57′ 28″
⊙ E.	5 03 43	64 21 14	⊙ E.	5 21 22	64 27 14

	⊙'s apparent zenith distance.	Apparent altitude.	*A*
At 4^h 59^m $37^s.5$	63° 39′ 45″	26° 20′ 15″	26° 18′ 21″
" 5 17 03.0	63 44 53	26 15 07	26 13 13

Chronometer error	4^h 44^m 55^s.	See below.
Mean time of observation	0 14 42	0^h 32^m 08^s
Hour angle	0 10 00	0 27 29

k	196″	Meridional arc . . .	75° 01′ 06″
x	41.9	Meridional arc + φ . .	153 35 17
A + *x*	26° 19′ 03″	Latitude	78 34 11
⊙'s declination . . .	14 52 58		
Latitude	78 33 55	Mean	78 34 03

Bedevilled Reach (Station Cape Inglefield), August 12, 1853. Theodolite observations for time.

Circle east.	Chronometer.	Level.	Reading.	Circle west.	Chronometer.	Level.	Reading.
⊙̄	10h 23m 27s	8.0	74° 17′ 55″	⊙̄	10h 39m 35s	11.4	195° 45′ 30″
		12.0	18 05			10.4	5
			18 05				0
			17 50				10
⊙̄	10 26 57	15.2	74 28 10	⊙̲	10 42 32	10.5	195 5 5
		5.0	15			11.2	4 50
			15				4 50
			5				5 0
⊙̲	10 30 28	12.2	75 10 15	⊙̲	10 46 34	11.8	194 53 5
		8.2	30			10.0	52 40
			25				52 40
			20				52 55
Circle west.				Circle east.			
⊙̄	10 35 16	11.2	195 58 5	⊙̲	10 50 49	13.0	76 10 30
		10.0	58 0			8.2	40
			57 45				45
			58 5				45

(NOTE.—Between the 13th and 14th there were two more observations taken, for which, however, there is no need.) Atmospheric temperature and pressure as above.

REDUCTION.

Taking means, we find	⊙̄ E.	10h 25m 12s	74° 22′ 56″		
	⊙̲ E.	10 30 28	75 10 18		
	⊙̄ W.	10 37 25	195 51 36		
	⊙̲ W.	10 44 33	194 58 53	Reduction to ⊙	+ 15′ 50″
	⊙̲ E.	10 50 49	76 10 35	"	— 15 50

⊙ E.	10h 27m 50s	74° 46′ 37″	⊙ W.	195° 14′ 43″	
⊙ W.	10 40 59	195 25 15	⊙ E.	75 54 45	
Mean	10 34 25	74 40 42		75 20 01	10h 47m 41s
Apparent altitude . . .		15 19 18		14 39 59	
A		15 15 48		74 36 19	
Δ		75 11 17		75 11 26	
L		78 34 30		78 34 30	
m		84 30 48		84 11 07	
p		86 12 14		89 31 06	
Time of observation . .		5h 49m 30s.3		6h 02m 45s.7	
Time by chronometer . .		10 34 25.0		10 47 41.0	
Error		—4 44 54.7		4 44 55.3	
Mean		—4 44 55.0 which was used in the reduction for latitude.			

August 23, 1853. Station 3 miles E. S. E. from the brig (either in Force Bay or Van Rensselaer Harbor). Sextant observations of circum-meridian altitudes of the sun.

Chronometer time.	Double altitude.	Chronometer time.	Double altitude.
⊙̲ 4h 37m 2s	45° 14′ 30″	⊙̄ 4h 48m 20s	46° 17′ 40″
39 17	14 45	49 43	17 30
40 42	15 00	50 40	17 30
⊙̄ 4 43 25	46 18 00	⊙̲ 4 52 0	45 14 10
44 30	18 10	54 0	13 50
46 00	18 10	55 12	13 5

Mr. Sonntag deduced the latitude 78° 37′ 9″

Marshall Bay. September 3, 1853. According to p. 390, vol. II. of the Narrative, this station is from bearings 1° 59′ east of the winter quarters, and hence in longitude 68° 54′. Rate of chronometer about $2^s.5$ gaining daily; error, September 12, on Fern Rock mean time $-4^h\ 43^m\ 26^s$.

Theodolite observations. Circum-meridian altitudes of the sun, for latitude.

Circle east.	Chron'r time.	Level.	Reading.	Circle west.	Chron'r time.	Level.	Reading.
⊙	$4^h\ 13^m\ 27^s$	N. 7.0	199° 7′ 10″	⊙	$4^h\ 43^m\ 00^s$	N. 10.0	71° 52′ 15″
		S. 15.0	6 45			S. 13.0	52 10
			6 45				51 50
			7 05				52 25
				Circle east.			
⊙	4 20 25	11.8	199 7 20	⊙	4 59 50	10.8	199 35 50
		11.7	6 50			12.3	30
			6 40				35
			6 55				50
Circle west.				Circle west.			
⊙	4 27 22	12.0	71 52 5	⊙	5 08 09	10.0	72 31 30
		11.3	51 55			13.0	30
			51 50				35
			52 10				40

Temperature 27°.5. Barometer 29.98 inches. The sun seen occasionally through clouds, observed without shade-glass.

REDUCTION.

⊙ E.	$4^h\ 16^m\ 56^s$	199° 07′ 00″		⊙ E.	$4^h\ 59^m\ 50^s$	199° 35′ 43″
⊙ W.	4 35 11	71 52 03		⊙ W.	5 08 09	72 31 31
⊙	4 26 04	71 22 32		⊙	5 04 00	71 27 54
Approximate altitude . .		18 37 28				18 32 06

On account of the uncertainty in the chronometer error it was considered safer to use the first combination alone, as being nearest to true noon.

Chronometer error . .	$-4^h\ 35^m\ 9^s$	$x =$	27″
Mean time of observation .	23 50 55	$a + x$	18° 35′ 03
Equation of time . .	+ 0 53	Declination	7 26 11
h	8 13	Latitude	78 51 08

RECAPITULATION OF RESULTS FOR LATITUDE AND ADOPTED LONGITUDES.

	Latitude.	Longitude W. of Greenwich.		
Fiskernaes	63° 02′.8	50° 32′.5	$=3^h\ 22^m\ 10^s$	Approx. longitude.
Pröven	72 23.0	55 37.5	3 42 30	" "
Upernavik	72 46.2	56 02.8	3 44 11	Long. by Inglefield.
Refuge Harbor	78 32.7	73 50	4 55 20	
Cape Inglefield	78 34.1	72 55	4 51 40	
Winter-quarters, Van Rensselaer Harbor	78 37.1	70 52.8	4 43 31	
Marshall Bay	78 51.1	68 54.0	4 35 36	

Determination of the elevation of station on Marshall Bay by means of the depression of the sea horizon. Observations with the theodolite.

	Level.	Reading.		Level.	Reading.
Circle east.	11.8	90° 56′ 5″	Circle west.	13.3	180° 37′ 10″
	11.8	55 50		10.0	5
		55 55			15
		56 5			20
	Mean	90 55 59		Corrected and converted	89 22 44

Apparent zenith distance of horizon 90 09 22

Using 0.08 for the co-efficient of refraction, the corresponding elevation is 27.8 metres or 91 feet.

The following record of determinations of latitudes, by various travelling parties, has been copied from volume II. of the Narrative, Appendix Nos. V. and VI.

Cape John Frazer, position XXIII, May 28, 1854.

This position is determined by an observation with sextant and ice horizon.

Altitude	⊙	31° 33′.5
	⊙	32 05.5
	⊙	31 49.5
Correction for dip, refraction, and parallax		—3.0
		31 46.5
Declination		21 29.4
Latitude		79 42.9

Cape Prescott, position XX, May 29, 1854.

Double altitude	⊙	64° 42′.0
	⊙	63 38.0
Altitude ⊙'s centre		32 05.0
Correction for refraction and parallax		—1.4
		32 03.6
Declination		21 38.8
Latitude		79 35.2

The determination of the latitude of Cape Hawks, position XV., does not agree with its location on the map, it is therefore here omitted.

Cape William Wood, position LXXI, June 7, 1854.

Double altitude ⊙	⊙	68° 16′		
" "	⊙	67 8		
		67 42		
Index error		—3		
		67 39	⊙	33° 50′
Correction for refraction and parallax				—2
				33 48
Declination				22 47
Latitude				78 59

Cache Island, position LXVII, June 14 and 16, 1854.

Double altitude ⊙ . .	67°	43′.5		67°	54′.0	
	68	47.5		68	57.5	
	68	15.5		68	25.7	
Index error		—3.5			—3.9	
	68	12.0	34 06.0	68	21.8	34 10.9
Correction for refraction and parallax .			—1.4			—1.3
			34 04.6			34 09.6
Declination			23 17.1			23 22.1
Latitude			79 12.5			79 12.5

Cape Andrew Jackson, position LVII, June 21, 1854.
Observations with pocket sextant and artificial horizon. One mile from entering cape of the channel.

Double altitude	⊙	66° 21′.5	
	⊙	67 27.5	
		66 54.5	33 27.2
Correction for refraction and parallax			—1.3
			33 25.9
Declination			23 27.5
Latitude			80 01.6

Cape Jefferson, position LI, June 24, 1854.

Double altitude	⊙	64° 59′.5	
	⊙	66 04.0	
		65 31.8	32 45.9
Correction for refraction and parallax			—1.3
Altitude ⊙			32 44.6
Declination			23 25.8
Latitude			80 41.2

Cape Madison, position LIV, June 26, 1854.

Double altitude	⊙	65° 35′.0	
	⊙	66 40.0	
		66 07.5	33 03.7
Correction for refraction and parallax			—1.3
Altitude ⊙			33 02.4
Declination			23 22.6
Latitude			80 20.2

(The data given on page 383, vol. II. of the Narrative, for longitude of the two last stations, are insufficient; the resulting longitude, as given on the map, must therefore be adopted. The index error of the sextant has been applied to the observations of the preceding three stations.)

Littleton Island, June 12, 1855.

The latitude of Littleton Island is determined by a set of circum-meridian altitudes of the sun, made on the east end of the island; the individual observations give (when corrected for refraction)—

Altitude ⊙'s centre	34° 47′ 27″	Mean 34 47 29
	32	
	25	
	22	
	38	
	26	
	26	
	35	
Altitude ⊙ corrected for parallax	34° 47′ 36″	
Declination	23 9 37	
Latitude	78 22 01	

Cape Alexander, June 17, 1855.

This position is obtained by an observation at a point on the ice five miles distant and N. 7° 26′ E. (true) from the cape.

Double altitude	$\overline{\odot}$ 70° 45′		
	$\underline{\odot}$ 69 41		
	70 13		
Index error	+8.7		
Corrected double altitude	70 21.7	35	10.8
Correction for refraction and parallax			—1.4
		35	09.4
Declination		23	23.7
Latitude		78	14.3
Latitude Cape Alexander		78	9.3

The map appended to this paper is based upon the preceding astronomical results; the astronomically determined positions (either in latitude or longitude) are indicated by a star; for its longitudes, it depends on the well determined meridian of the winter quarters; the detail of shoreline and the principal names are from Dr. Kane's map, in vol. I. of the Narrative. The projection depends on the following data, derived from Bessel's elements of the figure of the earth.

1° of the meridian in middle latitude	80½°	111649^{m}.1
1° of longitude in parallel	78	23216.2
" " "	79	21306.9
" " "	80	19391.0
" " "	81	17469.2
" " "	82	15541.8
" " "	83	13609.7

Examining the original map in the Narrative, I found that the longitude of the Observatory in Van Rensselaer harbor actually adopted was not that given in the text, but a value so nearly agreeing with my final result, that no change in the longitude of that part of the coast was required in the transfer of the shoreline to the new map. By request, Mr. Sonntag marked the exact position of the observatory

in reference to the shoreline of the harbor, an important datum, not given before. It will be perceived that the only change of importance made in the present map, is the shifting of the shores of Kennedy Channel to the southward to an amount of about nineteen nautical miles; it is well known that Dr. Kane had adopted the mean positions resulting from astronomical observations and dead reckoning, whereas in my map the astronomical determinations alone have been used. This change I made with the concurrence of Professor Bache, who, in May, 1858, communicated to the Royal Geographical Society, in England, that such a step seemed desirable and proper. The highest point of the shoreline, traced by Morton, on the east side of the Channel, is now placed in latitude 80° 56′, and, on the opposite side, the highest point distinctly seen by him is located in latitude 82° 07′.[1]

The following table contains the geographical positions of stations determined by travelling parties, and the latitudes of which have been given above.

	Latitude.	Long. W. of Gr.
Cape John Frazer	79° 42′.9	71° 30′
Cape Prescott	79 35.2	72 56
Cape William Wood	78 59	68 20
Cache Island	79 12.5	65 30
Cape Andrew Jackson	80 01.6	66 52
Cape Jefferson	80 41.2	67 52
Cape Madison	80 20.2	66 52
Littleton Island	78 22.0	74 10
Cape Alexander	78 09.3	74 20

The following results are taken from a report of Mr. Sonntag's to Dr. Kane, dated September 12, 1855 (at Godhavn).

	Latitude.	Long. W. of Gr.
Fitzclarence rock	76° 55′.0	
Dalrymple rock	76 30.5	70° 23′
Parker snow point	76 04.2	68 44
Cape York	75 56	66 48
Godhavn	69 14.6	

(NOTE.—In my discussion of the magnetic observations of the expedition the latitudes and longitudes of the stations could only be given approximately, and the results now obtained should be substituted instead of them.)

Observations in Connection with Twilight.—The following notes, made by Dr. Kane, has been extracted from his Log-Book. In calculating the sun's depression below the horizon, I have applied a correction for horizontal refraction, taking into account the temperature actually observed on that day.

Oct. 15, 1853.—Last entry of sunlight having been seen. "Astronomically, the upper limb of the sun should disappear at noon, October 25, if the horizon was free, but it is obstructed by a mountain ridge."[2]

---

[1] In a letter (dated Albany, February 29, 1860), Mr. Sonntag expresses himself as follows: "I am very glad to learn that you are going to reconstruct the map, and to reduce the upper portion of it, and I feel confident that, after the reduction is made, it will have claims to as much accuracy as any other map of any parts of the Arctic Regions."

[2] Page 105, vol. I. of the Narrative.

Nov. 2, 1853.—"A star observed at 2 P. M., and on the following day at half past one o'clock; on the 4th the thermometer had to be read by means of a lantern at 3 P. M., and on the following day at 2 P. M."

Nov. 7, 1853.—"Observed the first faint streak of daylight at 6 A. M. On the following day, stars of the 2d magnitude were visible at noonday; on the 2d instant, Capella had been seen at the same hour, and but for the misty haze probably earlier." Polaris was seen at noon on the 16th.

Nov. 22, 1853.—"The darkness is now (nearly) complete, being barely able to read at noonday." Sun's centre below the horizon 8° 09′ (temp. —35°).

Dec. 22, 1853.—Maximum depression of the sun's centre below the horizon at noon 11° 23′; temp. —35°.

Jan. 4, 1854.—"To-day at noon a distinct zone of illumination was seen to the south clearly defining the highest hills. This is the first departure we have had from our uniform darkness. The largest print is illegible at noon." Sun's centre below the horizon 10° 41′ (temp. —11°). On the following day, the first appearance of twilight was noticed at 7 A. M.; on the 7th and 18th, the largest print was not yet readable at noon.

Jan. 19, 1854.—"To-day at noon read the title page of my prayer book by turning the type towards the illuminated sky to the southward." Sun's centre below the horizon 8° 11′ (temp. —51°.)

Jan. 20, 1854.—"A faint appearance of brownish-red appeared above the hills to the southward between 11 A. M. and 1 P. M." On the 22d the standard thermometer could be read at noon without a lantern, and on Feb. 3, at 9 A. M.

Feb. 13, 1854.—"The light at noonday had a decided yellow tinge."

Feb. 20, 1854.—"At noon saw the sun's rays shining on the cliffs on the eastern side of the bay." Astronomically, the sun's upper limb should reappear on the horizon on the 16th. On the 2d and 4th of March twilight appeared at 3 A. M."

March 26, 1854.—"The standard thermometer is read at midnight without artificial light. On the 30th, stars of the 2d magnitude still visible at 1 A. M."

Oct. 29, 1854.—"The red of the graduated zone of sunset is deep cherry-red, running into crimson, which, after being cut by bluish-gray strata, blends with the higher blue by rosy pink."

Nov. 15, 1854.—"Can read type in Parry's Narrative at noon, but with great difficulty." Sun's centre below the horizon 6° 25′ (temp. —35°).

Nov. 19, 1854.—"At noon cannot read Parry's type." Sun's centre below the horizon 7° 26′ (temp. —14°).

Dec. 31, 1854.—"The twilight was remarkably apparent at noon to-day."

For comparison with the above, the following information has been extracted from Gehler's Physical Dictionary: In latitude 51°, Brandes was able to read the largest type, with the book turned toward the light, the sun's centre being 10½° below the horizon; ordinary large type was read with the sun's depression of 8½°. At Van Rensselaer Harbor, in latitude 78½, the limits of legibility, for ordinary large type, were with a depression of 7° 26′ and 8° 11′. It is generally assumed that, in temperate latitudes, complete darkness sets in when the sun's depression reaches 18°; on the 2d of March, the first appearance of twilight was noticed at a depression of 15° 0′ (temp. —37°) in latitude 78½; thus it appears that in this high latitude twilight is more feeble with the same depression of the sun than in lower latitudes. This circumstance is, doubtless, owing to the diminished height of the atmosphere (by contraction, on account of the cold, and by compression) in these high latitudes.

APPENDIX.

Directions to Sites of Rensselaer Harbor.

1. THE *observatory* was placed upon the northernmost of the rocky group of islets that formed our harbor. It is seventy-six English feet from the highest and northernmost salient point of this island, in a direction S. 14° E., or in line with said point and the S. E. projection of the southernmost islet of the group.

2. A natural face of gneiss rock formed the western wall of the observatory. A crevice in this rock has been filled with melted lead, in the centre of which is a copper bolt. Eight feet from this bolt and in the direction indicated by the crevice stood the magnetometer. This direction is given in case of local disturbance from the nature of the surrounding rocks.

3. On the highest point of the island mentioned in paragraph 1 is a deeply chiselled arrow-mark filled with lead. This is twenty-nine feet above the mean tidal plane of our winter quarters for the years 1853–4. The arrow points to a mark on a rocky face denoting the lowest tide of the season; both of these are referred by sextant to known points.

4. In an enlarged crack five feet due west of the above arrow is a glass jar containing documents.

5. A cairn calls attention to these marks: nothing is placed within it.

Extract from Appendix No. X, 2d volume of the Narrative, pp. 400—404, on methods of survey.

"It is proposed in the following sketch to give a general account of the methods used in surveying the coasts of Smith's Straits, and of Greenland as far south as Melville Bay. For a large portion of this labor I am indebted to my assistant Mr. Sonntag.

"It will be seen that the survey conducted by the returning expedition has more claims to accuracy than is attainable by a mere running or flying survey, although the operations were limited by the peculiar condition of the party.

"The means employed were, of course, not new; yet a short and precise account of the methods used to secure as perfect a delineation of the shore line as circumstances would permit may be properly given, with a view to a comparison of results with other surveys of the same region.

"It may be remarked at the outset that the geographical results of the expedition depend altogether for their longitude on the meridian of Rensselaer Harbor. The establishment of this prime meridian was, therefore, an object of great attention.

"As a general rule, the geographical positions were determined on shore whenever practicable; on some occasions on large floes, which afforded a firm basis for the artificial horizon. On several occasions in Smith's Straits, observations for latitude and longitude were made by means of a theodolite. This instrument was provided with a vertical circle of ten inches diameter, and its limb was divided to four seconds: attached to it was a very sensitive level, the value of a scale-division of which had been determined at Washington, and was found to equal 1″.13.

"For latitude a number of measurements of the altitude of the sun's upper and lower limb were taken, commencing about twenty minutes before and ending twenty minutes after the culminations. An equal number of readings of both limbs were taken with the instrument in the direct and reversed position. A screen of pasteboard protected the instrument from the direct action of the sun's rays.

"Observations for time (and longitude) were taken about 9 o'clock A. M. or 3 o'clock P. M.

"The apparent path of the sun in these high latitudes is but slightly inclined to the horizon; and the azimuth of any object was determined from the transit of the sun's first and second limb over the vertical wires of the instrument. The time being known, the azimuth of the zero of the limb is easily calculated, and nothing remained but to measure the horizontal angle between that direction and any object the astronomical bearing of which was desired. The azimuth is reckoned from north by east round to 360°. As objects for azimuthal determination, well defined glaciers, bluffs, islands, prominent capes, and the most distant headlands were selected; and, in order to make sure of the stability of the instrument during the period of observation, a second set of observations of the sun for azimuth of zero of limb was obtained.

"By means of two positions thus determined, a number of objects were located by the intersections of the bearings of the known points, and whenever practicable a third or check azimuth was obtained; in this latter case any discrepancy was properly taken into account according to known principles.

"In observing with the sextant for altitude of the sun, the usual precautions were taken, and in particular the parallelism of the upper and lower surfaces of the covering-glass of the artificial mercurial horizon was tested. An error of ten seconds, it is thought, cannot exist on this account, although another roof gave results differing as much as fifteen minutes (?) in the direct and reversed position, and consequently had to be rejected.

"The sextants used were made by Gambey, and divided to ten seconds. They were provided with an astronomical telescope, which has invariably been made use of in connection with the artificial horizon. When observing for latitude, multiplied observations were generally taken: first, three of the sun's upper limb; next, three of the lower; and finally, again three of the upper limb. These observations were commenced eight or ten minutes before noon. The corresponding index error was always determined.

"Observations for longitude were never made nearer than three hours from noon; and, whenever weather and time permitted, corresponding observations in the forenoon and afternoon were secured. On these occasions twelve observations, divided into four groups, and an equal number for the upper and lower limb, were taken. In observing corresponding altitudes, the index was set to an even five or ten minutes, and the time noted when the contact was perfect. The successive changes of the index were regulated according to the sun's relative changes in altitude. * * *

* * * * * "In working up the observations, index error, refraction, and change of the sun's declination, during the interval, were properly taken into account.

"In a few instances, when the weather or other causes prevented an observation for latitude at noon, two sets of observations were taken, as far distant from one another as practicable, and latitude and longitude deduced accordingly. Such was the case at Fiskernaes and Refuge Inlet. This method proved very accurate, provided one set was not more than two hours from noon, and the other at least two hours distant from the first.

"Time was noted by a pocket-chronometer, which was compared before and after each set of observations with four box-chronometers, the rates of which had been determined at New York before leaving port. At St. John's, Newfoundland, and at different times in our winter quarters the box-chronometers were rated by Mr. Sonntag by means of a transit instrument. The mean rate of the pocket-chronometer as found by comparison with each box-chronometer was adopted. As an approximate longitude of the prime meridian of Rensselaer Harbor, 70° 40′ W. of Greenwich has at present been adopted. A slight change is anticipated from some observed occultations of planets by the moon and a solar eclipse: these observations have not yet been worked up. Any change made hereafter in this longitude will, as has already been remarked, equally affect all the other longitudes.

"For the determination of azimuths by means of a sextant, the angle between the sun's centre and the object was measured and the time noted. For this purpose the smaller telescope was used, and sometimes a pocket-sextant. Whenever the object, the azimuth of which was to be found, was farther removed from 120° than from the sun, the angular distance of an intermediate object, about 90° from the sun, was introduced. At the same time the altitude of the sun was observed, to allow for the reduction of the arc of the horizon; this reduction was always small, since the sun was seldom higher than 30°, and in no case higher than 36°.

"When the azimuth of an object was thus determined, a number of other conspicuous objects were connected with it by horizontal angles. Two determinations of the azimuth of an object, obtained from two astronomically-determined points, seldom differed more than seven minutes.

"The principal points of the coast have thus become known, either by direct observations of latitude and longitude, by latitude and solar bearing, or by the intersection of two azimuths, according to methods explained above.

"The filling in of the minor or secondary points remains yet to be explained. The position was generally obtained by solar or compass bearings and estimated distances. In regard to the solar bearings, it may be remarked that their frequent application rendered the construction of a table of double entry for every degree of altitude of the sun from 5° to 36°, and for every degree of angular distance from 10° to 125°, quite an acceptable improvement in facilitating the reduction. In regard to magnetic bearings, it is to be remarked that they were taken with a pocket-compass, the face of which, divided into degrees, was fastened to the bottom of the box to allow the needle free play. The magnetic declination (variation of compass) observed with this instrument at different times at the same place seldom differed more than three degrees, while on the contrary, other compasses, with the card fastened to the needle, would remain stationary in any position in which they were placed, in consequence of the small horizontal force in the region traversed. Care was taken to keep the compass perfectly level, and in sighting the eye was kept directly over the north end of the needle.

"The estimation of distances of intermediate points was the only thing loosely obtained; but it must be remembered, however, that these distances were always checked by means of astronomically determined positions, and hence, no error of this kind, although they were of frequent occurrence, could be propagated. Distances estimated at the same time have in some instances received a proportionate correction obtained from the check of any single line directly from comparison with astronomical data. At other times, distances paced were found to agree remarkably well with their distance astronomically determined. In this way a journey undertaken in March, 1854, was found correct to within one-thirtieth of the whole distance travelled over in six days.

"The survey of bays and harbors was conducted in the ordinary way, by means of a base-line measured, either with a cord properly stretched or by pacing. Angles were then measured at each extremity, and occasionally another point was determined trigonometrically. The head-lands, prominent bluffs, and islands for these maps generally were determined astronomically. * * * *

* * * "The whole survey, made as explained above, embraces that portion of the coast north of Capes Alexander and Sabine. That portion of it included between Cape Alexander and Upernavik, which was in revision of the work of our English predecessors, as laid down in the Admiralty charts, was made during the escape of the party in boats. For the greater portion of this labor I am indebted to Mr. Sonntag.

E. K. K."

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WASHINGTON CITY,

MAY, 1860.

SMITHSONIAN CONTRIBUTIONS TO KNOWLEDGE.

TIDAL OBSERVATIONS

IN THE

ARCTIC SEAS.

BY

ELISHA KENT KANE, M.D., U.S.N.

MADE DURING THE SECOND GRINNELL EXPEDITION IN SEARCH OF SIR JOHN FRANKLIN, IN 1853, 1854, AND 1855, AT VAN RENSSELAER HARBOR.

REDUCED AND DISCUSSED,

BY

CHARLES A. SCHOTT,
ASSISTANT U. S. COAST SURVEY.

[ACCEPTED FOR PUBLICATION, JULY, 1860.]

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INTRODUCTORY LETTER.

WASHINGTON, July 4th, 1860.

PROFESSOR JOSEPH HENRY, LL.D.,

Secretary of the Smithsonian Institution:

DEAR SIR: The records of the tidal observations made under the direction of Dr. Kane, in the second Grinnell Expedition to the Arctic Regions, were placed in my hands by his late lamented father, Judge Kane, in December, 1857.

Dr. Kane had selected Assistant Charles A. Schott, of the U. S. Coast Survey, for the reduction of a considerable portion of the observations made on that expedition; and I, therefore, placed them in Mr. Schott's possession for reduction, and recommend his paper for publication in the "Smithsonian Contributions to Knowledge." It is proper to state that the computations were at the expense of the Smithsonian Institution. This is the sixth and last paper of the series.

Very respectfully, yours,

A. D. BACHE,

Superintendent U. S. Coast Survey.

RECORD AND REDUCTION OF THE TIDES.

THE observations and discussion of the tides at Van Rensselaer Harbor, the winter quarters of the Advance during 1853–54 and 1854–55, will form the last of the series of papers on the results of the expedition, prepared by me for publication.

Occasional tidal observations were made after passing Smith Straits, when, owing to the peculiar navigation through the narrow openings between the coast and the bay ice, the vessel was much exposed to the tidal action, frequently grounding at low water, and otherwise, by taking advantage of high tides, slowly advancing to her winter quarters.

The bay, near the head of which the Advance was laid up, and used as the winter quarters by Dr. Kane's party, is freely exposed to the north (true) and northwest; the indentation of the shore line is about five miles; some rocky islands are situated within the bay.

Shortly after the vessel entered the harbor a tide staff was arranged, and a series of tidal observations was commenced on September 11, 1853, and continued, with occasional interruptions (partly owing to defects in the pulley-gauge, afterwards rigged up, and partly owing to other unavoidable accidents) till the 24th of January, 1855, on which date the regular log book appears to have been discontinued.

The several series of observations during this period are of very unequal value, as will appear in the detailed examination and discussion of the results. The difficulties to be overcome in the attempt to secure a reliable set of observations were considerable, those of a physical nature being the greatest. The observations with the staff or sounding line are subject to irregularities from a slow movement of the vessel, which, though imbedded in ice during the greater part of the year, is yet not stationary; these observations may also be affected by the softness of the bottom; the observations by means of a pulley tide gauge may be defective, on account of a slow drift of the vessel and motion of the ice field, also in consequence of a lengthening or shortening of the rope, or it may be in consequence of slipping of the rope on the circumference of the wheel. The latter defect, or one similar in its nature, has been a source of much annoyance, requiring the application of corrections to the readings, in order to refer all observations to the same zero of the scale. There is another defect to which pulley-gauges are subject, namely, the gradual rise of the vessel, in consequence of the consumption of provisions and fuel. Notices of these defects will appear in the subsequent discussion.

The pulley-gauge is described by Dr. Kane, in volume I of the *Narrative*, p. 117, as follows: "Our tide register was on board the vessel, a simple pulley-gauge,

arranged with a wheel and index, and dependent on her rise and fall for its rotation."[1]

In order to ascertain the nature of the tides, as well as the degree of accuracy of the different observations, the readings were roughly plotted for a first examination; the following series were found suitable for discussion:—

SERIES I. *From October 10th*, 1853, *to December 28th*, 1853.—This series, with the exception of three days, is complete; the observations in the latter part of December appear to be of less reliable character. The observations between September 11 and October 4, 1853, are too fragmentary to be used. The pulley-gauge observations between October 4 and October 9 seem to have been only experimental. The hourly readings are superseded by half-hourly readings on November 8, and continue half hourly, day and night, to the end of the series. After November 28, corrective soundings were taken at noon each day. In order to make use of these soundings, the mean depth of the water at the anchorage was deduced from them as follows:—

		Mean reading.	
December,	1853.	43.8 feet,	from 31 soundings (at noon).
January,	1854.	44.9	21
February,	"	44 3	17
March,	"	43.3	19
April,	"	41.8	20
May,	"	43.5	9

The individual soundings will appear in the record following.

Mean depth of water at anchorage, in winter, 1853–54, 43.6 feet, as obtained from 117 soundings. The monthly mean values for the tidal level accord well, and show that no lateral change took place in the position of the brig (or else that the bottom was level). It will be seen that for Series I the reading 7.0 was adopted to express the mean level, the zero of the scale was, therefore, at an elevation of 36.6 feet from the bottom. The readings of the pulley guage are expressed in feet,[2] as I have been informed by Mr. Sonntag.

SERIES II. *From January 28th*, 1854, *to April 7th*, 1854.—The double half-hourly readings of the pulley-gauge are continued. The series is complete with the exception of ten days, which had to be omitted. The register broke January 22d; observations commenced January 24th, but were not sufficiently regular for use

[1] The following note is appended: One end of the cord represented a fixed point, by being anchored to the bottom; the free end, with an attached weight, rose and fell with the brig, and recorded its motion on the grooved circumference of a wheel. This method was liable to objections, but it was corrected by daily soundings. The movements of our vessel partook of those of the floe in which she was imbedded, and were unaccompanied by any lateral deviation.

[2] The following is an extract from Mr. Sonntag's letter to me, dated New York, March 23, 1860: "The circumference of the wheel (of the pulley-gauge) was divided into feet and tenths of a foot, and the records by the sounding line are also expressed in feet and decimals. The records of the wheel are very uncertain, as often the rope slid over the wheel without turning it, owing to the ice which surrounded the axis."

until January 28th. The corrective soundings at noon are continued, with occasional omissions, throughout this series. After April 7th there is a break in the observations, those between the 14th and 20th appear to be irregular.

SERIES III. *From April 20th*, 1854, *to August 3d*, 1854.—The double half-hourly readings of the pulley-gauge continue to May 5th, after which date single half-hourly readings are recorded. The corrective soundings cease on the 12th of May. Interruptions occur between May 4th and May 7th, also on July 8th, also between July 15th and 18th, and between July 20th and the 28th. On the 8th of August the brig was released from her ice cradle, and rose two and a half feet; occasional warpings of the brig after this date render the observations worthless. On the 23d of August the brig was in but seven feet of water, and grounded.

SERIES IV. *From September 7th*, 1854, *to October 22d*, 1854.—The hourly observations assume again a more regular appearance on the 7th of September; they were taken with the sounding line, and are expressed in fathoms and feet (as stated in a note, August 12th). The following note is of October 21st, 1854: "The tide register as yet not rigged, observations very faulty by sounding line." The irregularities increase after this date; on the 15th of November following, the tide register was arranged, and observations (hourly) commenced on the 17th; the slipping of the rope, however, was of so frequent occurrence and of so great an extent, that it was considered better to take no further notice of these observations; the record continues to January 24th, 1855, when the strength of the party no longer permitted due attention to the tidal phenomena.

It was apparent that before any closer insight into the nature of these tides could be obtained, they must first be reduced to the same zero or mean level of the sea. To effect this in a manner apparently best suiting the case, and otherwise unobjectionable, two curved lines were traced on the diagrams, the upper one enveloping the highest high water of each day, the other enveloping the lowest low water of each day; in tracing these lines some allowance was made, when necessary, for disturbing causes, so as to obtain tolerably smooth curves; cases of abrupt changes were, of course, treated accordingly. A line, equidistant from these curves, was assumed as representing the mean level, and when straightened out was adopted as axis of the mean level of the sea. The corrections to refer each observation to this adopted mean level; or, in other words, the corrections required to refer each observation to the same zero of the scale, so as to make them comparable with each other, were taken from the projection, and are given in the column headed "reduction," in the following record.

This method of treatment excludes necessarily in Series I, II, and III, any discussion of the variation in the mean level of the sea, the oscillations of which have been found small at other places. As an illustration of this, the tides at Singapore might be referred to; the Rev. W. Whewell (7th series of researches on the tides, *Phil. Trans. of the Roy. Soc.*, Part I, 1837), finds for these tides that, if a line is drawn representing the mean height (midway between high and low water each day) it is very nearly constant, though the successive low waters often differ by six

feet (on account of the diurnal inequality), the mean level only oscillates through a few inches. It appears from Mr. Lloyd's paper (*Phil. Trans.* of 1831) that the mean level at Sheerness is higher in spring tides than in neap tides by seven inches nearly; also there seems to be no doubt (as shown by Mr. Whewell, *Phil. Trans.*, 1839 and 1840) that the mean level increases as the moon's declination increases, amounting to three inches at Plymouth, when the moon's declination is 25°; at Petropaulofsk and Novo-Arkhangelsk the mean level rises as the moon's declination increases.

The use of the soundings intended to furnish corrections to the readings of the pulley-gauge is in many cases a doubtful remedy, on account of the continued change in the zero of the wheel's index; in fact, it would have required numerous soundings at other hours than noon. As it is, a combination of the corrections by enveloping curves and soundings had to be adopted. Thus, for December 5th, soundings at noon 43.0 feet (see record further on), mean level 36.6, hence reading of scale at noon 6.4; reading of pulley-gauge at that hour 19.0, correction by curve —12.5, corrected reading 6.5, which agrees with the first number; this is, however, a very favorable case. For intermediate hours the correction as given by the curves serve as guides. The reduction to the same level affects the times generally very little.

The following table contains the soundings taken at noon between the interval of the first and second series, those taken during the series being given in the record.

SOUNDINGS AT NOON.

1853.	Fath.	Feet.	Inch.	Register.	1854.	Fath.	Feet.	Inch.	Register.
December, 29.	7	3	0		January 13.	7	3	6	
30.	8	0	0	18.1 (changed.)	14.	---	---	---	
31.	8	2	0		15.	8	1	0	
1854. Jan. 1.	8	1	6		16.	7	2	6	
2.	8	1	6		17.	---	---	---	
3.	7	5	6		18.	7	3	9	
4.	7	3	0	Changed to 16.0	19.	7	5	6	
5.	7	1	6		20.	6	3	0	
6.	6	4	6	Changed to 10.5	21.	6	4	0	Changed to 10
7.	6	3	0		22.	Tide register broken.			
8.	---	---	---		23.	"	"		"
9.	6	4	2		24.	"	"		"
10.	7	0	0		25.	---	---	---	
11.	---	---	---		26.	---	---	---	
12.	7	4	0		27.	7	1	9	

The following soundings were taken between the second and third series:—

1854.	Fath.	Feet.	Inches.	1854.	Fath.	Feet.	Inches.
April 8.	6	5	6	April 16.	7	5	6
9.	6	4	0	(Fall 15 feet 8 inches.)			
10.	7	0	6	(17.	6	5	0
11.	6	5	6	at 20 minutes to 5.)			
13.	7	4	0	(18.	6	0	0
14.[1]	7	5	6	at 8^h 15^m P. M.)			
15.	8	0	0	19.	6	2	0
(Low water to high water 14 ft. 8 inch.)							

[1] For the past ten days the tide register has not been reliable on account of the rope slipping.

The note of February 3d, 1854, is very instructive in regard to the effect of the tides on the ice floe, viz: "The enormous elevation of the land ice by the tides has raised a barrier of broken tables seventy-two feet wide and twenty feet high between the brig and islands. This action has caused a recession of the main floe; our vessel has changed her position twenty feet within the last two spring tides, and the hawser connected with Butler Island parted with the strain." The cutwater of the brig was then 280 feet from the margin of the ice. (Note of February 4th.)

The mean of all the soundings taken during the fourth series is very nearly fifteen feet, hence the constant index error, to refer the observations to the level previously adopted, is eight feet, which correction was applied, converting at the same time the record of fathoms into feet.

The following tidal record extends, therefore, over about nine and a half lunations between October 10, 1853, and October 22, 1854, during which interval the time and height of nearly five hundred high and as many low waters were secured.

Record of the Observations of the Tides at Van Rensselaer Harbor, North Greenland, in 1853, 1854, *and* 1855.

POSITION OF THE WINTER QUARTERS,

Latitude 78° 37′ north, and longitude 70° 53′, or 4^h $43^m.5$ west of Greenwich.[1]

The first column for each day is copied from the original log-book, the second column contains the reduction to the adopted zero of scale found graphically as explained, and the third column contains the observations referred to the same mean level.

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[1] See my discussion of the astronomical observations of the expedition in vol. XII of the Smithsonian Contributions to Knowledge, 1860.

SERIES I.—TIDAL OBSERVATIONS FROM OCTOBER 10, 1853, TO DECEMBER 28, 1853.

Hourly observations on the pulley-gauge. Adopted reading of mean level 7.0, expressed in units of the scale. Increasing numbers indicate rise of water.

October, 1853.

Mean solar hour.	10th.	Red. to level.	Ref. obs.	11th.	Red. to level.	Ref. obs.	12th.	Red. to level.	Ref. obs.	13th.	Red. to level.	Ref. obs.	14th.	Red. to level.	Ref. obs.	17th.	Red. to level.	Ref. obs.
1	---		---	5.4	—1.0	4.4	5.0	—1.0	4.0	7.5	—1.3	6.2	7.0	—1.5	5.5	---		---
2	6.6	—1.0	5.6	5.4	"	4.4	5.0	"	4.0	6.4	"	5.1	5.4	"	3.9	---		---
3	7.6	"	6.6	5.5	"	4.5	5.2	"	4.2	5.0	"	3.7	4.4	"	2.9	---		---
4	8.1	"	7.1	6.0	"	5.0	6.0	"	5.0	5.5	"	4.2	4.2	"	2.7	---		---
5	8.7	"	7.7	6.9	"	5.9	7.9	"	6.0	7.9	"	6.6	4.4	—1.6	2.8	---		---
6	8.7	"	7.7	7.3	"	6.3	8.5	"	7.5	8.3	"	7.0	5.5	"	3.9	---		---
7	8.7	"	7.7	7.7	"	6.7	8.9	"	7.9	8.7	—1.4	7.3	7.5	"	5.9	---		---
8	9.0	"	8.0	7.7	"	6.7	8.9	"	7.9	9.4	"	8.0	9.6	"	8.0	---		---
9	6.4	"	5.4	7.6	"	6.6	---		---	10.5	"	9.1	11.2	"	9.6	---		---
10	5.9	"	4.9	6.6	"	5.6	7.8	—1.1	6.7	10.5	"	9.1	11.4	"	9.8	---		---
11	5.7	"	4.7	6.1	"	5.1	6.7	"	5.6	10.3	"	8.9	11.3	"	9.7	---		---
Noon	5.8	"	4.8	5.8	"	4.8	5.6	"	4.5	9.9	"	8.5	11.0	—1.7	9.3	---		---
1	6.7	"	5.7	5.8	"	4.8	5.3	"	4.2	7.6	"	6.2	9.4	"	7.7	---		---
2	7.3	"	6.3	5.8	"	4.8	5.3	"	4.2	6.7	"	5.3	7.4	"	5.7	---		---
3	8.9	"	7.9	6.3	"	5.3	5.3	"	4.2	5.6	—1.5	4.1	6.6	"	4.9	---		---
4	9.3	"	8.3	7.7	"	6.7	5.3	"	4.2	4.6	"	3.1	4.4	"	2.7	---		---
5	10.2	"	9.2	9.0	"	8.0	6.4	—1.2	5.2	6.5	"	5.0	4.6	"	2.9	4.2	—2.7	1.5
6	10.2	"	9.2	10.1	"	9.1	7.8	"	6.6	9.0	"	7.5	5.9	"	4.2	4.5	"	1.8
7	10.2	"	9.2	10.5	"	9.5	9.9	"	8.7	10.5	"	9.0	9.2	"	7.5	---		---
8	9.9	"	8.9	10.5	"	9.5	11.0	"	9.8	11.6	"	10.1	12.0	—1.8	10.2	9.5	"	6.8
9	8.8	"	7.8	9.8	"	8.8	11.3	—1.3	10.0	12.4	"	10.9	12.4	"	10.6	12.6	"	9.9
10	7.5	"	6.5	9.0	"	8.0	11.3	"	10.0	12.4	"	10.9	13.1	"	11.3	13.0	"	10.3
11	6.3	"	5.3	7.2	"	6.2	9.7	"	8.4	12.4	"	10.9	13.1	"	11.3	13.4	"	10.7
Midn't	5.7	"	4.7	5.6	"	4.6	8.3	"	7.0	10.4	"	8.9	13.0	—1.9	11.1	13.4	"	10.7

October, 1853.

Mean solar hour.	18th.	Red. to level.	Ref. obs.	19th.	Red. to level.	Ref. obs.	20th.	Red. to level.	Ref. obs.	21st.	Red. to level	Ref. obs.	22d.	Red. to level.	Ref. obs.	23d.	Red. to level.	Ref. obs.
1	11.5	—2.7	8.8	13.6	—2.2	11.4	13.8	—2.3	11.5	11.6	—1.7	9.9	10.7	—0.2	10.5	7.0	+0.8	7.8
2	8.9	"	6.2	12.0	"	9.8	12.6	"	10.3	---	"	---	10.2	"	10.0	8.0	"	8.8
3	6.8	"	4.1	8.9	"	6.7	10.5	"	8.2	10.8	—1.6	9.2	10.0	—0.1	9.9	9.5	"	10.3
4	5.5	"	2.8	6.6	"	4.4	8.0	"	5.7	9.6	—1.5	8.1	9.0	"	8.9	9.0	+0.9	9.9
5	4.4	—2.6	1.8	4.5	"	2.3	7.9	—2.2	5.7	6.7	—1.4	5.3	8.0	0.0	8.0	6.9	"	7.8
6	4.4	"	1.8	3.8	"	1.6	7.9	"	5.7	4.6	"	3.2	7.0	"	7.0	4.5	"	5.4
7	6.5	"	3.9	3.8	"	1.6	7.9	"	5.7	4.1	—1.3	2.8	5.0	"	5.0	3.4	"	4.3
8	8.7	"	6.1	4.7	"	2.5	8.9	"	6.7	4.1	—1.2	2.9	5.0	+0.1	5.1	3.0	"	3.9
9	11.8	—2.5	9.3	5.3	"	3.1	8.7	"	6.5	6.7	"	5.5	3.3	"	3.4	3.1	"	4.0
10	---		---	11.0	"	8.8	8.7	"	6.5	8.5	—1.1	7.4	4.5	+0.2	4.7	3.5	"	4.4
11	---		---	13.6	"	11.4	12.9	"	10.7	10.8	"	9.7	6.3	"	6.5	3.7	"	4.6
Noon	---		---	14.4	"	12.2	13.6	"	11.4	11.7	—1.0	10.7	7.2	"	7.4	4.5	"	5.4
1	---		---	14.6	"	12.4	14.0	—2.1	11.9	11.9	"	10.9	7.0	+0.3	7.3	6.5	"	7.4
2	14.8	"	12.3	12.6	"	10.4	14.0	"	11.9	11.9	—0.9	11.0	7.5	"	7.8	7.0	"	7.9
3	10.6	—2.4	8.2	10.4	"	8.2	---		---	11.9	—0.8	11.1	9.5	+0.4	9.9	8.5	"	9.4
4	8.6	"	6.2	9.6	—2.3	7.3	---		---	11.8	"	11.0	9.2	"	9.6	9.5	"	10.4
5	6.6	"	4.2	6.6	"	4.3	7.7	"	5.6	9.0	—0.7	8.3	9.2	"	9.6	8.0	+0.8	8.8
6	4.4	"	2.0	5.2	"	2.9	6.2	"	4.1	7.5	"	6.8	6.7	+0.5	7.2	7.4	"	8.2
7	4.4	—2.3	2.1	4.2	"	1.9	5.5	"	3.4	5.5	—0.6	4.9	5.2	"	5.7	7.0	"	7.8
8	5.5	"	3.2	4.8	"	2.5	5.2	—2.0	3.2	5.0	"	4.4	3.9	+0.6	4.5	6.1	"	6.9
9	8.3	"	6.0	6.8	"	4.5	4.7	"	2.7	5.0	—0.5	4.5	3.9	"	4.5	5.5	"	6.3
10	10.4	"	8.1	9.4	"	7.1	6.8	—1.9	4.9	5.0	"	4.5	4.0	"	4.6	4.5	+0.7	5.2
11	12.6	"	10.3	11.6	"	9.3	9.8	"	7.9	5.0	—0.4	4.6	6.3	+0.7	7.0	5.0	"	5.7
Midn't	13.7	—2.2	11.5	13.4	"	11.1	11.0	—1.8	9.2	5.0	—0.3	4.7	---		---	5.5	"	6.2

Regular observations commence October 10, 2 A. M.
Oct. 15. Tide rope found broken at 10 A. M., and the lead lost through the ice hole.
Oct. 17. Tides irregular, index changed 12 units; hence most of the observations on this day had to be omitted.
Oct. 20. The observation for 10 A. M. is incorrect, on account of obstruction by the ice.
Oct. 21. Flood [rise] commenced at 8 P. M.
Oct. 23. Slack water [stand] at 8 o'clock, flood commences.

SERIES I.—TIDAL OBSERVATIONS FROM OCTOBER 10, 1853, TO DECEMBER 28, 1853.

Hourly observations on the pulley-gauge. Adopted reading of mean level 7.0, expressed in units of the scale. Increasing numbers indicate rise of water.

October, 1853.

Mean solar hour.	24th.	Red. to level.	Ref. obs.	25th.	Red. to level.	Ref. obs.	26th.	Red. to level.	Ref. obs.	27th.	Red. to level.	Ref. obs.	28th.	Red. to level.	Ref. obs.	29th.	Red. to level.	Ref. obs.
1	6.5	+0.7	7.2	5.5	—0.1	5.4	5.0	+0.3	5.3	4.0	+0.8	4.8	4.5	+1.1	5.6	5.1	+0.9	6.0
2	7.0	"	7.7	5.8	"	5.7	5.5	"	5.8	4.0	"	4.8	3.5	"	4.6	4.4	"	5.3
3	8.0	"	8.7	6.5	—0.2	6.3	5.5	+0.4	5.9	4.5	"	5.3	3.4	"	4.5	2.8	"	3.7
4	8.0	+0.6	8.6	7.2	"	7.0	5.8	"	6.2	5.0	+0.9	5.9	4.3	"	5.4	2.5	"	3.4
5	7.3	"	7.9	7.3	"	7.1	5.8	"	6.2	6.0	"	6.9	5.3	"	6.4	3.0	"	3.9
6	6.5	"	7.1	7.0	—0.3	6.7	6.2	+0.5	6.7	6.8	"	7.7	5.6	"	6.7	5.5	"	6.4
7	5.4	"	6.0	6.4	"	6.1	6.5	"	7.0	7.1	+1.0	8.1	7.3	"	8.4	7.0	"	7.9
8	4.0	+0.5	4.5	5.6	"	5.3	6.5	"	7.0	7.1	"	8.1	8.2	"	9.3	7.8	"	8.7
9	5.0	"	5.5	5.6	—0.4	5.2	6.1	"	6.6	7.1	"	8.1	---		---	9.8	"	10.7
10	5.0	"	5.5	5.6	"	5.2	5.6	"	6.1	6.0	"	7.0	---		---	9.8	"	10.7
11	5.0	"	5.5	5.6	"	5.2	5.5	+0.6	6.1	5.6	"	6.6	---		---	9.6	"	10.5
Noon	5.0	+0.4	5.4	5.6	"	5.2	5.5	"	6.1	4.5	"	5.5	---		---	9.3	"	10.2
1	7.7	"	8.1	7.3	—0.3	7.0	5.5	"	6.1	4.5	"	5.5	4.8	"	5.9	6.8	"	7.7
2	---		---	6.3	"	6.0	5.5	"	6.1	5.0	"	6.0	4.3	"	5.4	4.8	"	5.7
3	---		---	6.8	—0.2	6.6	6.0	"	6.6	5.3	"	6.3	4.0	"	5.1	4.0	"	4.9
4	---		---	7.5	"	7.3	6.5	"	7.1	6.3	"	7.3	4.0	"	5.1	4.0	"	4.9
5	9.5	+0.2	9.7	7.3	—0.1	7.2	7.5	+0.7	8.2	7.7	"	8.7	6.0	"	7.1	4.0	"	4.9
6	9.5	"	9.7	7.6	"	7.5	8.0	"	8.7	7.3	+1.1	8.4	7.1	"	8.2	5.5	"	6.4
7	8.1	+0.1	8.2	8.3	"	8.2	8.2	"	8.9	8.6	"	9.7	8.0	+1.0	9.0	6.7	"	7.6
8	7.0	"	7.1	8.5	0.0	8.5	8.5	"	9.2	8.7	"	9.8	9.4	"	10.4	9.0	"	9.9
9	6.0	0.0	6.0	7.1	"	7.1	8.5	"	9.2	8.7	"	9.8	9.8	"	10.8	9.5	"	10.4
10	5.8	"	5.8	6.1	+0.1	6.2	7.1	"	7.8	7.1	+1.2	8.3	9.8	"	10.8	10.5	"	11.4
11	5.5	—0.1	5.4	5.4	"	5.5	6.1	+0.8	6.9	6.3	"	7.5	9.0	+0.9	9.9	10.5	"	11.4
Midn't	5.5	"	5.4	5.0	+0.2	5.2	4.8	"	5.6	5.9	"	7.1	7.3	"	8.2	8.5	"	9.4

October, 1853. November, 1853.

Mean solar hour.	30th.	Red. to level.	Ref. obs.	31st.	Red. to level.	Ref. obs.	1st.	Red. to level.	Ref. obs.	2d.	Red. to level.	Ref. obs.	3d.	Red. to level.	Ref. obs.	4th.	Red. to level.	Ref. obs.
1	4.5	+0.9	5.4	5.4	+1.5	6.9	6.8	+1.7	8.5	9.1	+1.4	10.5	13.5	—1.7	11.8	13.0	—1.4	11.6
2	3.5	"	4.4	3.8	"	5.3	4.0	"	5.7	8.8	+1.3	10.1	12.0	"	10.3	12.5	"	11.1
3	2.0	"	2.9	3.0	+1.6	4.6	2.5	"	4.2	7.1	+1.2	8.3	9.0	"	7.3	11.2	"	9.8
4	2.0	"	2.9	0.0	"	1.6	1.0	"	2.7	4.7	+1.0	5.7	6.7	—1.6	5.1	9.8	"	8.4
5	3.2	"	4.1	1.0	"	2.6	1.0	"	2.7	1.5	+0.7	2.2	3.7	"	2.1	6.0	"	4.6
6	4.2	"	5.1	1.2	"	2.8	2.2	"	3.9	0.5	+0.5	1.0	1.8	"	0.2	4.4	"	3.0
7	6.2	+1.0	7.2	3.1	+1.7	4.8	3.2	"	4.9	0.7	+0.2	0.9	1.5	—1.5	0.0	2.0	"	0.6
8	8.5	"	9.5	6.5	"	8.2	7.0	"	8.7	3.0	0.0	3.0	2.4	"	0.9	1.7	"	0.3
9	10.1	+1.1	11.2	8.5	"	10.2	9.5	+1.6	11.1	7.2	—0.2	7.0	3.4	"	1.9	3.7	"	2.3
10	10.4	"	11.5	9.3	"	11.0	10.5	"	12.1	9.8	—0.5	9.3	4.2	"	2.7	7.3	"	5.9
11	10.4	"	11.5	10.3	"	12.0	10.7	"	12.3	10.9	—0.7	10.2	6.0	"	4.5	10.5	"	9.1
Noon	10.4	+1.2	11.6	10.0	"	11.7	10.7	"	12.3	15.3	—1.0	14.3	6.7	"	5.2	12.6	"	11.2
1	8.2	"	9.4	7.5	"	9.2	10.2	"	11.8	15.2	—1.2	14.0	15.7	"	14.2	---		---
2	5.5	"	6.7	5.2	"	6.9	9.2	"	10.8	13.6	—1.5	12.1	15.2	"	13.7	---		---
3	3.7	"	4.9	3.7	"	5.4	8.1	"	9.7	10.5	—1.6	8.9	12.5	"	11.0	---		---
																12.0	"	10.6
4	3.4	"	4.6	0.1	"	1.8	4.5	+1.5	6.0	6.8	—1.7	5.1	10.1	"	8.6	11.5	"	10.1
5	2.6	+1.3	3.9	0.2	"	1.9	3.0	"	4.5	3.8	"	2.1	6.5	"	5.0	9.0	"	7.6
6	3.4	"	4.7	1.2	"	2.9	2.3	"	3.8	2.0	"	0.3	4.5	"	3.0	5.5	"	4.1
7	5.1	"	6.4	3.0	"	4.7	2.1	"	3.6	1.8	"	0.1	3.5	"	2.0	3.2	"	1.8
																3.0	"	1.6
8	6.8	"	8.1	5.2	"	6.9	4.0	"	5.5	3.2	"	1.5	3.5	"	2.0	3.0	"	1.6
													3.0	"	1.5			
9	9.5	+1.4	10.9	8.1	"	9.8	9.0	"	10.5	3.3	"	1.6	4.5	"	3.0	3.1	"	1.7
10	10.3	"	11.7	9.5	"	11.2	10.1	"	11.6	3.3	"	1.6	7.3	"	5.8	5.0	"	3.6
11	10.3	"	11.7	9.5	"	11.2	10.1	"	11.6	3.3	"	1.6	9.3	"	7.8	7.5	"	6.1
Midn't	9.0	+1.5	10.5	10.5	"	12.2	10.1	"	11.6	3.3	"	1.6	12.0	"	10.5	9.8	"	8.4

Oct. 29. Slack water [stand] of ebb at $4^h\ 30^m$ A. M.

Oct. 31. Slack water [stand] of ebb at 5 A. M.

Nov. 2 to Nov. 6. Between these dates there are occasionally half-hourly readings, but unless they occur near high or low water they are omitted in the above.

SERIES I.—TIDAL OBSERVATIONS FROM OCTOBER 10, 1853, TO DECEMBER 28, 1853.

Hourly observations on the pulley-gauge. Adopted reading of mean level 7.0, expressed in units of the scale. Increasing numbers indicate rise of water.

November, 1853.

Mean solar hour.	5th.	Red. to level.	Ref. obs.	6th.	Red. to level.	Ref. obs.	7th.	Red. to level.	Ref. obs.	8th.	Red. to level.	Ref. obs.	9th.	Red. to level.	Ref. obs.	10th.	Red. to level.	Ref. obs.
										4.3		3.8	3.8	+0.2	4.0	4.5	—0.2	4.3
1	11.5	—1.4	10.1	9.0	—1.0	8.0	6.6	—0.6	6.0	5.3	—0.5	4.8	3.9	"	4.1	4.5	"	4.3
										5.6	"	5.1	4.2	"	4.4	4.3	"	4.1
2	11.0	"	9.6	9.8	"	8.8	7.9	"	7.3	6.2	"	5.7	4.0	"	4.2	4.0	"	3.8
				9.9	"	8.9	8.8	"	8.2				4.5	"	4.7	4.2	"	4.0
3	10.0	"	8.6	10.0	"	9.0	8.8	"	8.2	7.1	"	6.6	5.0	"	5.2	4.5	—0.3	4.2
				10.0	"	9.0	8.8	"	8.2							4.5	"	4.2
4	9.2	—1.3	7.9	10.0	—0.9	9.1	8.8	"	8.2	7.9	"	7.4	6.0	"	6.2	4.1	"	3.8
				8.1	"	7.2	8.8	"	8.2	7.9	—0.4	7.5				5.8	"	5.5
5	5.7	"	4.4	7.7	"	6.8	8.6	"	8.0	8.2	"	7.8	7.5	"	7.7	6.5	"	6.2
										8.0	"	7.6						
6	3.5	"	2.2	5.5	"	4.6	7.8	—0.5	7.3	7.8	"	7.4	7.9	"	8.1	8.5	"	8.2
													7.9	"	8.1	9.9	"	9.6
7	2.3	"	1.0	4.5	"	3.6	6.5	"	6.0	7.3	—0.3	7.0	8.0	+0.1	8.1	9.5	"	9.2
				4.0	"	3.1							8.0	"	8.1	10.0	"	9.7
8	2.0	"	0.7	3.6	—0.8	2.8	5.4	"	4.9	6.3	"	6.0	8.0	"	8.1	10.2	—0.4	9.8
	2.0	"	0.7	3.1	"	2.3							7.4	"	7.5	10.2	"	9.8
9	2.4	"	1.1	3.1	"	2.3	4.0	"	3.5	5.5	"	5.2	6.9	"	7.0	10.2	"	9.8
	2.6	"	1.3	3.2	"	2.4	4.0	"	3.5							10.1	"	9.7
10	2.7	—1.2	1.5	4.3	"	3.5	3.7	"	3.2	5.3	"	5.0	6.0	"	6.1	9.8	"	9.4
							3.9	"	3.4									
11	6.7	"	5.5	5.7	—0.7	5.0	4.4	"	3.9	5.5	"	5.2	4.8	"	4.9	9.0	"	8.6
							5.5	"	5.0	5.3	—0.2	5.1						
Noon	11.1	"	9.9	8.3	"	7.6	6.8	"	6.3	5.1	"	4.9	4.6	0.0	4.6	7.5	—0.5	7.0
										5.3	"	5.1						
1	13.1	"	11.9	---			8.1	"	7.6	5.6	"	5.4	4.4	"	4.4	6.5	"	6.0
	13.6	"	12.4										4.5	"	4.5	6.3	"	5.8
2	14.2	"	13.0	---			9.5	"	9.0	7.1	"	6.9	4.5	"	4.5	6.0	"	5.5
	14.2	"	13.0										5.1	"	5.1	6.0	"	5.5
3	14.1	—1.1	13.0	---			10.6	"	10.1	8.3	"	8.1	5.5	"	5.5	6.5	—0.6	5.9
	13.0	"	11.9				10.9	"	10.4									
4	12.3	"	11.2	---			11.2	"	10.7	9.5	"	9.3	7.1	"	7.1	7.0	"	6.4
				11.5	—0.6	10.9	11.2	"	10.7									
5	10.8	"	9.7	11.0	"	10.4	11.1	"	10.6	10.1	—0.1	10.0	9.2	—0.1	9.1	7.9	"	7.3
				10.7	"	10.1	10.2	"	9.7	10.5	"	10.4	9.6		9.5			
6	8.2	"	7.1	9.1	"	8.5	10.2	"	9.7	10.5	"	10.4	10.1	"	10.0	9.5	"	8.9
										10.5	"	10.4	9.5		9.4			
7	5.1	"	4.0	7.5	"	6.9	8.5	"	8.0	10.5	"	10.4	11.1	"	11.0	10.9	"	10.3
										10.5	"	10.4	11.1		11.0	11.4	"	10.8
8	3.3	"	2.2	5.4	"	4.8	7.5	"	7.0	10.0	0.0	10.0	11.0	"	10.9	11.0	"	10.4
	2.9	"	1.8										9.8		9.7	11.0	"	10.4
9	3.0	"	1.9	4.2	"	3.6	5.6	"	5.1	8.1	"	8.1	8.9	"	8.8	11.0	"	10.4
	3.5	"	2.4	4.0	"	3.4										11.3	"	10.7
10	4.1	—1.0	3.1	3.2	"	2.6	4.4	"	3.9	7.0	+0.1	7.1	7.0	"	6.9	11.3	—0.7	10.6
				3.2	"	2.6	4.3	"	3.8							10.9	"	10.2
11	6.0	"	5.0	4.0	"	3.4	4.1	"	3.6	4.9	"	5.0	4.7	—0.2	4.5	9.5	"	8.8
				4.5	"	3.9	4.1	"	3.6	4.2	"	4.3	4.7		4.5			
Midn't	7.3	"	6.3	4.9	"	4.3	4.0	"	3.5	4.0	+0.2	4.2	4.5	"	4.3	8.5	"	7.8

Nov. 8. From this date the observations are half-hourly; in the above record, however, only those half-hourly readings were inserted, which occur near a high or low water.

SERIES I.—TIDAL OBSERVATIONS FROM OCTOBER 10, 1853, TO DECEMBER 28, 1853.

Hourly observations on the pulley-gauge. Adopted reading of mean level 7.0, expressed in units of the scale. Increasing numbers indicate rise of water.

November, 1853.

Mean solar hour.	11th.	Red. to level.	Ref. obs.	12th.	Red. to level.	Ref. obs.	13th.	Red. to level.	Ref. obs.	14th.	Red. to level.	Ref. obs.	15th.	Red. to level.	Ref. obs.	16th.	Red. to level.	Ref. obs.
	6.1	—0.7	5.4													16.8	—5.5	11.3
1	4.6	"	3.9	6.0	—0.9	5.1	8.8	—1.6	7.2	11.5	—4.1	7.4	13.0	—5.2	7.8	15.1	"	9.6
	4.4	"	3.7															
2	3.6	—0.8	2.8	5.5	"	4.6	6.7	"	5.1	9.1	—4.2	4.9	10.0	"	4.8	14.7	—5.6	9.1
	3.1	"	2.3	4.5	"	3.6												
3	3.5	"	2.7	4.0	—1.0	3.0	4.9	—1.7	3.2	7.5	—4.3	3.2	8.0	"	2.8	13.0	"	7.4
	3.6	"	2.8	4.0	"	3.0	4.6	"	2.9	7.0	"	2.7						
4	4.1	"	3.3	3.8	"	2.8	4.4	—1.8	2.6	6.5	—4.4	2.1	6.6	"	1.4	10.5	"	4.9
				4.1	"	3.1	4.5	"	2.7	6.5	"	2.1	6.0	"	0.8	6.1	—5.7	6.4
5	5.0	"	4.2	4.6	"	3.6	4.5	—1.9	2.6	6.5	"	2.1	5.9	"	0.7	6.1	"	0.4
							5.0		3.1	6.5	"	2.1	5.9	"	0.7	6.3	—5.8	0.5
6	5.6	"	4.8	7.1	"	6.1	5.5	"	3.6	7.0	—4.5	2.5	6.2	"	1.0	6.3	"	0.5
7	8.0	"	7.2	8.6	"	7.6	7.5	—2.0	5.5	9.0	"	4.5	8.0	"	2.8	7.3	—5.9	1.4
	8.3	"	7.5															
8	9.5	"	8.7	10.5	"	9.5	10.2	—2.1	8.1	12.4	—4.6	7.8	10.5	"	5.3	10.0	—6.0	4.0
	10.3	"	9.5	11.5	"	10.5												
9	10.3	"	9.5	12.0	"	11.0	12.7	"	10.6	15.5	"	10.9	12.9	"	7.7	12.7	"	6.7
	10.0	"	9.2	12.2	"	11.2	13.0	—2.2	10.8									
10	10.0	"	9.2	12.2	"	11.2	13.7	"	11.5	17.0	—4.7	12.3	16.0	"	10.8	16.4	—6.1	10.3
				12.0	"	11.0	13.7	—2.3	11.4	17.5	—4.8	12.7	17.3	"	12.1			
11	9.5	"	8.7	11.7	—1.1	10.6	13.5	"	11.2	17.3	—4.9	12.4	18.5	"	13.3	17.9	"	11.8
							12.9	"	10.6	17.1	"	12.2	18.5	"	13.3	18.5	—6.2	12.3
Noon	7.5	"	6.7	9.0	"	7.9	12.1	—2.4	9.7	16.4	—5.0	11.4	18.3	—5.3	13.0	19.9	—6.3	13.6
													18.0	"	12.7	19.9	"	13.6
1	6.0	"	5.2	8.0	"	6.9	11.1	—2.5	8.6	14.1	"	9.1	17.6	"	12.3	18.7	—6.4	12.3
2	5.3	"	4.5	6.3	"	5.2	9.1	—2.6	6.5	12.0	"	7.0	15.5	"	10.2	17.9	"	11.5
	5.3	"	4.5	5.6	"	4.5												
3	5.0	"	4.2	4.9	"	3.8	7.8	—2.7	5.1	9.3	—5.1	4.2	12.0	"	6.7	15.0	"	8.6
	5.0	"	4.2	5.0	"	3.9												
4	5.5	"	4.7	5.0	"	3.9	6.3	—2.8	3.5	8.5	"	3.4	10.3	"	5.0	12.6	—6.5	6.1
				5.0	"	3.9				9.0	"	3.9	9.5	"	4.2			
5	6.6	"	5.8	5.5	—1.2	4.3	6.3	—2.9	3.4	8.0	"	2.9	8.9	"	3.6	10.6	"	4.1
							5.5	"	2.6	8.0	"	2.9	8.9	"	3.6	10.3	—6.7	3.6
6	8.0	"	7.2	6.4	"	5.2	5.5	—3.0	2.5	8.5	—5.2	3.3	8.9	—5.4	3.5	10.0	"	3.3
							6.8	—3.1	3.7				8.9	"	3.5	10.0	—6.8	3.2
7	10.0	"	9.2	7.7	"	6.5	8.7	—3.2	5.5	9.6	"	4.4	9.2	"	3.8	10.0	—6.9	3.1
																11.0	"	4.1
8	11.4	—0.9	10.5	10.4	—1.3	9.1	11.0	—3.3	7.7	11.4	"	6.2	10.7	"	5.3	11.5	—7.0	4.5
	11.8	"	10.9															
9	12.7	"	11.8	11.8	"	10.5	13.7	—3.4	10.3	13.1	"	7.9	13.7	"	8.3	14.0	"	7.0
	12.7	"	11.8	12.8	"	11.5												
10	12.1	"	11.2	12.7	—1.4	11.3	14.4	—3.6	10.8	14.7	"	9.5	16.6	"	11.2	16.0	"	9.0
				12.5	"	11.1	14.5	—3.7	10.8	15.0	"	9.8						
11	11.4	"	10.5	11.9	"	10.5	14.8	—3.8	11.0	14.6	"	9.4	17.8	"	12.4	17.5	—7.1	10.4
							14.4	—3.9	10.5	14.5	"	9.3	18.5	—5.5	13.0	18.0	"	10.9
Midn't	9.2	"	8.3	10.6	—1.5	9.1	13.6	—4.0	9.6	14.1	"	8.9	18.5	"	13.0	17.9	"	10.8

SERIES I.—TIDAL OBSERVATIONS FROM OCTOBER 10, 1853, TO DECEMBER 28, 1853.

Hourly observations on the pulley-gauge. Adopted reading of mean level 7.0, expressed in units of the scale. Increasing numbers indicate rise of water.

November, 1853.

Mean solar hour.	17th.	Red. to level.	Ref. obs.	18th.	Red. to level.	Ref. obs.	19th.	Red. to level.	Ref. obs.	20th.	Red. to level.	Ref. obs.	21st.	Red. to level.	Ref. obs.	22d.	Red. to level.	Ref. obs.
	17.8	—7.2	10.6	1.4	+12.3	13.7	16.5	—6.7	9.8	16.5	—8.2	8.3						
1	17.0	"	9.8	1.0	"	13.3	16.5	"	9.8	17.0	"	8.8	17.3	—9.6	7.7	3.5	+3.2	6.7
				20.3	—7.6	12.7	16.5	"	9.8	17.4	—8.3	9.1	17.5	"	7.9	3.9	"	7.1
2	16.0	—7.3	8.7	20.0	—7.5	12.5	16.0	"	9.3	16.8	"	8.5	17.6	"	8.0	4.3	+3.1	7.4
													17.6	"	8.0	4.4	+3.0	7.4
3	14.9	—7.4	7.5	18.0	"	10.5	15.1	—6.8	8.3	16.0	"	7.7	17.6	—9.7	7.9	4.5	+2.9	7.4
													17.0	"	7.3	4.5	"	7.4
4	12.0	—7.5	4.5	16.5	"	9.0	13.8	"	7.0	14.5	—8.4	6.1	16.5	"	6.8	4.0	+2.8	6.8
5	10.4	"	2.9	14.3	—7.4	6.9	11.4	—6.9	4.5	12.7	"	4.3	13.6	"	3.9	3.2	+2.6	5.8
6	9.8	—7.6	2.2	13.5	"	6.1	10.2	"	3.3	12.0	—8.5	3.5	13.4	—9.8	3.6	3.5	+2.5	6.0
	9.0	"	1.4	---	"		9.5	—7.0	2.5				13.2	"	3.4			
7	9.0	—7.7	1.3	7.2	—7.3	-0.1	9.0	—7.1	1.9	11.6	"	3.1	13.0	"	3.2	3.3	+2.4	5.7
	10.0	"	2.3	7.5	"	0.2	10.0	—7.2	2.8	11.2	"	2.7	13.0	"	3.2	3.0	"	5.4
8	11.0	"	3.3	7.8	"	0.5	10.2	—7.3	2.9	11.2	—8.6	2.6	13.0	"	3.2	3.0	+2.3	5.3
				9.6	"	2.3				11.5	"	2.9	13.0	"	3.2	2.8	"	5.1
9	13.5	"	5.8	11.9	—7.2	4.7	12.0	"	4.7	12.4	—8.7	3.7	13.1	"	3.3	2.9	"	5.2
																3.0	+2.2	5.2
10	16.1	—7.8	8.3	14.5	"	7.3	14.9	—7.4	7.5	14.5	—8.8	5.7	16.7	"	6.9	3.5	"	5.7
11	19.3	"	11.5	17.0	—7.1	9.9	17.3	"	9.9	17.5	—8.9	8.6	19.1	"	9.3	4.3	"	6.5
	20.0	"	12.2															
Noon	20.8	"	13.0	18.5	—7.0	11.5	19.2	—7.5	11.7	19.5	—9.0	10.5	19.5	—9.9	9.6	5.6	+2.1	7.7
	20.8	"	13.0	19.0	"	12.0	19.5	"	12.0	20.0	"	11.0						
1	20.6	"	12.8	19.0	—6.9	12.1	20.0	"	12.5	20.5	—9.1	11.4	20.0	"	10.1	7.2	+2.0	9.2
	20.5	"	12.7	18.9	"	12.0	20.5	"	13.0	20.5	"	11.4						
2	19.0	—7.9	11.1	18.5	—6.8	11.7	20.0	—7.6	12.4	20.6	"	11.5	1.0	+9.6	10.6	8.0	+1.8	9.8
							19.6	"	12.0	20.5	—9.2	11.3	3.5	+7.2	10.7			
3	17.0	"	9.1	16.3	"	9.5	19.0	"	11.4	20.2	"	11.0	5.2	+4.9	10.1	8.4	+1.6	10.0
													5.2	"	10.1	8.5	"	10.1
4	16.0	"	8.1	14.4	"	7.6	17.4	—7.7	9.7	18.9	—9.3	9.6	5.0	+4.8	9.8	8.5	+1.4	9.9
													4.3	"	9.1	8.5	"	9.9
5	12.0	"	4.1	11.0	"	4.2	15.4	"	7.7	17.0	"	7.7	3.9	+4.6	8.5	8.5	+1.3	9.8
	11.4	"	3.5													8.0	"	9.3
6	11.0	"	3.1	10.0	"	3.2	13.0	—7.8	5.2	15.2	—9.4	5.8	3.2	+4.4	7.6	4.8	+1.2	6.0
	11.0	"	3.1															
7	11.0	"	3.1	9.0	"	2.2	12.0	—7.9	4.1	13.5	"	4.1	1.6	+4.2	5.8	5.6	+1.1	6.7
	11.4	"	3.5	8.7	"	1.9	11.0	"	3.1				1.0	"				
8	12.0	"	4.1	8.0	"	1.2	10.3	—8.0	2.3	13.2	—9.5	3.7	0.3	+4.0	4.3	4.6	+1.0	5.6
				10.3	"	3.5	11.0	"	3.0	13.1	"	3.6	0.4	"	4.4			
9	14.5	"	6.6	11.1	—6.7	4.4	12.5	—8.1	4.4	13.1	"	3.6	0.6	+3.8	4.4	3.1	+0.9	4.0
										13.5	"	4.0	0.5	"	4.3	3.1	"	4.0
10	17.5	"	9.6	14.0	"	7.3	14.5	"	6.4	13.7	—9.6	4.1	0.8	+3.6	4.4	3.1	+0.8	3.9
													0.5	"	4.1	3.1	+0.7	3.8
11	19.7	—7.8	11.9	16.2	"	9.5	15.9	"	7.8	14.7	"	5.1	0.2	+3.4	3.6	3.1	+0.6	3.7
	20.3	"	12.5										1.2		4.6	3.5	+0.5	4.0
Midn't	1.4	+12.2	13.6	16.5	"	9.8	16.1	—8.2	7.9	16.2	"	6.6	1.7	+3.3	5.0	4.1	+0.4	4.5

Nov. 17. The scale reads up to 20, hence the reading 1.4 at midnight is equivalent to 21.4.

Nov. 21. At 1 P. M. the upper limit of the scale was reached, the index was changed afterwards.

SERIES I.—TIDAL OBSERVATIONS FROM OCTOBER 10, 1853, TO DECEMBER 28, 1853.

Hourly observations on the pulley-gauge. Adopted reading of mean level 7.0, expressed in units of the scale. Increasing numbers indicate rise of water.

November, 1853.

Mean solar hour.	23d.	Red. to level.	Ref. obs.	24th.	Red. to level.	Ref. obs.	25th.	Red. to level.	Ref. obs.	26th.	Red. to level.	Ref. obs	27th.	Red. to level.	Ref. obs.	28th.	Red. to level.	Ref. obs.
				6.7	—3.0	3.7	10.0	—6.3	3.7	14.8	—10.3	4.5						
1	4.7	+0.4	5.1	7.4	—3.2	4.2	10.2	"	3.9	14.5	—10.	4.2	14.7	—10.4	4.3	17.5	—12.0	5.5
				7.8	—3.3	4.5	10.4	—6.4	4.0	14.6	"	4.3						
2	5.6	+0.2	5.8	8.1	—3.4	4.7	10.7	—6.5	4.2	14.7	—10.4	4.3	13.7	"	3.3	15.3	—12.1	3.2
													13.3	"	2.9	14.9	"	2.8
3	6.2	0.0	6.2	9.1	—3.5	5.6	11.2	—6.6	4.6	15.2	—10.5	4.7	13.1	—10.3	2.8	14.7	—12.2	2.5
													13.0	"	2.7	14.5	"	2.3
4	7.0	—0.2	6.8	10.0	—3.6	6.4	12.5	—6.7	5.8	15.5	—10.6	4.9	13.2	—10.4	2.8	14.5	—12.3	2.2
																14.8	"	2.5
5	7.0	—0.3	6.7	10.5	—3.7	6.8	13.6	—6.9	6.7	16.5	"	5.9	16.0	"	5.6	15.6	—12.4	3.2
6	7.5	—0.5	7.0	11.1	—3.8	7.3	15.0	—7.0	8.0	18.0	—10.7	7.3	17.3	"	6.9	18.2	—12.5	5.7
	7.5	—0.6	6.9				15.6	"	8.6									
7	7.6	—0.7	6.9	11.6	—3.9	7.7	15.7	—7.1	8.6	19.4	"	8.7	19.8	—10.5	9.3	20.3	—12.6	7.7
	7.8	—0.8	7.0	11.9	"	8.0	16.0	—7.2	8.8									
8	7.9	—0.9	7.0	12.5	—4.0	8.5	15.6	—7.3	8.3	20.0	—10.8	9.2	20.9	—10.6	10.3	22.6	—12.7	9.9
	7.8	—0.9	6.9	11.6	—4.1	7.5				20.2	"	9.4	21.2	"	10.6	23.8	"	11.1
9	7.7	—1.0	6.7	11.0	—4.2	6.8	15.2	—7.4	7.8	20.0	"	9.2	21.5	—10.7	10.8	24.5	—12.8	11.7
	7.7	"	6.7							19.5	"	8.7	21.6	"	10.9	24.7	"	11.9
10	7.7	—1.1	6.6	9.5	—4.4	5.1	15.7	—7.6	8.1	19.0	—10.7	8.3	21.3	—10.8	10.5	24.8	"	12.0
	7.7	"	6.6										20.9	"	10.1	24.3	"	11.5
11	8.0	—1.2	6.8	9.0	—4.5	4.5	16.0	—7.8	8.2	17.8	"	7.1	20.9	—10.9	10.0	23.8	—12.9	10.9
				8.8	"	4.3												
Noon	8.6	—1.3	7.3	8.0	—4.6	3.4	15.5	—8.0	7.5	16.3	"	5.6	19.2	"	8.3	22.7	"	9.8
				8.9	"	4.3	15.5	—8.1	7.4									
1	9.6	—1.5	8.1	9.9	—4.7	5.2	15.4	—8.2	7.2	15.7	"	5.0	18.2	—11.0	7.2	21.4	—13.0	8.4
							15.2	—8.3	6.9	15.4		4.7						
2	10.4	—1.6	8.8	10.3	—4.8	5.5	15.8	—8.4	7.4	15.1	"	4.4	17.1	"	6.1	18.4	"	5.4
										15.0		4.3						
3	11.4	—1.8	9.6	11.4	—4.9	6.5	16.0	—8.6	7.4	15.1	"	4.4	15.2	—11.1	4.1	17.1	"	4.1
										15.4		4.7	14.9	"	3.8	15.8	"	2.8
4	11.8	—2.0	9.8	12.6	—5.0	7.6	16.4	—8.8	7.6	15.5	—10.6	4.9	14.6	—11.2	3.4	15.7	"	2.7
	12.0	—2.1	9.9										16.9	"	5.7	15.6	"	2.6
5	12.0	—2.2	9.8	13.5	—5.1	8.4	18.1	—9.0	9.1	17.0	"	6.4	17.5	—11.3	6.2	15.9	"	2.9
	12.0	—2.3	9.7	13.9	—5.2	8.7	19.1	—9.1	10.0							16.4	"	3.4
6	12.2	"	9.9	14.6	—5.3	9.3	19.6	—9.3	10.3	19.1	"	8.5	19.3	—11.4	7.9	17.7	"	4.7
	11.8	—2.4	9.4	14.9	—5.4	9.5	19.7	—9.4	10.3									
7	11.4	"	9.0	14.4	—5.5	8.9	19.8	—9.5	10.3	20.0	"	9.4	20.9	—11.5	9.4	20.0	"	7.0
				14.4	—5.6	8.8	20.0	—9.7	10.3	20.5		9.9	22.0	"	10.5			
8	10.0	—2.5	7.5	13.7	—5.7	8.0	19.4	—9.8	9.6	20.4	—10.5	9.9	22.1	—11.6	10.5	22.0	"	9.0
										20.4		9.9	22.8	"	11.2			
9	9.0	—2.6	6.4	12.8	—5.9	6.9	18.5	—9.9	8.6	20.4	"	9.9	22.9	—11.7	11.2	23.7	"	10.7
										20.1		9.6	22.9	"	11.2	23.9	"	10.9
10	8.2	—2.7	5.5	12.5	—6.0	6.5	18.0	—10.0	8.0	19.8	"	9.3	22.6	—11.8	10.8	23.9	"	10.9
													22.1	"	10.3	24.0	"	11.0
11	7.7	—2.8	4.9	11.5	—6.1	5.4	16.0	—10.1	5.9	17.7	"	7.2	21.6	—11.9	9.7	23.5	"	12.5
	7.4	—2.9	4.5													21.1	"	8.1
Midn't	7.2	—3.0	4.2	10.9	—6.2	4.7	15.0	—10.3	4.7	16.2	—10.4	5.8	19.7	—12.0	7.7	20.8	"	7.8

Nov. 26. From 11 A. M. of this day two readings are given for each half hour; the mean of the two observations has been inserted above. The two corresponding readings agree generally within a few tenths, the difference being due to the effect of the small waves.

Nov. 28. Orders were given to observe and record careful soundings by lead line at the tide hole every day at twelve o'clock.

SERIES I.—TIDAL OBSERVATIONS FROM OCTOBER 10, 1853, TO DECEMBER 28, 1853.

Hourly observations on the pulley-gauge. Adopted reading of mean level 7.0, expressed in units of the scale. Increasing numbers indicate rise of water.

	November, 1853.						December, 1853.											
Mean solar hour.	29th.	Red. to level.	Ref. obs.	30th.	Red. to level.	Ref. obs.	1st.	Red. to level.	Ref. obs.	2d.	Red. to level.	Ref. obs.	3d.	Red. to level.	Ref. obs.	4th.	Red. to level.	Ref. obs.
							---		---	18.0	—8.7	9.3	---		---	18.0	—10.8	7.2
1	18.7	—13.0	5.7	13.1	—5.8	7.3	15.0	—6.6	8.4	17.6	"	8.9	19.3	—9.9	9.4	18.6	"	7.8
													18.8	"	8.9	19.2	—10.9	8.3
2	15.8	—12.9	2.9	9.3	"	3.5	12.4	"	5.8	15.5	—8.8	6.7	17.8	"	7.9	19.2	"	8.3
																19.1	"	8.2
3	14.7	"	1.8	7.2	"	1.4	9.2	—6.7	2.5	12.1	—8.9	3.2	16.0	"	6.1	18.7	—11.0	7.7
	14.1	"	1.2	7.0	"	1.2												
4	13.8	—12.8	1.0	6.2	"	0.4	8.2	—6.8	1.4	10.1	—9.0	1.1	14.1	"	4.2	17.1	"	6.1
	13.5	"	0.7	5.9	"	0.1												
5	13.6	"	0.8	6.8	"	1.0	6.0	"	—0.8	8.0	—9.1	—1.1	11.6	"	1.7	14.0	—11.1	2.9
	14.2	—12.7	1.5	8.2	"	2.4	5.6	"	—1.2	7.3	"	—1.8				12.5	"	1.4
6	14.7	"	2.0	9.6	"	3.8	6.5	—6.9	—0.4	7.1	—9.2	—2.1	10.1	"	0.2	11.4	—11.2	0.2
							6.7	"	—0.2	9.0	—9.3	—0.3	9.7	"	—0.2	11.3	"	0.1
7	16.8	—12.6	4.2	11.7	"	5.9	7.5	—7.0	0.5	9.8	—9.4	0.4	9.5	"	—0.4	11.5	"	0.3
													10.0	"	0.1	12.0	—11.3	0.7
8	19.7	—12.5	7.2	13.8	"	8.0	11.0	"	4.0	10.5	—9.5	1.0	11.2	"	1.3	12.0	"	0.7
9	23.5	—12.4	11.1	17.7	"	11.9	13.8	—7.1	6.7	14.6	—9.6	5.0	14.2	"	4.3	13.8	"	2.5
10	25.2	—12.3	12.9	19.2	"	13.4	18.1	—7.2	10.9	17.8	—9.7	8.1	16.0	"	6.1	17.3	—11.4	5.9
	25.5	—12.2	13.3	19.5	"	13.7												
11	25.5	—12.1	13.4	19.5	"	13.7	19.3	—7.3	12.0	20.2	—9.8	10.4	18.3	"	8.4	19.8	"	8.4
	25.8	—12.0	13.8	19.2	"	13.4	19.8	"	12.5	22.4	—9.9	12.5						
Noon	18.2	—5.8	12.4	18.3	"	12.5	20.2	—7.4	12.8	22.9	—10.0	12.9	21.6	—9.8	11.8	21.7	—11.5	10.2
	17.1	"	11.3				20.0	"	12.6	23.3	"	13.3						
1	15.2	"	9.4	16.3	"	10.5	19.8	—7.5	12.3	23.6	"	13.6	22.5	"	12.7	23.8	"	12.3
										23.1	"	13.1	22.6	"	12.8	24.7	"	13.2
2	11.7	"	5.9	13.0	—5.9	7.1	16.9	—7.6	9.3	22.0	"	12.0	22.7	—9.9	12.8	25.2	"	13.7
													21.5	"	11.6	24.3	"	12.8
3	8.7	"	2.9	9.0	"	3.1	13.7	—7.7	6.0	19.8	"	9.8	20.5	10.0	10.5	23.9	"	12.4
	8.2	"	2.4															
4	7.0	—5.8	1.2	8.1	—6.0	2.1	10.1	—7.8	2.3	16.2	"	6.2	18.0	10.1	7.9	21.8	"	10.3
	7.2	"	1.4	8.0	"	2.0												
5	7.1	"	1.3	7.7	"	1.7	8.5	—7.9	0.6	12.9	"	2.9	15.7	"	5.6	19.8	"	8.3
	7.4	"	1.6	7.7	"	1.7	8.1	"	0.2									
6	7.8	"	2.0	8.0	—6.1	1.9	7.7	—8.0	—0.3	10.9	"	0.9	14.5	10.2	4.3	16.7	"	5.2
	9.2	"	3.4	9.2	"	3.1	7.7	"	—0.3	10.3	"	0.3						
7	10.0	"	4.2	10.2	"	4.1	8.2	—8.1	0.1	10.0	"	0.0	11.9	10.3	1.6	14.5	"	3.0
										10.6	"	0.6	11.2	"	0.9			
8	13.3	"	7.5	11.9	—6.2	5.7	11.1	—8.2	2.9	10.6	"	0.6	10.4	10.4	0.0	13.6	"	2.1
													10.3	"	—0.1	13.3	"	1.8
9	14.8	"	9.0	14.4	"	8.2	12.6	—8.3	4.3	12.0	"	2.0	11.3	10.5	0.8	13.1	"	1.6
																13.3	"	1.8
10	15.9	"	10.1	16.2	—6.3	9.9	15.3	—8.4	6.9	14.9	"	4.9	13.7	10.6	3.1	14.0	"	2.5
	16.5	"	10.7															
11	16.5	"	10.7	16.6	—6.4	10.2	17.3	—8.5	8.8	17.0	"	7.0	15.6	10.7	4.9	16.0	"	4.5
	16.3	"	10.5	17.0	"	10.6	17.9	"	9.4	18.2	"	8.2						
Midn't	16.1	"	10.3	17.3	—6.5	10.8	18.1	—8.6	9.5	18.9	"	8.9	18.2	10.8	7.4	17.8	—11.5	6.3

Nov. 29. Tide register corrected at noon. Sounding at noon 7 fath., 0 feet, 4 inches, register 18.2. It may be remarked that soundings are subject to uncertainty in case of any drift of the ice field in which the vessel was imbedded, and also in case the bottom be soft. Some allowance must be made for stretch of the line.

			Fath.	Feet.	Inch.	Reg.	
Nov. 30.	Sounding at noon		7	2	3	18.2	(This sounding was not used, apparently not reliable.)
Dec. 1.	"	"	8	0	0	20.2	A mean correction was used for these days, as deduced from enveloping curves and the soundings.
" 2.	"	"	7	5	6	22.7	
" 3.	"	"	8	0	0	22.0	
" 4.	"	"	7	4	0	22.0	

SERIES I.—TIDAL OBSERVATIONS FROM OCTOBER 10, 1853, TO DECEMBER 28, 1853.

Hourly observations on the pulley-gauge. Adopted reading of mean level 7.0, expressed in units of the scale. Increasing numbers indicate rise of water.

December, 1853.

Mean solar hour.	5th.	Red. to level.	Ref. obs.	6th.	Red. to level.	Ref. obs.	7th.	Red. to level.	Ref. obs.	8th.	Red. to level.	Ref. obs.	9th.	Red. to level.	Ref. obs.	10th.	Red. to level.	Ref. obs.
										2.3	+1.4	3.7	1.8	—0.1	1.7			
1	19.7	—11.6	8.1	20.1	—15.3	4.8	4.7	—2.7	2.0	2.5	+1.0	3.5	1.2	"	1.1	7.5	—1.8	5.7
	20.2	"	8.6							3.1	+0.8	3.9	1.4	—0.2	1.2	7.3	"	5.5
2	20.5	—11.7	8.8	21.6	—15.8	5.8	5.2	—3.1	2.1	3.7	+0.7	4.4	1.6	"	1.4	7.1	—1.9	5.2
	20.8	"	9.1	22.1	—16.1	6.0										7.2	"	5.3
3	20.4	—11.8	8.6	22.5	—16.4	6.1	7.9	—3.5	4.4	4.7	+0.5	5.2	2.7	—0.3	2.4	7.5	—2.0	5.5
	19.9	"	8.1	22.4	—16.6	5.8												
4	19.2	—11.9	7.3	22.5	—16.9	5.6	9.0	—3.9	5.1	5.6	—0.3	5.9	3.6	"	3.3	8.2	"	6.2
				22.5	—17.1	5.4												
5	17.9	—12.0	5.9	22.1	—17.3	4.8	10.0	—4.4	5.6	7.0	0.0	7.0	7.0	—0.4	6.6	9.5	—2.1	7.4
										8.0	—0.7	7.3						
6	17.1	—12.1	5.0	21.2	—17.6	3.6	11.0	—5.0	6.0	9.1	—1.5	7.6	9.1	"	8.7	11.2	—2.2	9.0
							12.1	—5.2	6.9	9.8	—2.2	7.6						
7	14.7	—12.2	2.5	21.3	—17.9	3.4	11.9	—5.4	6.5	9.9	—3.0	6.9	10.3	—0.5	9.8	12.3	"	10.1
	14.3	"	2.1	20.5	—18.1	2.4	12.5	—5.7	6.8									
8	13.6	—12.3	1.3	20.6	—18.3	2.3	12.4	—5.9	6.5	11.3	—4.5	6.8	11.3	"	10.8	13.0	—2.3	10.7
	13.6	"	1.3	20.7	—18.4	2.3	12.5	—6.1	6.4				11.8	—0.6	11.2	13.1	"	10.8
9	13.7	—12.4	1.3	21.1	—18.6	2.5	12.3	—6.3	6.0	11.4	—6.0	5.4	11.6	"	11.0	13.3	—2.4	10.9
	14.4	"	2.0				11.7	—6.5	5.2				11.2	—0.7	10.5	13.5	"	11.1
10	15.2	—12.5	2.7	21.6	—18.9	2.7	12.2	—6.8	5.4	12.4	—7.5	4.9	10.7	"	10.0	13.3	—2.5	10.8
11	17.8	—12.6	5.2	22.7	—19.3	3.4	11.2	—7.3	3.9	13.2	—9.0	4.2	9.7	—0.8	8.9	11.8	"	9.3
Noon	19.0	—12.7	6.3	24.7	—19.6	4.1	11.1	—7.7	3.4	13.6	—10.5	3.1	8.0	—0.9	7.1	9.8	—2.6	7.2
										14.1	—11.2	2.9						
1	20.9	—12.9	8.0	26.7	—19.9	6.8	17.1	—13.1	4.0	15.0	—12.0	3.0	4.5	"	3.6	9.2	—2.7	6.5
													4.7	—1.0	3.7	8.6	—2.8	5.8
2	23.5	—13.1	10.4	28.3	—20.3	8.0	19.7	—13.6	6.1				4.7	"	3.7	8.2	—2.9	5.3
	23.4	—13.2	10.2	29.5	—20.4	9.1										8.3	"	5.4
3	24.1	—13.3	10.8	30.3	—20.6	9.7	21.3	—14.2	7.1				5.2	—1.1	4.1	8.7	—3.0	5.7
	24.3	—13.2	11.1	31.0	—20.8	10.2										9.2	—3.1	6.1
4	24.1	—13.5	10.6	31.3	—21.0	10.3	24.2	—14.7	9.5				7.2	—1.2	6.0	9.7	"	6.6
				31.5	—21.2	10.3												
5	23.2	—13.7	9.5	31.5	—21.3	10.2	4.9	+4.8	9.7				10.2	"	9.0	10.2	—3.2	7.0
				30.5	—21.5	9.0												
6	21.6	—13.9	7.7	28.5	—21.7	6.8	5.3	+4.4	9.7				11.2	—1.3	9.9	11.2	—3.3	7.9
							5.7	+4.2	9.9									
7	18.9	—14.1	4.8	27.5	—22.0	5.5	6.4	+4.0	10.4				12.8	"	11.5	11.9	—3.5	8.4
							6.8	+3.8	10.6				13.0	—1.4	11.6	12.2	"	8.7
8	17.2	—14.2	3.0	24.7	—22.4	2.3	7.0	+3.6	10.6				13.2	"	11.8	12.9	—3.6	9.3
				24.5	—22.5	2.0	6.7	+3.4	10.1				13.1	—1.5	11.6	12.7	—3.7	9.0
9	16.1	—14.4	1.7	24.7	—22.7	2.0	6.0	+3.2	9.2				12.4	"	10.9	13.0	—3.8	9.2
	15.5	—14.5	1.0	24.9	—22.9	2.0										13.0	—3.9	9.1
10	15.8	—14.6	1.2	25.0	—23.1	1.9	4.2	+2.7	6.9				11.1	—1.6	9.5	12.6	—4.0	8.6
	16.6	—14.7	1.9	24.7	—23.3	1.4												
11	17.1	—14.8	2.3	24.7	—23.5	1.2	2.9	+2.2	5.1				9.8	"	8.2	11.2	—4.1	7.1
				24.7	—23.7	1.0												
Midn't	18.9	—15.0	3.9	25.1	—23.9	1.2	2.0	+1.8	3.8				8.2	—1.7	6.5	9.5	—4.2	5.3

Readings omitted. Corrections uncertain. Rope slipping on the wheel.

		Fath.	Feet.	Inch.	Reg.	
Dec. 5.	Sounding at noon	7	1	0	20, changed to 19.	On these days the corrections deduced by enveloping curves or soundings agree very well.
" 6.	" "	6	5	0	25	
" 7.	" "	6	4	0	11.1, changed to 16.	
" 8.	" "	6	3	7	13.6	
" 9.	" "	6	4	0	7.6	(The mean of the two readings is 8.0.)
" 10.	" "	6	4	6	9.7	(" " " " " 9.8.)

From the 9th to the 18th of December the corrections deduced from curves and soundings differ by a constant of nearly 4 feet. The differences are partly due to imperfect soundings, partly to sudden changes of the pulley-gauge (see readings between noon and 1 P. M. on the 9th). The heights given, as corrected by the soundings and curves, are, during this period, of little value, the times being less affected. The soundings were increased by 4 feet, equal to a reading of the mean level of 32.6.

SERIES I.—TIDAL OBSERVATIONS FROM OCTOBER 10, 1853, TO DECEMBER 28, 1853.

Hourly observations on the pulley-gauge. Adopted reading of mean level 7.0, expressed in units of the scale. Increasing numbers indicate rise of water.

December, 1853.

Mean solar hour.	11th.	Red. to level.	Ref. obs.	12th.	Red. to level.	Ref. obs.	13th.	Red. to level.	Ref. obs.	14th.	Red. to level.	Ref. obs.	15th.	Red. to level.	Ref. obs.	16th.	Red. to level.	Ref. obs.
							21.4	—14.0	7.4							23.0	—10.6	12.4
1	8.2	—4.3	3.9	12.2	—8.8	3.4	20.7	—14.1	6.6	13.9	—7.6	6.3	15.4	—8.5	6.9	22.7	—10.8	11.9
2	7.4	—4.4	3.0	11.1	—9.1	2.0	20.3	—14.3	6.0	12.9	"	5.3	13.7	"	5.2	20.4	—11.1	9.3
3	6.8	—4.5	2.3	10.2	—9.3	0.9	19.8	—14.5	5.3	11.2	—7.7	3.5	12.2	—8.6	3.6	18.5	—11.4	7.1
	6.3	—4.6	1.7	10.0	—9.5	0.5	18.9	—14.6	4.3	10.2	"	2.5						
4	6.5	—4.7	1.8	10.0	—9.7	0.3	18.2	—14.7	3.5	10.0	"	2.3	11.5	"	2.9	16.0	—11.7	4.3
	7.5	—4.8	2.7	10.2	—9.8	0.4	18.7	—14.8	3.9	10.0	"	2.3	11.3	"	2.7	15.3	—11.8	3.5
5	8.7	—4.9	3.8	10.4	—10.0	0.4	19.4	—14.9	4.5	10.0	"	2.3	11.1	—8.7	2.4	15.4	—12.0	3.4
										10.2	"	2.5	11.4	"	2.7	15.9	—12.2	3.7
6	11.8	—5.0	6.8	12.9	—10.2	2.7	20.8	—15.1	5.7	10.6	—7.8	2.8	11.7	"	3.0	16.1	—12.3	3.8
													12.2	—8.8	3.4			
7	12.4	—5.1	7.3	15.5	—10.4	5.1	22.5	—15.3	7.2	12.1	"	4.3	12.9	"	4.1	17.2	—12.6	4.6
8	13.7	—5.2	8.5	18.0	—10.7	7.3	24.7	—15.5	9.2	15.1	—7.9	7.2	15.2	"	6.4	19.1	—12.9	6.2
	14.2	—5.3	8.9															
9	14.7	—5.4	9.3	19.7	—10.9	8.8	25.7	—15.7	10.0	17.2	"	9.3	17.8	—8.9	8.9	21.2	—13.4	7.8
	15.0	—5.5	9.5															
10	15.0	"	9.5	20.4	—11.1	9.3	26.7	—15.9	10.8	19.4	—8.0	11.4	19.6	"	10.7	24.0	—13.7	10.3
	14.7	—5.6	9.1	20.8	—11.2	9.6	27.0	—16.0	11.0	20.2	"	12.2						
11	14.3	"	8.7	21.2	—11.3	9.9	27.0	—16.1	10.9	20.5	"	12.5	20.5	"	11.6	26.0	—14.1	11.9
				20.2	—11.4	8.8	27.1	—16.2	10.9	20.2	"	12.2						
Noon	13.4	—5.7	7.7	20.2	—11.5	8.7	26.8	—16.3	10.5	19.6	—8.1	11.5	21.0	—9.0	12.0	27.3	—14.5	12.8
							12.0	?	---				22.0	"	13.0	27.5	—14.7	12.8
1	11.2	—5.9	5.3	20.2	—11.7	8.5	11.9		---	18.2	"	10.1	22.3	—9.1	13.2	27.3	—14.8	12.5
													21.2	"	12.1	26.8	—15.0	11.8
2	9.4	—6.1	3.3	18.5	—11.9	6.6	10.9	?	---	16.2	"	8.1	20.1	—9.2	10.9	26.0	—15.1	10.9
	8.7	—6.2	2.5															
3	8.3	—6.4	1.9	16.8	—12.1	4.7	10.8	—7.1	3.7	13.8	—8.2	5.6	17.6	—9.3	8.3	23.1	—15.3	7.8
	8.3	—6.5	1.8															
4	8.7	—6.7	2.0	15.9	—12.3	3.6	10.2	—7.2	3.0	11.5	"	3.3	16.2	—9.4	6.8	21.0	—15.5	5.5
				15.2	—12.4	2.8	10.0	"	2.8	11.1	"	2.9						
5	9.7	—6.9	2.8	15.6	—12.5	3.1	10.3	"	3.1	10.8	"	2.6	15.6	—9.5	6.1	18.3	—15.6	2.7
							10.3	"	3.1	10.8	"	2.6	15.4	"	5.9			
6	11.2	—7.1	4.1	17.7	—12.7	5.0	10.7	—7.3	3.4	10.7	—8.3	2.4	15.1	—9.6	5.5	17.6	—15.8	1.8
										10.9	"	2.6	15.2		5.6	17.5	"	1.7
7	12.3	—7.3	5.0	19.7	—12.9	6.8	12.2	"	4.9	11.2	"	2.9	15.7	—9.7	6.0	17.5	—15.9	1.6
																17.5	"	1.6
8	13.7	—7.6	6.1	21.0	—13.1	7.9	13.0	"	5.7	13.7	"	5.4	16.8	—9.8	7.0	17.7	—16.0	1.7
9	15.2	—7.8	7.4	21.9	—13.3	8.6	15.1	—7.4	7.7	15.6	"	7.3	18.8	—9.9	8.9	19.7	—16.1	3.6
	15.7	—7.9	7.8				15.7	"	8.3									
10	15.8	—8.1	7.7	22.8	—13.5	9.3	16.0	"	8.6	16.9	—8.4	8.5	21.2	—10.1	11.1	21.5	—16.2	5.3
	15.8	—8.3	7.5	23.2	—13.6	9.6	16.0	"	8.6	17.2	"	8.8						
11	15.3	—8.4	6.9	23.3	—13.7	9.6	16.0	—7.5	8.5	17.3	"	8.9	22.4	—10.3	12.1	23.1	—16.3	5.8
				23.4	—13.8	9.6	15.7	"	8.2	17.2	"	8.8	22.9	—10.4	12.5			
Midn't	13.7	—8.6	5.1	23.4	—13.9	9.5	15.2	"	7.7	17.1	"	8.7	23.0	—10.5	12.5	23.8	—16.4	7.4

		Fath.	Feet.	Inch.	Reg.	
Dec. 11.	Sounding at noon	6	2	9	13.3	
" 12.	" "	6	4	0	19.9	
" 13.	" "	7	1	3	13.3	(Changed from 26.8)
" 14.	" "	7	2	2	19.4	
" 15.	" "	7	4	0	21.2	
" 16.	" "	7	3	6	27.6	

SERIES I.—TIDAL OBSERVATIONS FROM OCTOBER 10, 1853, TO DECEMBER 28, 1853.

Hourly observations on the pulley-gauge. Adopted reading of mean level 7.0, expressed in units of the scale. Increasing numbers indicate rise of water.

December, 1853.

Mean solar hour.	17th. *	Red. to level.	Ref. obs.	18th. *	Red. to level.	Ref. obs.	19th. *	Red. to level.	Ref. obs.	20th.	Red. to level	Ref. obs.	21st.	Red. to level.	Ref. obs.	22d.	Red. to level.	Ref. obs.
	24.0	—16.5	7.5	23.4	—17.6	5.8	4.1	+3.0	7.1									
1	23.7	—16.6	7.1	23.4	"	5.8	4.2	+2.9	7.1	14.5	—3.9	10.6	20.4	—10.7	9.7	20.6	—13.7	6.9
				23.4	"	5.8	5.0	+2.7	7.7									
2	23.8	—16.7	7.1	23.2	"	5.6	5.7	+2.5	8.2	15.1	—4.2	10.9	21.4	—11.0	10.4	21.6	"	7.9
				22.6	"	5.0	5.7	+2.3	8.0	15.3	—4.4	10.9	22.4	—11.1	11.3			
3	22.9	"	6.2	21.7	"	4.1	5.0	+2.2	7.2	15.2	—4.5	10.7	22.9	—11.3	11.6	22.2	"	8.5
										14.2	—4.7	9.5	22.3	—11.4	10.9	22.4	"	8.7
4	21.5	—16.8	4.7	20.2	"	2.6	3.7	+2.0	5.7	13.5	—4.8	8.7	21.3	—11.6	9.7	22.5	—13.8	8.7
																22.9	"	9.1
5	20.5	"	3.7	21.3	"	3.7	2.1	+1.8	3.9	12.2	—5.2	7.0	21.0	—11.9	9.1	22.3	"	8.5
	19.9	"	3.1															
6	19.6	—16.9	2.7	20.0	"	2.4	1.4	+1.6	3.0	10.5	—5.5	5.0	19.3	—12.2	7.1	21.7	"	7.9
	19.7		2.8	19.3	"	1.7	1.1	+1.4	2.5									
7	20.2	"	3.3	18.5	"	0.9	1.1	+1.3	2.4	10.1	—5.8	4.3	18.3	—12.4	6.9	20.9	"	7.1
				20.2	"	2.6	0.9	+1.1	2.0									
8	21.7	—17.0	4.7	20.4	—17.6	2.8	1.6	+1.0	2.6	9.6	—6.1	3.5	17.8	—12.6	5.2	19.3	—13.9	5.4
										7.7	—6.3	1.4	17.2	—12.7	4.5	19.4		5.5
9	25.0	"	8.0	4.3	?	---	2.9	+0.8	3.7	8.0	—6.4	1.6	17.4	—12.8	4.6	19.0	"	5.1
										8.7	—6.5	2.2	17.8	—12.9	4.9	19.0		5.1
10	27.7	—17.1	10.6	7.8	"	---	5.0	+0.6	5.6	9.5	—6.7	2.8	18.3	—13.0	5.3	19.3	"	5.4
11	28.8	"	11.7	8.3	"	---	7.1	+0.3	7.4	11.3	—7.1	4.2	19.5	—13.2	6.3	20.3	"	6.4
	29.7	—17.2	12.5															
Noon	23.0	?	---	10.9	"	---	8.2	0.0	8.2	13.1	—7.5	5.6	21.2	—13.4	7.8	21.7	—14.0	7.7
	22.6	"	---										27.8	?	---			
1	21.8	"	---	12.4	"	---	10.4	—0.2	10.2	16.9	—7.7	9.2	27.7	"	---	23.0	"	9.0
				12.5	"	---	10.7	—0.3	10.4									
2	20.0	"	---	12.5	"	---	10.7	—0.5	10.2	18.2	—7.9	10.3	24.4	—13.4	11.0	24.5	—14.1	10.4
							10.7	—0.6	10.1	18.4	—8.0	10.4						
3	18.6	"	---	---		---	10.6	—0.8	9.8	18.5	—8.1	10.4	24.7	—13.5	11.2	25.3	—14.2	11.1
										18.5	—8.2	10.3	25.0	"	11.5	25.0	"	10.8
4	18.5	—17.6	0.9	---		---	9.0	—1.0	8.0	17.9	—8.3	9.6	25.0	"	11.5	25.8	—14.3	11.5
	18.3	"	0.7										24.4	"	10.9	25.9	"	11.6
5	18.2	"	0.6	---		---	8.2	—1.2	7.0	17.0	—8.5	8.5	23.5	"	10.0	25.6	—14.4	11.2
	18.2	"	0.6							16.2	—8.6	7.6				25.1	"	10.7
6	18.3	"	0.7	---		---	8.5	—1.5	7.0	15.6	—8.7	6.9	22.1	"	8.6	24.3	—14.5	9.8
	18.4	"	0.8							16.0	—8.9	7.1						
7	18.3	?	---	15.2	?	---	7.7	—1.7	6.0	16.6	—9.1	7.5	20.2	"	6.7	22.5	—14.6	7.9
	18.3	"	---				7.6	—1.9	5.7									
8	18.3	"	---	15.4	"	---	7.6	—2.0	5.6	17.0	—9.4	7.6	19.3	—13.6	5.7	21.0	—14.7	6.3
	18.8	"	---				9.8	—2.2	7.6				18.3	"	4.7			
9	19.4	"	---	16.0	"	---	10.4	—2.4	8.0	17.0	—9.7	7.3	18.0	"	4.4	20.8	—14.8	6.0
													18.0	"	4.4			
10	20.8	"	---	17.6	"	---	11.6	—2.8	8.8	17.6	—10.0	7.6	18.0	"	4.4	19.8	—14.9	4.9
													18.3	"	4.7	19.4	"	4.5
11	21.9	"	---	20.2	"	---	13.6	—3.2	10.4	18.2	—10.2	8.0	19.2	"	5.6	19.2	—15.0	4.2
																19.4	"	4.4
Midn't	23.3	—17.6	5.7	23.2	—17.0	6.2	15.7?	—3.6	(12.1)	18.9	—10.4	8.5	19.5	—13.7	5.8	19.8	—15.1	4.7

		Fath.	Feet.	Inch.	Register.	
Dec. 17.	Sounding at noon	7	5	0	30.0 changed to 23.0.	* Results doubtful.
" 18.	" "	7	5	3	31.3 (=11.3).	Tide register broke down at 2½ P. M.; was repaired and observations commenced at 7 P. M.
" 19.	No sounding taken.					
" 20.	" "					
" 21.	Sounding at noon	7	3	6	21.5.	Correction at noon by soundings 12.3, by curves 14.5, mean adopted.
" 22.	" "	7	3	6	21.7.	Mean correction —14.0.

The heights on the 18th and 19th have been rejected.

SERIES I.—TIDAL OBSERVATIONS FROM OCTOBER 10, 1853, TO DECEMBER 28, 1853.

Hourly observations on the pulley-gauge. Adopted reading of mean level 7.0, expressed in units of the scale. Increasing numbers indicate rise of water.

December, 1853.

Mean solar hour.	23d.	Red. to level.	Ref. obs.	24th.	Red. to level.	Ref. obs.	25th.	Red. to level.	Ref. obs.	26th.	Red. to level.	Ref. obs.	27th.	Red. to level.	Ref. obs.	28th.	Red. to level.	Ref. obs.
							19.5	"	2.7									
1	20.0	—15.2	4.8	19.1	—16.0	3.1	19.3	—16.9	2.4	1.9	+1.4	3.3	3.1	—0.4	2.7	7.1	—2.0	5.1
							19.3	"	2.4	1.8	"	3.2	2.7	"	2.3			
2	21.1	—15.3	5.8	19.7	"	3.7	19.6	—17.0	2.6	1.8	"	3.2	2.3	—0.5	1.8	5.7	—2.1	3.6
										1.9		3.3	2.7	"	2.2			
3	22.0	—15.4	6.6	21.0	"	5.0	20.3	—17.1	3.2	2.1	+1.3	3.4	3.5	—0.6	2.9	4.4	"	2.3
																4.1	—2.2	1.9
4	22.7	—15.5	7.2	21.7	—15.9	5.8	21.8	—17.2	4.6	3.2	+1.2	4.4	?3.0	"	?2.4	4.2	"	2.0
																4.3	—2.3	2.0
5	23.0	—15.6	7.4	22.0	"	6.1	23.4	—17.3	6.1	5.6	"	6.8	4.7	—0.7	4.0	4.7	"	2.4
	23.1	"	7.5															
6	23.1	—15.7	7.4	23.4	"	7.5	24.9	—17.4	7.5	6.7	+1.0	7.7	6.6	"	5.9	6.9	—2.4	4.5
	22.7	"	7.0	23.6	"	7.7												
7	23.0	—15.8	7.2	23.6	—15.8	7.8	25.3	—17.5	7.8	8.2	+0.9	9.1	8.5	—0.8	7.7	9.2	"	6.8
				23.1	"	7.3	25.5		8.0	8.7	"	9.6						
8	22.4	—15.9	6.5	22.9	"	7.1	25.6	—17.6	8.0	9.2	+0.8	10.0	10.6	—0.9	9.7	11.1	—2.5	8.6
							25.6	"	8.0	10.7	"	11.5						
9	21.9	—16.0	5.9	22.3	"	6.5	25.1	"	7.5	9.8	+0.7	10.5	11.9	—1.0	10.9	13.3	"	10.8
													12.2	"	11.2	13.8	"	11.3
10	20.6	—16.1	4.5	21.2	"	5.4	23.6	—17.7	5.9	8.5	"	9.2	12.1	—1.1	11.0	14.2	—2.6	11.6
													11.6	"	10.5	14.2	"	11.5
11	19.4	—16.2	3.2	21.0	"	5.2	22.9	—17.8	5.1	6.7	+0.6	7.3	11.0	—1.2	9.8	13.7	"	11.1
	19.3	"	3.1	20.7	"	4.9	22.3	"	4.5									
Noon	20.4	—16.3	4.1	20.3	—15.7	4.6	22.0	—17.9	4.1	5.6	+0.6	6.2	9.2	—1.3	7.9	11.7	—2.7	9.0
				21.3		5.6	22.0	"	4.1									
1	21.4	"	5.1	21.7	"	6.0	22.2	—18.0	4.2	4.4	"	5.0	6.9	"	5.6	10.0	—2.9	7.1
										4.4	"	5.0						
2	22.5	"	6.2	22.5	—15.8	6.7	22.5	"	4.5	4.3	+0.5	4.8	5.2	—1.4	3.8	9.6	—3.3	6.3
										4.3	"	4.8						
3	23.6	—16.2	7.4	23.5	—15.9	7.6	23.2	—18.1	5.1	4.3	"	4.8	4.5	—1.5	3.0	9.5	—3.8	5.7
										4.3	"	4.8	4.4	"	2.9			
4	24.6	"	8.4	24.5	—16.0	8.5	23.6	—18.2	5.4	4.5	+0.4	4.9	4.4	"	2.9	9.5	—4.5	5.0
	25.0	"	8.8										4.4	"	2.9	9.6	—4.7	4.9
5	24.9	"	8.7	25.1	—16.1	9.0	24.6	"	6.4	5.2	+0.3	5.5	4.7	—1.6	3.1	9.8	—4.9	4.9
	24.7	"	8.5													10.0	—5.1	4.9
6	24.6	"	8.4	25.4	—16.2	9.2	25.3	—18.3	7.0	6.8	"	7.1	6.3	"	4.7	10.4	—5.3	5.1
				25.5	"	9.3												
7	23.7	—16.1	7.6	25.1	—16.3	8.8	25.3	"	7.0	8.1	+0.2	8.3	7.8	—1.7	6.1	12.6	—5.7	6.9
							25.6	"	7.3	8.5	"	8.7						
8	22.3	"	6.2	24.2	—16.4	7.8	25.4	—18.4	7.0	9.1	+0.1	9.2	9.3	"	7.6	14.2	—6.0	8.2
										9.1	"	9.2						
9	20.1	"	4.0	23.1	—16.5	6.6	25.0	"	6.6	9.1	0.0	9.1	10.0	—1.8	8.2	16.3	—6.3	10.0
													10.9	"	9.1			
10	19.4	"	3.3	22.6	—16.6	6.0	24.1	—18.5	5.6	8.1	—0.1	8.0	10.8	"	9.0	17.1	—6.9	10.2
													10.4	"	8.6	17.4	—7.0	10.4
11	19.1	"	3.0	22.1	—16.7	5.4	23.1	"	4.6	7.2	—0.2	7.0	10.2	—1.9	8.3	17.7	—7.1	10.6
	19.0		2.9													17.7	—7.2	10.5
Midn't	19.0	—16.0	3.0	21.4	—16.8	4.6	22.4	—18.6	3.8	5.2	—0.3	4.9	9.0	—2.0	7.0	17.7	—7.3	10.4

			Fath.	Feet.	Inch.	Correction.	
Dec. 23.	Sounding at noon		6	3	8	—16.3	mean of sounding and curves.
" 24.	"	"	6	4	8	—15.7	" " "
" 25.	"	"	6	3	0	—17.9	" " "
" 26.	"	"	7	1	0	+ 0.6	" " "
" 27.	"	"	7	2	0	— 1.3	" " "
" 28.	"	"	7	4	6	(Ebb tide at 2½ P. M.)	Correction —2.7 mean of sounding and

curves; afternoon corrections from the curves. Between this date and the commencement of the second series the observations are too much affected by irregularities to be inserted.

SERIES II.—TIDAL OBSERVATIONS FROM JANUARY 28 TO APRIL 7, 1854.

Hourly observations on the pulley-gauge. Adopted reading of mean level 7.0, expressed in units of the scale. Increasing numbers indicate rise of water.

	January, 1854.												February, 1854.					
Mean solar hour.	28th.	Red. to level.	Ref. obs.	29th.	Red. to level.	Ref. obs.	30th.	Red. to level.	Ref. obs.	31st.	Red. to level.	Ref. obs.	1st.	Red. to level.	Ref. obs.	2d.	Red. to level.	Ref. obs.
	13.2	—2.6	10.6	21.9	—10.0	11.9	16.5	—7.5	9.0	14.9	—5.8	9.1				13.2	—6.2	7.0
1	12.8	—2.8	10.0	21.5	—10.1	11.4	16.2	—7.4	8.8	15.5	"	9.7	16.2	—5.8	10.4	13.5	"	7.3
										15.2	"	9.4						
2	12.0	—3.3	8.7	19.6	—10.2	9.4	15.6	—7.3	8.3	14.7	"	8.9	16.8	—5.9	10.9	14.3	"	8.1
													17.0	"	11.1			
3	11.0	—3.8	7.2	17.7	—10.3	7.4	12.8	—7.2	5.6	14.3	—5.7	8.6	17.0	"	11.1	15.6	"	9.4
													17.0	"	11.1	16.0	"	9.8
4	8.8	—4.2	4.6	16.1	—10.4	5.7	10.5	—7.1	3.4	11.7	"	6.0	16.9	—6.0	10.9	16.2	"	10.0
																16.2	"	10.0
5	6.3	—4.7	1.6	15.0	—10.5	4.5	9.2	—7.0	2.2	9.2	"	3.5	12.6	"	6.6	15.7	"	9.5
	5.9	—4.9	1.0															
6	6.2	—5.1	1.1	12.2	—10.6	1.6	7.4	—6.9	0.5	6.9	"	1.2	10.6	—6.1	4.5	14.0	"	7.8
	6.7	—5.3	1.4	11.9	"	1.3	7.4	"	0.5	5.9	—5.6	0.3						
7	8.2	—5.4	2.8	12.1	—10.7	1.4	7.5	—6.8	0.7	5.3	"	—0.3	8.5	"	2.4	10.6	"	4.4
				13.4	"	2.7	7.8	"	1.0	5.3	"	—0.3	7.9	"	1.8			
8	11.0	—5.9	5.1	14.6	—10.8	3.8	8.2	—6.7	1.5	5.3	"	—0.3	7.7	"	1.6	8.9	"	2.7
										5.3	—5.5	—0.2	7.7	"	1.6	9.1	"	2.9
9	15.6	—6.4	9.2	18.6	—10.9	7.7	10.3	—6.6	3.7	6.9	"	1.4	7.5	—6.2	1.3	8.2	"	2.0
													8.3	"	2.1	8.2	"	2.0
10	17.7	—7.2	10.5	20.7	—11.0	9.7	12.2	—6.5	5.7	10.0	"	4.5	10.0	"	3.8	8.7	"	2.5
11	19.9	—8.0	11.9	23.4	—11.1	12.3	14.3	—6.4	7.9	13.0	—5.4	7.6	13.0	"	6.8	11.2	"	5.0
Noon	21.0	—8.8	12.2	24.5	—11.2	13.3	18.3	—6.3	12.0	16.2	—5.3	10.9	16.3	—6.3	10.0	13.0	—6.1	6.9
	21.2	"	12.4	20.7	—11.1	9.6				17.3	"	12.0						
1	20.4	—8.9	11.5	19.7	—11.0	8.7	20.1	"	13.8	18.3	"	13.0	17.7	"	11.4	14.6	"	8.5
				19.2	—10.9	8.3	20.2	"	13.9	19.0	"	13.7						
2	18.8	—9.0	9.8	18.7	—10.8	7.9	19.7	—6.2	13.5	18.2	—5.4	12.8	18.4	"	12.1	16.0	"	9.9
													19.0	"	12.7	16.2	"	10.1
3	17.1	—9.1	8.0	15.6	—10.6	5.0	17.7	—6.1	11.6	16.8	"	11.4	19.2	"	12.9	16.7	"	10.6
													18.9	"	12.6	16.0	"	9.9
4	15.6	—9.2	6.4	12.0	—10.4	1.6	14.6	"	8.5	15.7	—5.5	10.2	18.2	"	11.9	16.0	"	9.9
5	13.7	—9.3	4.4	10.8	—10.2	0.6	8.2	—6.0	2.2	13.0	"	7.5	15.8	"	9.5	14.9	—6.2	8.7
6	12.2	—9.4	2.8	10.0	—10.0	0.0	6.3	"	0.3	9.7	—5.6	4.1	12.4	"	6.1	13.9	"	7.7
	12.0	"	2.6	9.7	—9.9	—0.2	6.1	"	0.1									
7	12.2	—9.5	2.7	9.2	—9.8	—0.6	5.7	"	—0.3	7.3	"	1.7	10.0	"	3.7	10.8	"	4.6
				8.6	—9.7	—1.1	5.6	—5.9	—0.3	7.2	"	1.6						
8	14.2	—9.6	4.6	7.8	—9.6	—1.8	5.5	"	—0.4	7.2	"	1.6	8.7	"	2.4	8.1	"	1.9
				7.7	—9.5	—1.8	5.7	"	—0.2	7.2	—5.7	1.5	8.5	"	2.2			
9	17.1	—9.7	7.4	8.7	—9.4	—0.7	6.7	"	0.8	7.4	"	1.7	8.4	"	2.1	6.6	"	0.4
										8.0	"	2.3	8.4	"	2.1	6.6	"	0.4
10	19.9	—9.8	10.1	10.8	—9.2	0.6	9.3	"	3.4	9.0	"	3.3	8.6	"	2.3	6.6	—6.3	0.3
																6.6	"	0.3
11	21.1	—9.9	11.2	13.4	—9.0	4.4	12.1	"	6.2	12.0	"	6.3	10.0	"	3.7	7.2	"	0.9
Midn't	21.6	—10.0	11.6	14.8	—8.7	6.1	14.0	—5.8	8.2	14.6	—5.8	8.8	12.1	—6.2	5.9	9.3	"	3.0

Jan. 27. At 11 P. M., 13.7; at $11^h\ 30^m$, 13.8; at 28th, 0^h, 13.9, high water; corrected high water 11.3.

			Fath.	Feet.	Inch.	
Jan. 28.	Sounding at noon		8	0	0	Corrected reading by sounding 11.4, by curves 13.1, mean 12.2.
" 29.	"	"	8	1	6	Index changed to 19.6. Corrected reading by sounding 12.9, by curves 13.7, mean 13.3.
" 30.	"	"	8	0	6	Corrected reading by sounding 11.9, by curves 12.1, mean 12.0.
" 31.	"	"	---	---	---	Corrected reading by curves 10.9.
Feb. 1.	"	"	7	4	6	Ebb tide at $7\frac{1}{2}$ A. M.
" 2.	"	"	7	1	0	Ebb tide at 4 P. M. (probably means ebb commences). Index 13.0.

Note to Feb. 1 and 2. The correction is derived from the soundings and curves.

Series II.—Tidal Observations from January 28 to April 7, 1854.

Hourly observations on the pulley-gauge. Adopted reading of mean level 7.0, expressed in units of the scale. Increasing numbers indicate rise of water.

February, 1854.

Mean solar hour.	3d.	Red. to level.	Ref. obs.	4th.	Red. to level.	Ref. obs.	5th.	Red. to level.	Ref. obs.	6th.	Red. to level.	Ref. obs.	7th.	Red. to level.	Ref. obs.	8th.	Red. to level.	Ref. obs.
							10.6	—6.8	3.8	11.7	—7.2	4.5	9.5	—5.2	4.3			
1	12.0	—6.4	5.6	11.2	—6.0	5.2	10.9	—7.0	3.9	11.7	—7.1	4.6	9.3	"	4.1	9.7	—4.4	5.3
										12.2	"	5.1				9.2	"	4.8
2	13.0	"	6.6	13.0	—5.9	7.1	11.7	—7.1	4.6	12.6	—7.0	5.6	9.5	—5.1	4.4	9.2	—4.5	4.7
																9.2	"	4.7
3	14.0	—6.5	7.5	14.3	"	8.4	12.9	—7.2	5.7	13.5	—6.9	6.6	10.2	—5.0	5.2	9.2	"	4.7
	14.4	"	7.9	14.7	—5.8	8.9										9.2	"	4.7
4	15.0	"	8.5	14.9	"	9.1	13.7	—7.3	6.4	15.9	"	9.0	11.1	—4.9	6.2	9.2	"	4.7
	15.0	"	8.5	14.9	"	9.1				15.8	—6.8	9.0				9.6	"	5.1
5	14.8	—6.6	8.2	14.9	—5.7	9.2	17.1	—7.4	9.7	16.1	"	9.3	12.0	"	7.1	10.0	"	5.5
				14.8	"	9.1				16.0	"	9.2						
6	13.9	"	7.3	14.2	—5.6	8.6	17.5	—7.5	10.0	16.0	—6.7	9.3	13.0	—4.8	8.2	11.5	"	7.0
							17.5	"	10.5	16.0	"	9.3						
7	12.1	"	5.5	12.8	"	7.2	17.7	—7.6	10.1	16.0	—6.6	9.4	13.7	—4.7	9.0	12.6	—4.6	8.0
							17.7	"	10.1	16.0	"	9.4	14.0	"	9.3			
8	11.1	"	4.5	11.7	—5.5	6.2	17.4	—7.7	9.7	16.0	—6.5	9.5	14.0	—4.6	9.4	13.4	"	8.8
	10.6	"	4.0	9.8	"	4.3				16.0	"	9.5	13.7	"	9.1			
9	10.1	—6.7	3.4	9.2	—5.4	3.8	16.3	—7.8	8.5	15.2	—6.4	8.8	13.3	—4.5	8.8	13.9	"	9.3
	10.2	"	3.5	9.2	"	3.8										14.0	"	9.4
10	10.8	"	4.1	9.8	—5.4	4.4	15.5	—8.0	7.5	14.4	—6.3	8.1	12.8	—4.4	8.4	14.1	"	9.5
																14.1	"	9.5
11	11.9	"	5.2	10.5	"	5.1	15.2	—8.1	7.1	13.6	"	7.3	12.2	—4.3	7.9	13.9	"	9.3
										13.0	"	6.7						
Noon	12.6	—6.8	5.8	10.7	—5.3	5.4	15.0	—8.2	6.8	10.0	—6.2	3.8	11.8	—4.2	7.6	11.6	—4.7	6.9
							13.2	"	5.0	10.1	"	3.9						
1	12.9	"	6.1	11.2	—5.4	5.8	13.7	—8.1	5.6	10.5	—6.1	4.4	11.0	"	6.8	10.2	"	5.5
							14.1	"	6.0				11.0	"	6.8			
2	14.1	—6.7	7.4	12.8	—5.5	7.3	14.4	—8.0	6.4	11.0	—6.0	5.0	10.0	"	5.8	9.1	"	4.4
													10.0	"	5.8	8.2	"	3.5
3	14.8	"	8.1	13.5	—5.6	7.9	15.5	—7.9	7.6	11.3	"	5.3	10.0	"	5.8	8.0	"	3.3
	15.1	—6.6	8.5										10.0	"	5.8	8.0	"	3.3
4	15.2	"	8.6	14.2	—5.7	8.5	17.7	—7.8	9.9	12.0	—5.9	6.1	10.0	"	5.8	8.0	"	3.3
	---	"	---										10.0	"	5.8	---		---
5	14.6	—6.5	8.1	14.6	—5.8	8.8	18.3	—7.7	10.5	12.5	—5.8	6.7	11.3	—4.3	7.0	8.1	"	3.4
				14.7	"	8.9	18.4	"	10.7									
6	12.9	"	6.4	14.6	—5.9	8.7	18.0	—7.6	10.4	12.6	—5.7	6.9	11.4	"	7.1	9.7	"	5.0
										12.6	"	6.9						
7	11.2	—6.4	4.8	14.2	—6.0	8.2	17.2	—7.5	9.7	12.7	—5.6	7.1	12.2	"	7.9	10.2	"	5.5
										12.7	"	7.1	12.5	"	8.2			
8	9.6	—6.3	3.3	13.5	—6.1	7.4	15.0	—7.4	7.6	12.7	—5.5	7.2	12.5	"	8.2	11.1	"	6.4
										12.7	"	7.2	12.2	"	7.9	11.2	"	6.5
9	8.7	"	2.4	12.2	—6.2	6.0	13.7	—7.4	6.3	12.5	—5.4	7.1	12.0	—4.4	7.6	11.4	"	6.7
	8.4	—6.2	2.2													11.4	"	6.7
10	8.4	"	2.2	11.0	—6.4	4.6	12.4	—7.3	5.1	11.3	"	5.9	11.8	"	7.4	11.4	"	6.7
	8.6	—6.1	2.5													11.3	"	6.6
11	8.8	"	2.7	10.6	—6.5	4.1	11.9	"	4.6	9.5	—5.3	4.2	11.2	"	6.8	11.1	"	6.4
				10.6	—6.6	4.0	11.8	"	4.5	9.0	"	3.7						
Midn't	9.7	—6.0	3.7	10.6	—6.7	3.9	11.7	—7.2	4.5	9.0	—5.2	3.8	10.7	—4.4	6.3	11.0	"	6.3

			Fath.	Feet.	Inch.	
Feb. 3.	Sounding at noon		6	5	6	Corrected reading by sounding 4.9, by curves 6.7, mean 5.8.
" 4.	"	"	---	---	---	
" 5.	"	"	---	---	---	
" 6.	"	"	6	4	0	Corrected reading by sounding 3.4, by curves 4.3, mean 3.8.
" 7.	"	"	---	---	---	
" 8.	"	"	6	5	6	Corrected reading by sounding and curves 6.9.

SERIES II.—TIDAL OBSERVATIONS FROM JANUARY 28 TO APRIL 7, 1854.

Hourly observations on the pulley-gauge. Adopted reading of mean level 7.0, expressed in units of the scale. Increasing numbers indicate rise of water.

February, 1854.

Mean solar hour.	9th.	Red. to level.	Ref. obs.	10th.	Red. to level.	Ref. obs.	11th.	Red. to level.	Ref. obs.	12th.	Red. to level.	Ref. obs.	13th.	Red. to level.	Ref. obs.	14th.	Red. to level.	Ref. obs.
													14.7	—6.7	8.0			
1	9.9	—4.6	5.3	11.4	—5.6	5.8	10.7	—6.3	4.4	11.1	—6.2	4.9	14.2	"	7.5	19.5	—9.4	10.1
2	8.8	"	4.2	11.0	—5.7	5.3	10.1	"	3.8	11.1	"	4.9	13.6	"	6.9	18.5	—9.6	8.9
	8.4	"	3.8															
3	8.4	"	3.8	10.4	—5.8	4.6	8.8	"	2.5	10.2	"	4.0	12.7	—6.8	5.9	16.0	—9.8	6.2
	8.4	"	3.8															
4	8.4	"	3.8	10.0	—5.9	4.1	8.2	"	1.9	9.0	"	2.8	9.7	"	2.9	14.0	—10.0	4.0
	8.4	"	3.8				7.9	"	1.6	9.5	"	3.3						
5	8.8	"	4.2	10.0	—6.0	4.0	7.5	—6.2	1.3	9.2	"	3.0	8.2	"	1.4	13.7	—10.1	3.6
							7.5	"	1.3	9.0	"	2.8	8.0		1.2			
6	10.0	"	5.4	10.0	—6.1	3.9	7.8	"	1.6	9.0	"	2.8	7.6	—6.9	0.7	13.3	—10.3	3.0
				9.8	"	3.7				9.0	"	2.8	8.5	"	1.6	12.9	—10.4	2.5
7	11.6	"	7.0	11.0	—6.2	4.8	9.1	"	2.9	9.7	"	3.5	8.9	"	2.0	12.9	—10.5	2.4
																13.7	—10.6	3.1
8	12.8	"	8.2	12.8	—6.3	6.5	10.3	—6.1	4.2	11.2	"	5.0	10.9	"	4.0	14.7	—10.7	4.0
9	13.5	"	8.9	15.0	—6.4	8.6	12.6	"	6.5	13.2	"	7.0	13.0	—7.0	6.0	16.2	—10.8	5.4
				15.2	"	8.8												
10	14.1	"	9.5	15.7	—6.5	9.2	15.5	"	9.4	15.3	"	9.1	16.0	"	9.0	18.7	—10.9	7.8
	14.3	"	9.7	15.7	"	9.2				16.6	"	10.4	16.9	"	9.9			
11	14.2	"	9.6	15.7	"	9.2	16.1	"	10.0	17.7	"	11.5	19.1	"	12.1	20.8	—11.1	9.7
	13.8	"	9.2	15.0	"	8.5	16.4	"	10.3	17.4	"	11.2	19.6	"	12.6			
Noon	13.6	—4.5	9.1	14.0	—6.6	7.4	16.5	—6.0	10.5	17.1	—6.3	10.8	19.5	—7.1	12.4	21.7	—11.2	10.5
							16.1	"	10.1				19.5	—7.2	12.3	---		---
1	13.5	"	9.0	13.9	"	7.3	15.7	"	9.7	16.0	"	9.7	19.5	—7.3	12.2	24.8	"	13.6
																24.3	"	13.1
2	12.7	"	8.2	13.4	"	6.8	13.6	"	7.6	14.7	"	8.4	17.9	—7.5	10.4	23.2	—11.3	11.9
3	11.2	—4.6	6.6	10.7	"	4.1	11.4	"	5.4	12.3	—6.4	5.9	16.7	—7.7	9.0	21.5	—11.4	10.1
4	9.0	—4.7	4.3	8.7	—6.5	2.2	9.5	"	3.5	10.0	"	3.6	16.3	—7.9	8.4	19.5	"	8.1
	8.3	"	3.6	8.0		1.5	8.0	"	2.0				14.5	—8.0	6.5			
5	8.0	"	3.3	8.0	"	1.5	7.8	"	1.8	9.7	"	3.3	12.9	—8.1	4.8	16.7	—11.5	5.2
	8.7	—4.8	3.9	8.0	"	1.5	8.0	"	2.0				12.3	—8.2	4.1			
6	9.3	"	4.5	8.0	"	1.5	8.0	"	2.0	8.9	—6.5	2.4	13.1	—8.3	4.8	14.7	"	3.2
				8.0	"	1.5				8.8	"	2.3				14.3	"	2.8
7	9.7	—4.9	4.8	8.5	"	2.0	9.6	"	3.6	8.8	"	2.3	15.2	—8.4	6.8	14.2	—11.6	2.6
										8.9	"	2.4				14.2	"	2.6
8	11.0	—5.0	6.0	9.8	—6.4	3.4	10.3	—6.1	4.2	9.7	"	3.2	16.3	—8.5	7.8	14.6	"	3.0
9	11.7	—5.1	6.6	11.2	"	4.8	11.4	"	5.3	9.9	—6.6	3.3	16.3	—8.7	7.6	15.1	"	3.5
10	12.4	—5.2	7.2	12.3	"	5.9	12.1	"	6.0	12.6	"	6.0	18.7	—8.8	9.9	15.8	—11.7	4.1
										14.3	"	7.7	19.1	—8.9	10.2			
11	12.3	—5.3	7.0	12.7	"	6.3	12.9	"	6.8	15.0	"	8.4	19.6	—9.0	10.6	16.6		4.9
	12.6	—5.4	7.2	12.7	"	6.3	13.3	"	7.2	15.0		8.4	19.5	—9.1	10.4			
Midn't	12.4	—5.5	6.9	12.9	—6.3	6.6	13.8	"	7.7	15.1	—6.7	8.4	19.5	—9.2	10.3	17.4	—11.8	5.6

		Fath.	Feet.	Inch.	
Feb. 9.	No sounding.				
" 10.	Sounding at noon	7	2	0	Corrected by sounding —6.6, by curves —6.6.
" 11.	" "	---	---	---	
" 12.	" "	7	4	6	Ebb tide at 6 P. M. Corrected by sounding —6.6, by curves —6.0, mean —6.3.
" 13.	" "	8	1	6	Corrected by sounding —6.6, by curves —7.6, mean —7.1.
" 14.	No sounding.				

SERIES II.—TIDAL OBSERVATIONS FROM JANUARY 28 TO APRIL 7, 1854.

Hourly observations on the pulley-gauge. Adopted reading of mean level 7.9, expressed in units of the scale. Increasing numbers indicate rise of water.

February, 1854.

Mean solar hour.	15th.	Red. to level.	Ref. obs.	16th.	Red. to level.	Ref. obs.	17th.	Red. to level.	Ref. obs.	18th.	Red. to level.	Ref. obs.	19th.	Red. to level.	Ref. obs.	20th.	Red. to level.	Ref. obs.
	23.6	—11.8	11.8	22.2	—9.1	13.1	20.7	—9.7	11.0									
1	23.6	"	11.8	22.2	—9.2	13.0	21.2	—9.6	11.6	16.5	—8.0	8.5	17.8	—8.2	9.6	11.3	—5.4	5.9
	23.5	"	11.7	22.1	—9.3	12.8	21.6	"	12.0									
2	23.5	—11.9	11.6	22.1	—9.4	12.7	21.8	—9.5	12.3	18.0	"	10.0	18.6	"	10.4	13.7	"	8.3
							21.8	"	12.3	18.4	—7.9	10.5						
3	23.5	"	11.6	20.9	—9.6	11.3	21.9	—9.4	12.5	18.5	"	10.6	19.4	—8.3	11.1	15.5	"	10.1
							21.9	"	12.5	18.5	"	10.6	19.6	"	11.3	15.9	"	10.5
4	19.7	"	7.8	19.0	—9.8	9.2	21.9	—9.3	12.6	18.2	—7.8	10.4	19.6	—8.4	11.2	16.2	"	10.8
													19.6	"	11.2	14.9	"	9.5
5	17.7	—12.0	5.7	16.3	—9.9	6.4	19.0	—9.2	9.8	16.3	"	8.5	19.3	"	10.9	14.0	—5.5	8.5
6	16.1	—12.1	4.0	14.7	—10.1	4.6	16.4	—9.1	7.3	15.0	—7.6	7.4	17.7	—8.5	9.2	12.7	"	7.2
7	15.3	"	3.2	13.2	—10.3	2.9	14.3	—9.0	5.3	11.8	"	4.2	15.8	"	7.3	11.4	"	5.9
				12.9	—10.4	2.5	12.9	"	3.9									
8	15.5	—12.2	3.3	12.7	—10.5	2.2	12.9	—8.9	4.0	10.6	"	3.0	14.2	—8.6	5.6	11.0	"	5.5
				13.7	—10.6	3.1	13.0	"	4.1	10.4	"	2.8				11.0	"	5.5
9	17.6	—12.3	4.8	14.8	—10.7	4.1	13.5	—8.8	4.7	10.2	—7.5	2.7	13.5	"	4.9	11.0	"	5.5
										10.2	"	2.7				11.4	"	5.9
10	19.7	—12.4	7.3	16.0	—10.9	5.1	15.4	—8.7	6.7	10.3	"	2.8	13.3	—8.7	4.6	11.0	"	5.5
													13.3	"	4.6	11.0	"	5.5
11	22.3	"	9.9	17.5	—11.0	6.5	18.0	"	9.3	13.5	"	6.0	13.2	"	4.5	11.0	"	5.5
							20.1	—8.6	11.5				13.3	"	4.6	11.3	"	5.8
Noon	24.6	—12.5	12.1	21.2	—11.1	10.1	14.6	?	---	14.5	—7.4	7.1	13.6	—8.8	4.8	11.7	—5.6	6.1
	25.2	"	12.7	22.1	"	11.0								---				
1	19.5	—6.8	12.7	24.0	—11.0	13.0	17.0	?	---	15.3	"	7.9	14.3	—5.5	8.8	12.2	"	6.6
	19.8	—6.9	12.9	23.9	"	12.9												
2	19.8	—7.0	12.8	24.0	—10.9	13.1	18.3	—6.6	11.7	17.2	—7.5	9.7	15.6	"	10.1	15.5	"	9.9
				24.0	"	13.1				17.7	"	10.2	15.9	"	10.4			
3	18.3	—7.2	11.1	22.5	—10.8	11.7	18.2	—6.7	11.5	17.7	—7.6	10.1	16.2	"	10.7	15.5	"	9.9
										17.6	"	10.0	16.2	"	10.7	16.0		10.4
4	18.4	—7.4	11.0	21.9	—10.7	11.2	17.2	—6.9	10.3	17.5	"	9.9	15.7	"	10.2	16.3	"	10.7
																15.7	"	10.1
5	17.2	—7.6	9.6	18.8	—10.6	8.2	15.4	—7.1	8.3	15.9	—7.7	8.2	15.4	—5.5	9.9	15.8	"	10.2
6	14.7	—7.8	6.9	16.0	—10.5	5.5	12.9	—7.2	5.7	14.4	"	6.7	14.3	"	8.8	15.5	"	9.9
7	12.7	—8.0	4.7	15.6	—10.4	5.2	11.2	—7.3	3.9	12.8	—7.8	5.0	12.0	"	6.5	15.5	?	---
	12.4	—8.1	4.3															
8	12.3	—8.2	4.1	12.9	—10.3	2.6	8.8	—7.5	1.3	11.6	"	3.8	10.3	"	4.8	15.5	"	---
	13.7	—8.3	5.4	12.5	—10.2	2.3	8.0	—7.6	0.4	11.1	—7.9	3.2						
9	15.6	—8.4	7.2	12.8	—10.1	2.7	8.0	—7.7	0.3	10.9	"	3.0	8.9	—5.4	3.5	14.1	"	---
							8.0	"	0.3	10.9	"	3.0						
10	18.1	—8.6	9.5	14.3	—10.0	4.3	8.7	—7.8	0.9	11.0	—8.0	3.0	8.4	"	3.0	13.7	"	---
													8.4	"	3.0	13.6		---
11	19.3	—8.8	10.5	17.1	—9.9	7.2	11.0	—7.9	3.1	12.3	"	4.3	8.4	"	3.0	13.5	"	---
													8.5	"	3.1	13.5	"	---
Midn't	20.4	—9.0	11.4	19.7	—9.8	9.9	13.8	—8.0	5.8	14.3	—8.1	6.2	9.4	—5.3	4.1	13.5	"	---

		Fath.	Feet.	Inch.	
Feb. 15.	Sounding at noon	8	1	0	Correction by sounding —12.2, by curves —12.8, mean —12.5.
" 16.	" "	---	---	---	
" 17.	" "	7	2	6	
" 18.	" "	7	1	6	Corrected reading by sounding 6.9, by curves 7.3, mean 7.1.
" 19.	" "	7	0	0	Corrected reading by sounding 5.4, by curves 4.2, mean 4.8.
" 20.	No sounding.				

SERIES II.—TIDAL OBSERVATIONS FROM JANUARY 28 TO APRIL 7, 1854.

Hourly observations on the pulley-gauge. Adopted reading of mean level 7.0, expressed in units of the scale. Increasing numbers indicate rise of water.

February, 1854.

Mean solar hour.	21st.	Red. to level.	Ref. obs.	22d.	Red. to level.	Ref. obs.	23d.	Red. to level.	Ref. obs.	24th.	Red. to level.	Ref. obs	25th.	Red. to level.	Ref. obs.	26th.	Red. to level.	Ref. obs.
				10.5	—6.0	4.5												
1	---		---	10.7	"	4.7	12.4	—7.2	5.2	14.4	—10.9	3.5	9.8	—2.1	7.7	10.6	—2.2	8.4
							11.8	—7.3	4.5	14.2	"	3.3						
2	---		---	11.5	"	5.5	11.8	—7.4	4.4	14.5	—11.0	3.5	7.8	"	5.7	8.8	—2.4	6.4
							11.8	—7.5	4.3									
3	---		---	12.9	"	6.9	11.8	—7.7	4.1	14.9	—11.1	3.8	5.8	—2.2	3.6	6.4	—2.7	3.7
							12.1	—7.8	4.3				5.3	"	3.1			
4	---		---	14.2	"	8.2	13.0	—8.0	5.0	16.1	—11.2	4.9	5.1	—2.3	2.8	5.2	—3.0	2.2
													15.4	"	3.1	4.1	—3.1	1.0
5	---		---	14.1	?	---	14.3	—8.2	6.1	17.2	—11.3	5.9	5.6	"	3.3	4.2	—3.2	1.0
																4.3	—3.3	1.0
6	---		---	13.6	"	---	15.8	—8.3	7.5	18.3	—11.5	6.8	7.6	—2.4	5.2	4.7	—3.5	1.2
7	---		---	13.2	"	---	16.8	—8.5	8.3	19.4	—11.6	7.8	9.7	"	7.3	6.6	—3.7	2.9
8	---		---	12.7	"	---	18.1	—8.6	9.5	21.7	—11.8	9.9	11.0	—2.5	8.5	9.0	—4.0	5.0
				15.0	—6.2	8.8												
9	---		---	15.5	"	9.3	18.4	—8.7	9.7	22.2	—11.9	10.3	12.7	"	10.2	11.0	—4.3	6.7
				15.6	"	9.4				22.2	"	10.3						
10	---		---	14.9	"	8.7	19.1	—8.8	10.3	22.3	—12.0	10.3	13.8	—2.6	11.2	13.0	—4.6	8.4
							19.5	"	10.7				13.8	"	11.2			
11	---		---	14.2	"	8.0	19.3	—8.9	10.4	22.2	—12.1	10.1	13.8	"	11.2	14.6	—4.9	9.7
Noon	---		---	12.8	—6.2	6.6	18.7	—9.0	9.7	20.7	—12.3	8.4	13.7	—2.7	11.0	15.4	—5.4	10.0
											---					17.0	—5.5	11.5
1	---		---	12.2	"	6.0	17.9	—9.3	8.6	10.0	—1.7	8.3	11.4	—1.9	9.5	17.5	—5.6	11.9
																15.7	—5.7	10.0
2	---		---	12.2	"	6.0	16.7	—9.6	7.1	7.6	"	5.9	9.0	—1.0	8.0	15.0	—5.8	9.2
3	---		---	12.2	—6.3	5.9	16.1	—9.9	6.2	6.6	—1.8	4.8	6.0	—1.1	4.9	13.1	—6.0	7.1
							16.0	—10.0	6.0	5.0		3.2						
4	---		---	12.5	"	6.2	16.0	—10.2	5.8	4.6	"	2.8	4.7	—1.3	3.4	10.2	—6.1	4.1
				11.0	"	4.7	16.0	"	5.8	5.3	"	3.5	3.3	"	2.0			
5	---		---	11.7	—6.4	5.3	16.2		5.7	5.6	"	3.8	3.7	—1.4	2.3	9.5	—6.2	3.3
				12.9	"	6.5	16.6	"	6.4							9.4	—6.3	3.1
6	---		---	14.2	"	7.8	17.0	—10.3	6.7	6.4	"	4.6	4.1	—1.5	2.6	9.4	—6.4	3.0
																9.5	—6.5	3.0
7	---		---	15.1	—6.5	8.6	18.0	"	7.7	7.7	"	5.9	5.4	—1.6	3.8	9.8	—6.6	3.2
				15.2	"	8.7												
8	13.5	—5.8	7.7	15.7	—6.6	9.1	18.9	—10.4	8.5	9.6	—1.9	7.7	8.0	—1.7	6.3	11.5	—6.7	4.8
				15.6	"	9.0	19.3	"	8.9									
9	12.5	"	6.7	15.3	—6.7	8.6	19.3	—10.5	8.8	10.8	"	8.9	10.2	—1.8	8.4	15.0	—6.8	8.2
				15.1		7.4	19.3	"	8.8	11.3		9.4						
10	11.2	—5.9	5.3	15.0	—6.8	8.2	19.0	—10.6	8.4	11.6	"	9.7	11.9	—1.9	10.0	16.3	—6.9	9.4
										11.6		9.7	12.3	"	10.4			
11	10.4	"	4.5	14.6	—6.9	7.7	18.5	—10.7	7.8	11.6	"	9.7	12.4	—2.0	10.4	17.8	—7.0	10.8
	10.5	"	4.6							11.6		9.7	12.4	"	10.4			
Midn't	10.2	"	4.3	13.8	—7.0	6.8	16.4	—10.8	5.6	10.6	—2.0	8.6	12.3	—2.0	10.3	18.4	—7.1	11.3

Feb. 21. Readings irregular, tide-gauge out of order at 8 A. M., repaired at noon. Sounding 7 fath., 1 ft., 0 in.
Feb. 22 and 23. No sounding.

		Fath.	Feet.	Inch.	
Feb. 24.	Sounding at noon	6	5	0	Corrections derived from curves.
" 25.	" "	7	0	6	Ebb tide at 11 A. M. Corrections derived from curves.
" 26.	" "	7	5	6	Correction derived from the means by sounding and curves.

SERIES II.—TIDAL OBSERVATIONS FROM JANUARY 28 TO APRIL 7, 1854.

Hourly observations on the pulley-gauge. Adopted reading of mean level 7.0, expressed in units of the scale. Increasing numbers indicate rise of water.

	February, 1854.						March, 1854.											
Mean solar hour.	27th.	Red. to level.	Ref. obs.	28th.	Red. to level.	Ref. obs.	1st.	Red. to level.	Ref. obs.	2d.	Red. to level.	Ref. obs.	3d.	Red. to level.	Ref. obs.	4th.	Red. to level.	Ref. obs.
				15.0	—4.9	10.1	15.5	—5.0	10.5	16.2	—5.0	11.2	14.5	—5.4	9.1			
1	18.3	—7.3	11.0	14.8	"	9.9	16.3	"	11.3	17.0	"	12.0	15.5	"	10.1	13.1	—5.1	8.0
										17.0	"	12.0	16.0		10.6			
2	17.5	—7.4	10.1	12.8	"	7.9	16.3	"	11.3	17.0	"	12.0	16.0	"	10.6	15.4	—5.0	10.4
										16.5	"	11.5	16.0		10.6	15.9	"	10.9
3	17.8	—7.5	10.3	11.0	"	6.1	13.9	"	8.9	16.0	"	11.0	16.0	"	10.6	16.0	—4.9	11.1
													15.7		10.3	16.0	"	11.1
4	19.3	?	- - -	7.8	"	2.9	12.0	"	7.0	15.1	"	10.1	14.8	—5.5	9.3	15.8	"	10.9
	5.3	—4.8	0.5															
5	4.4	"	—0.4	5.5	"	0.6	10.5	"	5.5	12.8	"	7.8	13.6	"	8.1	14.2	—4.8	9.4
	4.4	"	—0.4	5.5	"	0.6												
6	5.0	"	0.2	5.0	"	0.1	7.2	"	2.2	11.1	"	6.1	12.4	"	6.9	12.1	"	7.3
				5.0	"	0.1	5.5	"	0.5									
7	5.8	"	1.0	5.0	"	0.1	5.5	"	0.5	9.0	"	4.0	11.1	—5.6	5.5	9.7	—4.7	5.0
				6.2	"	1.3	5.5		0.5	8.8	"	3.8				9.1	"	4.4
8	8.3	"	3.5	7.0	"	2.1	5.5	"	0.5	7.5	"	2.5	9.4	"	3.8	8.6	"	3.9
					"		5.7	"	0.7		"		8.1		2.5	8.7	"	4.0
9	11.1	"	6.3	10.0	"	5.1	7.0	"	2.0	8.2	"	3.2	9.0	"	3.4	9.0	"	4.3
10	14.4	"	9.6	12.9	"	8.0	9.5	"	4.5	10.0	"	5.0	9.7	—5.7	4.0	8.4	"	3.7
																8.7	"	4.0
11	16.3	"	11.5	16.0	"	11.1	13.5	"	8.5	12.8	"	7.8	11.2	"	5.5	9.7	"	5.0
	16.9		12.1															
Noon	17.6	—4.9	12.7	17.7	—4.9	12.8	16.1	—5.0	11.1	15.6	—5.0	10.6	13.3	—5.8	7.5	12.1	—4.6	7.5
	16.0	"	11.1	17.9	"	13.0												
1	15.3	"	10.4	17.9	"	13.0	17.6	"	12.6	17.9	"	12.9	15.7	"	9.9	13.5	"	8.9
				17.2	"	12.3	17.9	"	12.9	18.0	"	13.0						
2	14.1	"	9.2	15.9	"	11.0	17.9	"	12.9	18.0	"	13.0	16.0	—5.7	10.3	15.3	"	10.7
							17.2	"	12.2				16.6	"	10.9	15.5	"	10.9
3	12.8	"	7.9	13.4	"	8.5	16.7	"	11.7	17.2	—5.1	12.1	16.3	"	10.6	15.6	—4.5	11.1
													16.3	"	10.6	15.2	"	10.7
4	8.7	"	3.8	9.7	"	4.8	13.9	"	8.9	15.8	"	10.7	15.3	"	9.6	15.0	"	10.5
5	4.7	"	—0.2	7.8	"	2.9	12.4	"	7.4	14.4	—5.2	9.2	14.9	—5.6	9.3	12.9	—4.4	8.5
	4.5	"	—0.4															
6	4.0	"	—0.9	6.2	"	1.3	11.7	"	6.7	13.4	"	8.2	14.2	"	8.6	11.2	"	6.8
	4.0	"	—0.9	6.0	"	1.1												
7	4.7	"	—0.2	6.0	"	1.1	11.1	"	6.1	12.0	"	6.8	13.5	—5.5	8.0	9.9	"	5.5
				6.0	"	1.1				11.3	"	6.1						
8	6.5	"	1.6	6.0	"	1.1	9.4	"	4.4	10.0	—5.3	4.7	12.1	"	6.6	8.2	—4.3	3.9
				6.4	"	1.5	8.5	"	3.5	7.7	"	2.4	8.6	"	3.1	6.4	"	2.1
9	8.9	"	4.0	8.0	"	3.1	6.3	"	1.3	7.5	"	2.2	6.9	—5.4	1.5	5.2	—4.2	1.0
							7.2	"	2.2	7.2	"	1.9	6.9	"	1.5	5.3	"	1.1
10	11.6	"	6.7	10.4	"	5.5	8.9	"	3.9	8.5	"	3.2	7.2	"	1.8	5.3	"	1.1
																6.0	—4.1	1.9
11	13.8	"	8.9	15.8	"	10.9	11.8	"	6.8	11.2	"	5.9	9.2	—5.3	3.9	6.4	"	2.3
	14.7	"	9.8	17.0	"	12.1												
Midn't	15.2	"	10.3	17.3	"	12.4	14.6	"	9.6	13.9	—5.4	8.5	11.4	—5.2	6.2	8.6	—4.0	4.6

		Fath.	Feet.	Inch.	
Feb. 27.	Sounding at noon	7	5	6	Mean correction by sounding and curves adopted, the latter [showing weight 2.
" 28.	No sounding.				
March 1.	No sounding.				
" 2.	Sounding at noon	7	5	6	Corrected reading by sounding 11.0, by curves 10.2, mean 10.6.
" 3.	" "	7	1	6	Corrected reading by sounding 7.0, by curves 8.0, mean 7.5.
" 4.	No sounding.				

SERIES II.—TIDAL OBSERVATIONS FROM JANUARY 28 TO APRIL 7, 1854.

Hourly observations on the pulley-gauge. Adopted reading of mean level 7.0, expressed in units of the scale. Increasing numbers indicate rise of water.

March, 1854.

Mean solar hour.	5th.	Red. to level.	Ref. obs.	6th.	Red. to level.	Ref. obs.	7th.	Red. to level.	Ref. obs.	10th.	Red. to level.	Ref. obs.	11th.	Red. to level.	Ref. obs.	15th.	Red. to level.	Ref. obs.
													15.1	—6.9	8.2	17.6	—6.4	11.2
1	10.5	—3.8	6.7	10.7	—3.5	7.2	9.7	—4.1	5.6	9.6	—4.7	4.9	14.3	"	7.4	17.5	—6.5	11.0
										9.1	"	4.4						
2	11.8	"	8.0	12.1	"	8.6	11.0	"	6.9	8.9	—4.8	4.1	13.2	—7.0	6.2	15.7	—6.7	9.0
										8.9	"	4.1						
3	12.7	—3.7	9.0	13.2	—3.6	9.6	12.1	"	8.0	8.9	—4.9	4.0	12.5	"	5.5	15.2	—6.9	8.3
	12.8*	"	9.1							9.0	"	4.1	12.4	"	5.4			
4	12.8	—3.6	9.2	14.0	"	10.4	12.8	"	8.7	9.0	—5.0	4.0	12.4	"	5.4	14.0	—7.1	6.9
	11.9	"	8.3	14.1	"	10.5	12.9		8.8	9.0	"	4.0	12.4	"	5.4			
5	11.7	—3.5	8.2	14.1	—3.7	10.4	12.9	"	8.8	9.0	—5.1	3.9	12.4	"	5.4	11.5	—7.3	4.2
	11.2	"	7.7	14.0	"	10.3	12.9		8.8	9.6	—5.2	4.4	12.4	"	5.4			
6	10.9	—3.4	7.5	13.9	"	10.2	12.9	—4.2	8.7	10.0	—5.3	4.7	12.4	"	5.4	10.2	—7.5	2.7
							12.9		8.7				12.5	"	5.5	10.0	—7.7	2.3
7	9.7	"	6.3	12.9	—3.8	9.1	12.9	"	8.7	11.3	—5.4	5.9	12.8	"	5.8	10.7	—7.9	2.8
							12.9		8.7									
8	8.7	—3.3	5.4	12.2	"	8.4	12.9	"	8.7	13.1	—5.5	7.6	14.2	"	7.2	12.4	—8.1	4.3
	7.4	"	4.1				12.7		8.5									
9	6.3	—3.2	3.1	10.1	—3.9	6.2	12.1	"	7.9	15.2	—5.6	9.6	16.0	"	9.0	17.0	—8.3	8.7
	6.6	"	3.4	10.0	"	6.1				15.5	—5.6	9.9						
10	6.6	—3.1	3.5	10.0	"	6.1	10.5	"	6.3	15.5	—5.7	9.8	17.2	"	10.2	19.2	—8.5	10.7
	6.7	"	3.6	10.0	"	6.1	10.5		6.3	15.5	"	9.8	17.5	"	10.5			
11	7.3	"	4.2	10.0	"	6.1	10.0	"	5.8	15.3	—5.8	9.5	17.6	"	10.6	20.7	—8.7	12.0
				10.4		6.5	10.2		6.0							21.5	—8.8	12.7
Noon	9.5	—3.0	6.5	10.4	—4.0	6.4	10.2	—4.3	5.9	15.0	—5.9	9.1	---			18.0	—8.9	9.1
1	10.5	"	7.5	11.3	"	7.3	10.5	"	6.2	14.0	—6.0	8.0				18.3	—9.0	9.3
2	11.8	—3.1	8.7	12.0	"	8.0				11.9	—6.1	5.8				17.3	—9.1	8.2
	12.3	"	9.2															
3	13.2	"	10.1	12.6	"	8.6				11.5	—6.2	5.3				16.0	—9.2	6.8
	13.2	"	10.1							11.4	"	5.2						
4	13.2	—3.2	10.0	12.9	"	8.9				11.3	"	5.1				13.7	"	4.5
	12.7	"	9.5							11.3	—6.3	5.0						
5	11.9	"	8.7	13.3	"	9.3				11.3	"	5.0				12.9	—9.3	3.6
				13.6	"	9.6				11.6	"	5.3						
6	10.4	—3.3	7.1	13.3	"	9.3				11.8	—6.4	5.4				12.6	—9.4	3.2
																12.4	"	3.0
7	9.8	"	6.5	12.7	"	8.7				12.3	—6.5	5.8				12.3	—9.5	2.8
																12.3	"	2.8
8	8.8	"	5.5	12.2	"	8.2				12.9	"	6.4				12.3	—9.6	2.7
																12.3	"	2.7
9	7.7	—3.4	4.3	9.5	"	5.5				13.5	—6.6	6.9				14.0	—9.7	4.3
	7.4	"	4.0															
10	7.3	"	3.9	8.2	"	4.2				15.0	—6.7	8.3				16.5	—9.8	6.7
	7.5	"	4.1	8.1	"	4.1				15.5	"	8.8						
11	7.8	"	4.4	8.1	"	4.1				15.5	"	8.8				19.1	—9.9	9.2
				8.4	"	4.4				15.5	"	8.8						
Midn't	9.2	—3.5	5.7	8.6	—4.1	4.5				15.5	—6.8	8.7				20.5	—10.0	10.5

Observations become irregular.

Observations become irregular.

March 5. Soundings at noon 6 fath., 3 feet, 6 inches. Correction from curves.

" 7. Tide register broke at 9 A. M., was repaired immediately. No sounding.

		Fath.	Feet.	Inch.
" 9.	Sounding at noon	6	4	0
" 10.	" "	7	0	0
" 11.	" "	7	—	—
" 14.	" "	7	5	6
" 15.	" "	8	—	—

March 6. No sounding.

March 8. No sounding.

March 12. No sounding and but a few observations taken.

" 13. But few observations taken.

The corrections after March 7 are derived from curves.

SERIES II.—TIDAL OBSERVATIONS FROM JANUARY 28 TO APRIL 7, 1854.

Hourly observations on the pulley-gauge. Adopted reading of mean level 7.0, expressed in units of the scale. Increasing numbers indicate rise of water.

March, 1854.

Mean solar hour.	16th.	Red. to level.	Ref. obs.	17th.	Red. to level.	Ref. obs.	18th.	Red. to level.	Ref. obs.	19th.	Red. to level.	Ref. obs.	20th.	Red. to level.	Ref. obs.	23d.	Red. to level.	Ref. obs.
	20.5	—10.0	10.5										19.8	—11.0	8.8	Irregular.		
1	20.5	"	10.5	21.4	—9.6	11.8	19.5	—8.8	10.7	21.4	—10.3	11.1	20.9	"	9.9			
	20.5	"	10.5	21.6	"	12.0	20.3	"	11.5									
2	20.0	"	10.0	21.6	"	12.0	20.9	"	12.1	22.2	—10.4	11.8	21.3	"	10.3			
				21.0	"	11.4	20.8	"	12.0	22.7	"	12.3	21.5	"	10.5			
3	17.5	"	7.5	19.8	—9.5	10.3	19.5	"	10.7	22.7	—10.5	12.2	21.7	"	10.7			
										22.7	"	12.2	22.4	"	11.4			
4	15.4	"	5.4	17.5	"	8.0	17.7	—8.7	9.0	22.2	—10.6	11.6	22.4	"	11.4	10.4	—4.0	6.4
													22.4	"	12.4			
5	15.1	—10.1	5.0	16.7	—9.4	7.3	15.9	"	7.2	19.2	"	8.6	22.2	"	11.2	10.5	—4.1	6.4
6	14.8	"	4.7	14.8	"	5.4	12.4	"	3.7	17.0	—10.7	6.3	19.3	"	8.3	11.5	—4.2	7.3
																12.3	"	8.1
7	14.3	"	4.2	12.7	"	3.3	11.2	"	2.5	15.0	"	4.3	19.0	"	8.0	13.2	"	9.0
										14.1	"	3.4				13.7	"	9.5
8	13.9	"	3.8	10.3	"	0.9	10.7	"	2.0	13.4	"	2.7				13.2	—4.3	8.9
	13.3	"	3.2	10.0	—9.3	0.7	10.5	"	1.8	14.1	"	3.4						
9	15.6	"	5.5	11.2	"	1.9	10.3	"	1.6	14.7	—10.8	3.9				12.6	—4.4	8.2
							10.3	"	1.6									
10	16.5	"	6.4	16.0	"	6.7	10.3	"	1.6	16.2	"	5.4				12.0	—4.5	7.5
11	18.3	"	8.2	19.6	—9.2	10.4	13.3	"	4.6	17.2	"	6.4				11.0	—4.7	6.3
Noon	18.3	—10.2	8.1	17.0	?	---	14.6	—8.6	6.0	19.3	"	8.5				11.2	—4.8	6.4
	18.4	"	8.2															
1	18.6	"	8.4	19.6	—9.2	10.4	16.9	"	8.3	20.3	"	9.5				11.1	—5.0	6.1
	18.5	"	8.3													11.1	"	6.1
2	18.5	—10.1	8.4	19.5	"	10.3	18.2	—8.7	9.5	21.5	"	10.7				10.4	—5.1	5.3
							18.1		9.4	21.6	—10.9	10.7				10.5	"	5.4
3	15.0	"	4.9	18.6	—9.1	9.5	18.1	"	9.4	21.6	"	10.7				11.1	—5.2	5.9
										21.6	"	10.7						
4	13.5	—10.0	3.5	17.2	"	8.1	16.0	—8.8	7.2	21.4	"	10.5				11.8	—5.4	6.4
	13.2	"	3.2															
5	13.0	"	3.0	16.8	"	7.7	14.6	—8.9	5.7	20.2	"	9.3				12.2	—5.5	6.7
	13.0	"	3.0															
6	13.0	—9.9	3.1	15.7	—9.0	6.7	14.1	—9.0	5.1	17.2	"	6.3				13.4	—5.6	7.8
	13.0	"	3.1															
7	13.0	"	3.1	14.3	"	5.3	13.1	—9.1	4.0	13.9	"	3.0				13.9	—5.7	8.2
	13.0	"	3.1				12.6	—9.2	3.4	13.7	"	2.8						
8	13.0	"	3.1	12.1	"	3.1	12.4	—9.3	3.1	13.5	"	2.6				14.2	—5.8	8.4
	13.3	"	3.4	10.2	"	1.2	12.5	—9.4	3.1	13.5	"	2.6				14.3	"	8.5
9	14.8	—9.8	5.0	10.4	"	1.4	13.0	—9.6	3.4	13.5	"	2.6				14.0	"	8.2
				11.3	"	2.3				13.5	"	2.6						
10	15.8	"	6.0	13.2	—8.9	4.3	14.2	—9.8	4.4	14.0	"	3.1				13.8	—5.9	7.9
11	18.3	"	8.5	13.6	"	4.7	17.2	—10.0	7.2	18.4	"	7.5				12.2	"	6.3
Midn't	20.0	—9.7	10.3	13.9	"	5.0	19.2	—10.2	9.0	20.9	—11.0	9.9				12.0	—6.0	6.0

Observations irregular.

		Fath.	Feet.	Inch.	
March 16.	Sounding at noon	8	—	—	Corrections from curves.
" 17.	" "	7	5	6	
" 18.	" "	7	3	0	
" 19.	No sounding.				
" 20.	" "				
" 21.	Sounding at noon	6	1	0	
" 22.	" "	6	0	0	
" 23.	No sounding.				

SERIES II.—TIDAL OBSERVATIONS FROM JANUARY 28 TO APRIL 7, 1854.

Hourly observations on the pulley-gauge. Adopted reading of mean level 7.0, expressed in units of the scale. Increasing numbers indicate rise of water.

March, 1854.

Mean solar hour.	24th.	Red. to level.	Ref. obs.	25th.	Red. to level.	Ref. obs.	26th.	Red. to level.	Ref. obs.	27th.	Red. to level.	Ref. obs.	28th.	Red. to level.	Ref. obs.	29th.	Red. to level.	Ref. obs.
																15.5	—3.5	12.0
1	11.3	—6.0	5.3	8.5	—0.1	8.4	9.9	—2.9	7.0	10.2	—1.1	9.1	15.0	—4.7	10.3	15.3	—3.3	12.0
	10.9	"	4.9													14.0	"	10.7
2	10.9	—6.1	4.8	6.5	—0.2	6.3	8.3	—3.0	5.3	8.2	—1.3	6.9	12.4	—4.9	7.5	13.3	—3.2	10.1
	10.9	"	4.8	5.5	"	5.3												
3	11.2	—6.2	5.0	5.5	—0.3	5.2	7.5	—3.2	4.3	6.0	—1.4	4.6	9.7	—5.1	4.6	11.3	—3.1	8.2
				5.5	"	5.2	7.3	—3.3	4.0									
4	12.1	"	5.9	5.5	—0.4	5.1	7.3	—3.4	3.9	4.1	—1.5	2.6	9.0	—5.2	3.8	9.0	—3.0	6.0
				5.6	"	5.2	7.3	—3.5	3.8	3.9	—1.6	2.3						
5	12.9	—6.3	6.6	5.7	—0.5	5.2	7.6	—3.6	4.0	3.9	—1.7	2.2	8.0	—5.3	2.7	7.5	"	4.5
										4.2	—1.8	2.4	7.7	—5.4	2.3	7.1		4.1
6	13.8	"	7.5	8.2	—0.7	7.5	9.2	—3.8	5.4	4.5	—1.9	2.6	7.5	—5.5	2.0	6.5	"	3.5
													8.2	—5.6	2.6	6.5	"	3.5
7	15.0	—6.4	8.6	9.2	—0.8	8.4	11.8	—4.0	7.8	5.3	—2.0	3.3	8.7	—5.7	3.0	6.5	"	3.5
	16.0	"	9.6													7.2	"	4.2
8	16.7	—6.5	10.2	9.9	—1.0	8.9	13.5	—4.2	9.3	8.0	—2.1	5.9	11.2	—5.8	5.4	8.6	"	5.6
	16.4	"	9.9															
9	16.0	—6.6	9.4	11.2	—1.1	10.1	16.0	—4.4	11.6	12.1	—2.2	9.9	16.4	"	10.6	12.8	"	9.8
				11.5	—1.2	10.3	16.2	—4.5	11.7									
10	15.5	—6.7	8.8	11.5	—1.3	10.2	16.2	—4.7	11.5	13.7	—2.4	11.3	16.9	"	11.1	14.9	"	11.9
				11.5	"	10.2	15.5	—4.9	10.6	14.0	—2.5	11.5	17.2	"	11.4			
11	15.0	—6.8	8.2	11.5	—1.4	10.1	14.0	—5.2	8.8	14.0	—2.1	11.9	17.7	"	11.9	16.5	"	13.5
	---			10.5	"	9.1				14.0	—2.7	11.3	17.8	"	12.0			
Noon	8.7	—0.7	8.0	9.5	—1.5	8.0	12.0	—5.5	6.5	13.9	—2.8	11.1	16.0	—5.9	10.1	17.2	—3.0	14.2
							---									17.5	"	14.5
1	7.7	—0.5	7.2	8.7	—1.6	7.1	10.3	?	---	12.6	—2.9	9.7	16.3	"	10.4	17.5	"	14.5
																17.4		14.4
2	5.8	—0.3	5.5	7.7	—1.7	6.0	8.7	"	---	9.4	—3.1	6.3	16.3	—5.8	10.5	16.9	"	13.9
	5.6		5.3															
3	5.6	—0.1	5.5	6.6	—1.9	4.7	6.2	"	---	6.6	—3.2	3.4	16.6	—5.6	11.0	11.0	"	8.0
	5.6	"	5.5															
4	5.6	0.0	5.6	6.3	—2.0	4.3	3.7	0.0	3.7	6.5	—3.4	3.1	12.8	—5.3	7.5	7.7	"	4.7
							3.4	"	3.4	4.9	"	1.5						
5	6.0	"	6.0	6.6	—2.1	4.5	3.5	—0.1	3.4	5.1	—3.5	1.6	11.5	—5.1	6.4	5.0	"	2.0
				7.3	"	5.2				4.9	—3.6	1.3						
6	6.8	"	6.8	7.8	—2.2	5.6	3.9	—0.3	3.6	5.2	—3.7	1.5	10.2	—4.9	5.3	2.9	"	—0.1
													3.5	—4.8	—1.3	2.8	"	—0.2
7	7.6	"	7.6	9.3	—2.3	7.0	4.6	—0.4	4.2	6.9	—3.9	3.0	3.8	—4.7	—0.9	3.2	"	0.2
													5.2	"	0.5			
8	7.7	"	7.7	10.9	—2.4	8.5	6.9	—0.5	6.4	8.6	—4.1	4.5	6.2	—4.6	1.6	5.2	"	2.2
9	8.3	"	8.3	11.4	—2.5	8.9	9.9	—0.6	9.3	12.3	—4.2	8.1	11.6	—4.4	7.2	7.2	"	4.2
				12.0	"	9.5												
10	9.1	"	9.1	12.2	—2.6	9.6	11.2	—0.8	10.4	13.9	—4.3	9.6	12.6	—4.2	8.4	10.5	"	7.5
	9.2	"	9.2	12.0	"	9.4				14.4	"	10.1						
11	9.2	"	9.2	12.0	—2.7	9.3	11.9	—0.9	11.0	14.8	—4.4	10.4	14.6	—4.0	10.6	13.7	"	10.7
	8.7	"	8.7				12.3	"	11.4	15.3	"	10.9						
Midn't	8.4	"	8.4	11.5	—2.8	8.7	11.4	—1.0	10.4	15.2	—4.5	10.7	15.5	—3.7	11.8	15.2	"	12.2

		Fath.	Feet.	Inch.	
March 24.	Sounding at noon	6	2	6	
" 25.	" "	6	3	6	
" 26.	" "	7	0	0	
" 27.	No sounding.				
" 28.	Sounding at noon	7	4	0	Correction by sounding —6.6, by curve —5.2, mean —5.9
" 29.	" "	7	5	6	

Series II.—Tidal Observations from January 28 to April 7, 1854.

Hourly observations on the pulley-gauge. Adopted reading of mean level 7.0, expressed in units of the scale. Increasing numbers indicate rise of water.

	March, 1854.						April, 1854.											
Mean solar hour.	30th.	Red. to level.	Ref. obs.	31st.	Red. to level.	Ref. obs.	4th.	Red. to level.	Ref. obs.	5th.	Red. to level.	Ref. obs.	6th.	Red. to level.	Ref. obs.	7th.	Red. to level.	Ref. obs.
	15.3	—3.0	12.3							8.3	—3.0	5.3	7.5	—1.7	5.8	7.0	—1.5	5.5
1	15.3	"	12.3	13.8	—3.0	10.8	---			9.6	"	6.6	7.8	"	6.1	7.5	"	6.0
	15.4	"	12.4	14.5	"	11.5												
2	15.5	"	12.5	14.5	"	11.5	---			10.5	—2.9	7.6	8.4	—1.6	6.8	7.5	"	6.0
	15.3	"	12.3	13.2	"	10.2												
3	14.6	"	11.6	12.0	"	9.0	---			11.2	—2.8	8.4	9.6	"	8.0	7.5	"	6.0
4	13.6	"	10.6	9.7	"	6.7	---			11.8	"	9.0	10.0	"	8.4	8.0	"	6.5
5	11.8	"	8.8	7.0	"	4.0	---			12.2	—2.7	9.5	10.4	"	8.8	8.6	"	7.1
										12.4	"	9.7	10.4	"	8.8			
6	9.4	"	6.4	5.6	"	2.6	---			12.4	"	9.7	10.4	"	8.8	9.8	"	8.3
																9.9	"	8.4
7	6.9	"	3.9	5.0	"	2.0	---			11.2	—2.6	8.6	10.4	"	8.8	10.0	"	8.5
				4.7	"	1.7							10.4	"	8.8	10.0	"	8.5
8	6.3	"	3.3	4.5	"	1.5	---			9.2	—2.5	6.7	10.4	"	8.8	10.0	"	8.5
				5.0	"	2.0							10.2	"	8.6	10.0	"	8.5
9	7.2	"	4.2	6.0	"	3.0	---			8.1	"	5.6	10.0	"	8.4	10.0	"	8.5
																10.0	"	8.5
10	10.1	"	7.1	8.0	"	5.0	---			7.4	—2.4	5.0	9.1	"	7.5	9.5	"	8.0
										7.4	"	5.0						
11	12.9	"	9.9	10.1	"	7.1	---			7.4	"	5.0	8.5	"	6.9	8.8	"	7.3
	15.2	"	12.2							7.4	"	5.0						
Noon	16.5	"	13.5	11.9	"	8.9	9.0	—4.0	5.0	8.0	—2.3	5.7	8.0	—1.5	6.5	8.5	—1.5	7.0
	16.1	"	13.1															
1	15.3	"	12.3	14.7	"	11.7	9.7	"	5.7	8.6	"	6.3	7.5	"	6.0	7.0	"	5.5
				16.0	"	13.0										7.0	"	5.5
2	13.3	"	10.3	15.8	"	12.8	11.0	—3.9	7.1	8.9	—2.2	6.7	7.5	"	6.0	7.0	"	5.5
				16.0	"	13.0							7.5	"	6.0	7.0	"	5.5
3	12.3	"	9.3	15.2	"	12.2	11.3	"	7.4	8.9	—2.1	6.8	7.5	"	6.0	7.0	"	5.5
							12.3	—3.8	8.5							7.0	"	5.5
4	8.1	"	5.1	14.7	"	11.7	13.1	"	9.3	8.9	"	6.8	7.5	"	6.0	7.0	"	5.5
							12.9	—3.7	9.2									
5	7.0	"	4.0	12.9	"	9.9	11.7	"	8.0	8.6	—2.0	6.6	7.9	"	6.4	7.5	"	6.0
										8.9	"	6.9						
6	5.5	"	2.5	10.8	"	7.8	9.9	—3.6	6.3	8.9	"	6.9	8.0	"	6.5	8.1	"	6.6
										8.7	—1.9	6.8						
7	4.4	"	1.4	11.5	"	8.5	9.0	"	5.4	8.7	"	6.8	8.0	"	6.5	8.7	"	7.2
	4.3	"	1.3															
8	4.3	"	1.3	8.4	—2.9	5.5	8.0	—3.5	4.5	8.1	"	6.2	8.0	"	6.5	9.0	"	7.5
	4.4	"	1.4	7.0	"	4.1												
9	6.8	"	3.8	6.1	—2.8	3.3	8.2	—3.4	4.8	8.0	—1.8	6.2	8.2	"	6.7	9.0	"	7.5
				7.6	"	4.8	7.8	"	4.4							9.0	"	7.5
10	10.3	"	7.3	8.8	—2.7	6.1	7.5	—3.3	4.2	7.5	"	5.7	7.8	"	6.3	9.0	"	7.5
							7.5	"	4.2	7.5	"	5.7				9.0	"	7.5
11	12.2	"	9.2	11.4	—2.6	8.8	7.5	—3.2	4.3	7.5	"	5.7	7.3	"	5.8	9.0	"	7.5
				12.2	"	9.6	7.7	"	4.5	7.5	"	5.7	7.0	"	5.5			
Midn't	13.1	"	10.1	13.0	—2.5	10.5	8.3	—3.1	5.2	7.5	—1.7	5.8	7.0	"	5.5	9.0	"	7.5
				12.4	"	9.9												

		Fath.	Feet.	Inch.	
March 30.	Sounding at noon	7	4	6	Correction by curves preferred.
" 31.	No sounding,				
April 1-3.	" "				
" 4.	Sounding at noon	6	3	0	Corrections derived from curves, readings (heights) not reliable, see preceding note of April 14.
" 5.	" "	6	2	0	
" 6.	" "	6	2	6	
" 7.	" "	6	2	6	

SERIES III.—TIDAL OBSERVATIONS FROM APRIL 20 TO AUGUST 3, 1854.

Hourly observations on the pulley-gauge. Adopted reading of mean level 7.0, expressed in units of the scale. Increasing numbers indicate rise of water.

April, 1854.

Mean solar hour.	20th.	Red. to level.	Ref. obs.	21st.	Red. to level.	Ref. obs.	22d.	Red. to level.	Ref. obs.	23d.	Red. to level.	Ref. obs.	24th.	Red. to level.	Ref. obs.	25th.	Red. to level.	Ref. obs.
				6.7	—2.2	4.5	7.8	—3.5	4.3									
1				7.3	"	5.1	7.5	"	4.0	10.0	—4.2	5.8	9.4	—4.0	5.4	11.1	—3.5	7.6
							7.5	"	4.0									
2				7.9	—2.3	5.6	7.7	—3.6	4.1	9.9	"	5.7	7.5	"	3.5	8.8	"	5.3
										8.5	"	4.3						
3				9.0	—2.4	6.6	7.9	"	4.3	8.3	"	4.1	6.7	"	2.7	7.5	"	4.0
										8.5	"	4.3	6.5	"	2.5			
4				10.2	"	7.8	8.9	—3.7	5.2	8.7	"	4.5	6.5	—3.9	2.6	6.4	—3.4	3.0
													6.7	"	2.8	5.8	"	2.4
5				11.4	—2.5	8.9	9.7	"	6.0	10.2	"	6.0	7.1	"	3.2	5.0	"	1.6
																6.0	"	2.6
6	Irregular.			12.1	"	9.6	12.2	—3.8	8.4	11.8	"	7.6	8.8	"	4.9	7.0	"	3.6
7				12.5	—2.6	9.9	13.3	"	9.5	13.2	"	9.0	10.5	"	6.6	8.5	"	5.1
				12.6	"	10.0	13.7	"	9.9	14.0	"	9.8						
8				12.5	—2.7	9.8	14.3	—3.9	10.4	14.9	"	10.7	12.9	"	9.0	10.9	—3.3	7.6
							14.0	"	10.1	14.9	"	10.7	15.0	"	11.1			
9	11.3	—1.0	10.3	11.0	—2.8	8.2	13.7	"	9.8	13.0	"	8.8	15.0	"	11.1	13.4	"	10.1
																14.5	"	11.2
10	8.3	—1.1	7.2	9.9	"	7.1	12.3	"	8.4	8.1	?	---	14.9	"	11.0	15.5	"	12.2
																15.3	"	12.0
11	6.7	—1.2	5.5	8.5	—2.9	5.6	11.3	"	7.4	10.7	"	---	14.6	"	10.7	14.1	"	10.8
	6.4	"	5.2															
Noon	6.4	—1.3	5.1	7.9	—3.0	4.9	10.7	—4.0	6.7	11.5	—4.3	7.2	12.9	—3.8	9.1	12.5	—3.2	9.3
	6.4	"	5.1	7.4	"	4.4												
1	6.7	"	5.4	7.0	"	4.0	8.7	"	4.7	9.5	"	5.2	10.6	"	6.8	10.3	"	7.1
				7.0	"	4.0												
2	7.1	—1.4	5.7	7.0	—3.1	3.9	8.3	"	4.3	8.3	"	4.0	9.0	"	5.2	8.3	"	5.1
				7.4	"	4.3	8.0	"	4.0									
3	7.9	"	6.5	8.0	"	4.9	8.0	"	4.0	7.2	—4.2	3.0	7.4	"	3.6	6.9	"	3.7
							8.0	"	4.0	6.6	"	2.4						
4	9.0	—1.5	7.5	8.8	—3.2	5.6	8.0	"	4.0	6.1	"	1.9	6.1	—3.7	2.4	5.2	"	2.0
							8.3	"	4.3	6.0	"	1.8	5.4	"	1.7	5.0	"	1.8
5	9.5	"	8.0	8.5	"	5.3	9.0	—4.1	4.9	6.5	—4.1	2.4	5.7	"	2.0	5.0	"	1.8
	9.7	"	8.2													5.0	"	1.8
6	9.7	—1.6	8.1	9.2	—3.3	5.9	10.8	"	6.7	7.5	"	3.4	8.1	"	4.4	5.2	"	2.0
	9.7	"	8.1	10.1	"	6.8												
7	9.5	"	7.9	10.5	"	7.2	11.5	"	7.4	9.3	"	5.2	9.0	"	5.3	7.5	"	4.3
				10.5	"	7.2												
8	8.8	—1.7	7.1	10.5	"	7.2	12.5	"	8.4	10.8	"	6.7	10.4	—3.6	6.8	9.7	—3.1	6.6
				10.5	"	7.2												
9	7.9	—1.8	6.1	10.5	—3.4	7.1	13.0	"	8.9	12.0	"	7.9	13.5	"	9.9	---		---
				10.0	"	6.6	13.9	"	9.8	12.8	"	8.7	13.5	"	9.9			
10	7.0	—1.9	5.1	9.1	"	5.7	13.9	"	9.8	13.6	—4.0	9.6	13.5	"	9.9	---		---
							13.0	—4.2	8.8	13.6	"	9.6	12.5	"	8.9			
11	6.9	—2.0	4.9	8.4	"	5.0	12.0	"	7.8	13.0	"	9.0	12.0	"	8.4	---		---
Midn't	6.9	—2.1	4.8	7.9	—3.5	4.4	11.3	"	7.1	9.0	"	5.0	11.5	—3.5	8.0	---		---

April 20. No sounding.

		Fath.	Feet.	Inch.
" 21.	Sounding at noon	6	1	0
" 22.	" "	6	3	0
" 23.	" "	6	3	6
" 24.	" "	6	4	5
" 25.	" "	7	0	6

The corrections were deduced from the curves.

SERIES III.—TIDAL OBSERVATIONS FROM APRIL 20 TO AUGUST 3, 1854.

Hourly observations on the pulley-gauge. Adopted reading of mean level 7.0, expressed in units of the scale. Increasing numbers indicate rise of water.

	April, 1854.															May, 1854.		
Mean solar hour.	26th.	Red. to level.	Ref. obs.	27th.	Red. to level.	Ref. obs.	28th.	Red. to level.	Ref. obs.	29th.	Red. to level.	Ref. obs.	30th.	Red. to level.	Ref. obs.	1st.	Red. to level.	Ref. obs.
				14.4	"	11.4				16.4	—3.4	13.0	16.4	—3.6	12.8	16.2	"	12.3
1	10.1	—3.0	7.1	14.5	—3.0	11.5	9.2	—3.0	6.2	16.0	"	12.6	15.3	"	11.7	16.5	"	12.6
				14.1	"	11.1										16.5	"	12.6
2	9.1	"	6.1	12.8	"	9.8	7.8	"	4.8	14.9	"	11.5	12.8	"	9.2	15.9	—4.0	11.9
3	7.1	"	4.1	10.5	"	7.5	7.0	"	4.0	13.1	"	9.7	10.3	"	6.7	14.7	"	10.7
	6.3	"	3.3															
4	5.6	"	2.6	8.3	"	5.3	6.0	"	3.0	11.7	"	8.3	7.6	"	4.0	13.4	"	9.4
	5.8	"	2.8				5.3	"	2.3									
5	6.3	"	3.3	6.8	"	3.8	5.0	"	2.0	9.8	"	6.4	6.2	"	2.6	12.2	"	8.2
							5.1	"	2.1				5.5	"	1.9			
6	7.3	"	4.3	4.7	"	1.7	5.7	"	2.7	8.0	"	4.6	6.2	"	2.6	10.0	"	6.0
				4.0	"	1.0												
7	8.5	"	5.5	4.0	"	1.0	6.6	—3.1	3.5	5.9	"	2.5	7.7	"	4.1	8.9	"	4.9
				5.9	"	2.9				5.5	"	2.1						
8	9.4	"	6.4	8.7	"	5.7	7.5	"	4.4	6.2	"	2.8	9.1	"	5.5	8.2	"	4.2
																8.9	"	4.0
9	10.6	"	7.6	10.9	"	7.9	8.8	"	5.7	8.3	"	4.9	10.1	"	6.5	7.9	"	3.9
																8.4	"	4.4
10	11.4	"	8.4	12.7	"	9.7	10.3	"	7.2	10.9	"	7.5	11.2	"	7.6	9.7	"	5.7
11	13.9	"	10.9	14.4	"	11.4	11.7	"	8.6	13.5	"	10.1	13.0	"	9.4	11.9	"	7.9
	14.4	"	11.4	14.5	"	11.5				14.6	"	11.2						
Noon	15.0	"	12.0	15.1	"	12.1	13.7	—3.2	10.5	15.5	—3.5	12.0	14.7	—3.7	11.0	13.1	—4.1	9.0
	14.0	"	11.0	15.2	"	12.2	14.5	"	11.3	14.5	"	11.0	15.0	"	11.3	13.5	"	9.4
1	13.1	"	10.1	15.0	"	12.0	14.8	"	11.6	13.2	"	9.7	14.4	"	10.7	13.0	"	8.9
							14.4	"	11.2									
2	10.7	"	7.7	12.4	"	9.4	14.3	"	11.1	10.9	"	7.4	12.6	"	8.9	11.3	"	7.2
3	8.7	"	5.7	10.3	"	7.3	12.4	"	9.2	9.6	"	6.1	10.2	"	6.5	10.2	—4.2	6.0
4	6.1	"	3.1	7.3	"	4.3	9.2	"	6.0	7.1	"	3.6	8.0	"	4.3	9.8	"	5.6
				6.2	"	3.2							6.3	"	2.6			
5	4.1	"	1.1	5.2	"	2.2	6.0	"	2.8	5.3	—3.5	1.8	5.5	—3.8	1.7	9.1	"	4.9
				5.9	"	2.9				5.0	"	1.5	5.5	"	1.7	8.6	"	4.4
6	3.2	"	0.2	7.7	"	4.7	5.5	"	2.3	5.1	"	1.6	6.2	"	2.4	8.0	"	3.8
	3.1	"	0.1				5.3	"	2.1							8.0	"	3.8
7	4.6	"	1.6	9.6	"	6.6	5.3	—3.3	2.0	7.1	"	3.6	7.6	"	3.8	8.0	—4.3	3.7
							6.1	"	2.8							8.4	"	4.1
8	7.2	"	4.2	10.8	"	7.8	7.8	"	4.5	8.6	"	5.1	8.5	"	4.7	8.8	"	4.5
9	10.7	"	7.7	12.3	"	9.3	10.2	"	6.9	10.4	"	6.9	9.5	"	5.7	10.2	"	5.9
10	12.3	"	9.3	14.0	"	11.0	12.8	"	9.5	13.4	"	9.9	11.3	"	7.5	11.3	"	7.0
11	14.2	"	11.2	15.7	?	---	14.8	"	11.5	15.3	"	11.8	13.9	—3.9	10.0	12.7	"	8.4
										16.2	"	12.7						
Midn't	14.3	"	11.3	16.7	"	---	15.5	—3.3	12.2	16.4	"	12.9	15.4	"	11.5	14.1	—4.4	9.7

	Fath.	Feet.	Inch.	
April 26. Sounding at noon	7	3	0	Corrections deduced from the curves.
" 27. " "	7	3	2	" " " "
" 28–30. No sounding.				
May 1. Sounding at noon	7	4	0	

SERIES III.—TIDAL OBSERVATIONS FROM APRIL 20 TO AUGUST 3, 1854.

Hourly observations on the pulley-gauge. Adopted reading of mean level 7.0, expressed in units of the scale. Increasing numbers indicate rise of water.

May, 1854.

Mean solar hour.	2d.	Red. to level.	Ref. obs.	3d.	Red. to level.	Ref. obs.	4th.	Red. to level.	Ref. obs.	7th.	Red. to level.	Ref. obs.	8th.	Red. to level.	Ref. obs.	9th.	Red. to level.	Ref. obs.
										10.2	—4.2	6.0	10.5	—4.8	5.7			
1	15.1	—4.4	10.7	13.2	"	8.5	13.6	—5.2	8.4	10.2	"	6.0	10.0	"	5.2	10.7	—5.5	5.2
										10.5	"	6.3	11.5	"	6.7	10.0	"	4.5
2	16.7	"	12.3	14.0	"	9.3	14.0	—5.3	8.7	10.8	"	6.6	11.5	—4.9	6.6	10.0	—5.6	4.4
	16.8	"	12.4													10.5	"	4.9
3	16.5	"	12.1	14.2	"	9.5	14.8	—5.4	9.4	11.3	"	7.1	11.8	"	6.9	11.3	"	5.7
				14.3	"	9.6												
4	14.2	—4.5	9.7	14.3	"	9.6	16.1	—5.6	10.5	11.8	"	7.6	12.4	"	7.5	12.6	—5.7	6.9
				14.2	"	9.5												
5	12.5	"	8.0	14.1	"	9.4	16.2	—5.8	10.4	12.4	"	8.2	13.0	"	8.1	14.3	"	8.6
6	11.0	"	6.5	13.1	"	8.4	16.2	—6.0	10.2	13.2	—4.3	8.9	14.1	—5.0	9.1	15.6	"	9.9
							15.7	—6.1	9.6									
7	8.4	"	3.9	12.0	"	7.3	15.3	—6.3	9.0	13.2	"	8.9	16.2	"	11.2	16.4	—5.8	10.6
																16.9	"	11.1
8	6.7	"	2.2	10.9	"	6.2				13.0	"	8.7	16.0	"	11.0	17.2	—5.9	11.3
	6.4	"	1.9	10.2	"	5.5							16.5	"	11.5	17.2	"	11.3
9	6.4	—4.6	1.8	10.0	"	5.3				12.2	"	7.9	16.5	—5.1	11.4	17.2	—6.0	11.2
				10.3	"	5.6							16.3	"	11.2	16.6	"	10.6
10	7.4	"	2.8	10.5	"	5.8				11.0	"	6.7	16.0	"	10.9	16.0	—6.1	9.9
				10.8	"	6.1												
11	9.5	"	4.9	11.0	"	6.3				10.2	"	5.9	15.1	"	10.0	14.9	—6.2	8.7
Noon	11.3	—4.7	6.6	11.4	4.7	6.7				9.0	—4.4	4.6	14.1	—5.2	8.9	13.8	—6.3	7.5
1	13.1	"	8.4	12.8	"	8.1				8.1	"	3.7	13.0	"	7.8	?	"	---
				13.4	"	8.7				8.0	"	3.6						
2	14.9	"	10.2	13.8	"	9.1				8.0	"	3.6	10.6	"	5.7	11.2	"	4.9
	15.0	"	10.3	13.8	"	9.1				8.0	"	3.6						
3	14.5	"	9.8	13.8	"	9.1				8.4	"	4.0	9.0	—5.3	3.7	10.0	—6.2	3.8
				13.8	"	9.1							8.4	"	3.1	9.3	"	3.1
4	13.6	"	8.9	13.8	"	9.1				9.0	—4.5	4.5	8.0	"	2.7	8.0	"	1.8
				13.1	"	8.4							8.7	"	3.4	8.0	"	1.8
5	12.6	"	7.9	12.7	"	8.0				9.8	"	5.3	9.0	—5.4	3.6	8.9	"	2.7
6	10.1	"	5.4	12.1	—4.8	7.3				10.3	"	5.8	10.2	"	4.8	11.2	—6.1	5.1
7	9.5	"	4.8	11.8	"	7.0				11.0	—4.6	6.4	11.6	"	6.2	13.0	"	6.9
8	9.0	"	4.3	11.6	—4.9	6.7				11.3	"	6.7	12.3	"	6.9	14.2	"	8.1
	9.0	"	4.3	11.6	"	6.7												
9	9.0	"	4.3	11.4	"	6.5				12.0	"	7.4	12.9	"	7.5	15.5	"	9.4
	9.1	"	4.4	11.6	"	6.7				12.5	"	7.9	13.3	"	7.9			
10	9.5	"	4.8	12.0	—5.0	7.0				12.5	—4.7	7.8	13.5	"	8.1	14.6	"	8.5
										12.5	"	7.8	13.5	"	8.1			
11	10.1	"	5.4	12.7	"	7.7				12.0	"	7.3	13.3	"	7.9	14.0	"	7.9
Midn't	11.1	"	6.4	13.3	—5.1	8.2				10.5	—4.8	5.7	12.7	—5.5	7.2	13.5	—6.0	7.5

Readings irregular.

		Fath.	Feet.	Inch.	
May 2.	Sounding at noon	7	1	0	Correction derived from sounding and curves.
" 3.	" "	7	2	0	" " " " "
" 4.	" "	7	1	0	
" 5.	" "	6	5	0	From this day there is but one reading at each half hour.
" 6.	No sounding.				
" 7.	Sounding at noon	6	3	0	
" 8.	" "	7	2	0	
" 9.	" "	7	1	6	Correction from sounding and curves.

SERIES III.—TIDAL OBSERVATIONS FROM APRIL 20 TO AUGUST 3, 1854.

Hourly observations on the pulley-gauge. Adopted reading of mean level 7.0, expressed in units of the scale. Increasing numbers indicate rise of water.

May, 1854.

Mean solar hour.	10th.	Red. to level.	Ref. obs.	11th.	Red. to level.	Ref. obs.	12th.	Red. to level.	Ref. obs.	13th.	Red. to level.	Ref. obs.	14th.	Red. to level.	Ref. obs.	15th.	Red. to level.	Ref. obs.
				17.0	"	10.8										20.6	—6.7	13 9
1	12.5	—6.0	6.5	16.5	—6.3	10.2	17.4	—6.3	11.1	17.3	—6.5	10.8	18.3	—6.7	11.6	20.6	"	13.9
																19.7	"	13.0
2	9.8	"	3.8	13.7	"	7.4	16.0	"	9.7	16.1	"	9.6	16.2	"	9.5	18.8	"	12.1
3	9.5	"	3.5	11.5	"	5.2	13.7	"	7.4	15.3	"	8.8	12.3	"	5.6	17.6	"	10.9
4	8.3	"	2.3	9.6	"	3.3	10.8	"	4.5	14.0	"	7.5	9.9	"	3.2	16.5	"	9.8
	8.2	"	2.2	8.2	"	1.9												
5	8.0	"	2.0	8.3	"	2.0	8.4	"	2.1	---		---	---		---	15.4	"	8.7
	8.0	"	2.0				7.3	"	1.0									
6	8.0	"	2.0	9.5	"	3.2	7.3	"	1.0	---		---	---		---	10.4	"	3.7
	8.5	—6.1	2.4				9.2	"	2.9									
7	9.2	"	3.1	11.8	"	5.5	10.4	"	4.1	---		---	---		---	9.0	"	2.3
																8.4	"	1.7
8	11.7	"	5.6	15.4	"	9.1	12.3	"	6.0	---		---	---		---	9.0	"	2.3
9	12.5	"	6.4	15.0	"	8.7	14.2	"	7.9	16.5	—6.6	9.9	12.3	"	5.6	10.4	"	3.7
10	14.4	"	8.3	16.0	"	9.7	15.4	"	9.1	18.4	"	11.8	13.5	"	6.8	12.6	"	5.9
	15.0	"	8.9	16.8	"	10.5				19.0	"	12.4						
11	15.0	"	8.9	16.8	"	10.5	16.0	"	9.7	19.0	"	12.4	15.2	"	8.5	14.5	"	7.8
	14.2	"	8.1	16.8	"	10.5	16.5	"	10.2	18.4	"	11.8	17.8	"	11.1			
Noon	13.4	—6.2	7.2	16.0	—6.3	9.7	17.2	—6.2	11.0	18.0	—6.7	11.3	18.0	"	11.3	16.6	"	9.9
							16.9	"	10.7				17.4	"	10.7			
1	12.3	"	6.1	14.6	"	8.3	16.4	"	10.0	16.4	"	9.7	16.6	"	9.9	18.9	"	12.2
																19.0	"	12.3
2	10.3	"	4.1	13.0	"	6.7	13.4	"	7.2	14.4	"	7.7	14.7	"	8.0	19.0	"	12.3
	9.7	"	3.5													18.1	"	11.4
3	8.4	"	2.2	12.1	"	5.8	9.0	"	2.8	12.0	"	5.3	12.5	"	5.8	17.3	"	10.6
	8.4	"	2.2				8.3	"	2.1									
4	8.4	"	2.2	9.7	"	3.4	7.2	—6.3	0.9	9.8	"	3.1	10.6	"	3.9	15.5	"	8.8
	9.2	"	3.0	8.6	"	2.3				8.9	"	2.2						
5	10.3	"	4.1	7.6	"	1.3	7.2	"	0.9	8.0	"	1.3	9.0	"	2.3	12 3	"	5.6
				9.2	"	2.9	8.1		1.8	8.0	"	1.3	8.2	"	1.5			
6	11.0	"	4.8	10.3	"	4.0	9.5	"	3.2	9.3	"	2.6	7.5	"	0.8	10.3	"	3.6
													7.5	"	0.8			
7	12.7	"	6.5	12.4	"	6.1	10.7	"	4.4	11.1	"	4.4	8.0	"	1.3	7.9	"	1.2
																7.5	"	0.8
8	14.5	"	8.3	15.0	"	8.7	13.7	—6.4	7.3	12.9	"	6.2	10.2	"	3.5	7.2	"	0.5
																7.2	"	0.5
9	15.4	"	9.2	17.4	"	11.1	15.5	"	8.1	14.5	"	7.8	11.8	"	5.1	9.3	"	2.6
10	16.2	"	10.0	19.5	"	13.2	18.2	"	11.8	17.4	"	10.7	14.7	"	8.0	12.1	—6.8	5.3
				20.0	"	13.7												
11	17.1	"	10.9	20.0	"	13.7	19.5	"	13.1	20.3	"	13.6	18.2	"	11.5	16.5	—6.9	9.6
	17.8	"	11.6	19.6	"	13.3				20.1	"	13.4						
Midn't	18.0	"	11.8	18.8	"	12.5	19.5	"	13.1	20.1	"	13.4	20.2	"	13.5	19.0	—7.0	12.0

May 10 and 11. No sounding.

" 12. Sounding at noon 8 fathoms (last sounding recorded). Correction by sounding and curves.

SERIES III.—TIDAL OBSERVATIONS FROM APRIL 20 TO AUGUST 3, 1854.

Hourly observations on the pulley-gauge. Adopted reading of mean level 7.0, expressed in units of the scale. Increasing numbers indicate rise of water.

May, 1854.

Mean solar hour.	16th.	Ref. obs.	17th.	Ref. obs.	18th.	Ref. obs.	19th.	Ref. obs.	20th.	Ref. obs.	21st.	Ref. obs.	22d.	Ref. obs.	23d.	Ref. obs.	24th.	Ref. obs.
	19.6	12.4							12.0	5.2			10.3	3.4				
1	19.6	12.4	18.0	10.8	17.6	10.4	14.0	6.9	12.3	5.5	12.0	5.2	10.3	3.4	13.0	5.6	16.2	7.5
	19.0	11.8									11.6	4.8	10.3	3.4				
2	18.5	11.3	19.4	11.2	19.0	11.8	15.0	7.9	13.2	6.4	11.2	4.4	10.3	3.4	12.2	4.8	15.1	6.3
			20.0	12.8	19.7	12.5					11.2	4.4	10.3	3.4	11.3	3.8		
3	17.0	9.8	20.0	12.8	19.7	12.5	16.4	9.3	14.1	7.3	12.5	5.7	10.8	3.9	11.0	3.5	14.2	5.4
			18.9	11.7	19.7	12.5									11.5	4.0	13.8	4.9
4	16.0	8.8	18.0	10.8	19.7	12.5	17.7	10.6	15.2	8.5	14.2	7.4	11.5	4.6	12.0	4.4	13.0	4.1
					19.7	12.5	18.8	11.7									13.0	4.0
5	14.4	7.2	16.2	9.0	19.7	12.5	18.8	11.7	15.5	8.8	15.6	8.8	13.8	5.9	13.7	6.1	13.0	4.0
					18.6	11.4	18.8	11.7									13.5	4.5
6	12.5	5.3	14.3	7.1	17.8	10.6	18.8	11.7	15.5	8.8	16.8	10.0	15.2	8.2	15.2	7.5	14.2	5.1
							18.0	11.0	16.5	9.8	17.4	10.6	16.5	9.5				
7	10.0	2.8	12.6	5.4	15.8	8.6	17.4	10.4	16.5	9.8	17.9	11.1	17.6	10.6	17.2	9.5	16.6	7.5
	9.5	2.3							16.5	9.8	17.9	11.1	17.6	10.6	18.2	10.4	17.8	8.6
8	9.0	1.8	11.3	4.1	14.3	7.1	16.0	9.0	16.5	9.8	17.9	11.1	17.6	10.6	19.1	11.3	18.6	9.4
	9.7	2.5	10.2	3.0					15.8	9.1	17.6	10.8	17.6	10.6	19.1	11.2	18.1	9.9
9	10.0	2.8	9.0	1.8	13.0	5.8	14.4	7.4	14.9	8.2	17.0	10.2	17.0	10.6	18.7	10.8	17.8	8.5
			10.2	3.0														
10	10.9	3.7	11.1	3.9	10.0	2.8	12.4	5.4	13.6	6.9	15.7	8.9	16.5	9.5	17.5	9.5	16.7	7.4
					9.0	1.8												
11	12.4	5.2	13.4	6.2	9.0	1.8	11.7	4.7	12.8	6.1	14.6	7.8	15.1	8.1	16.0	8.0	15.1	5.8
					10.3	3.1	10.6	3.6										
Noon	14.3	7.1	14.6	7.4	11.6	4.4	10.0	3.0	12.1	5.4	12.8	6.0	13.7	6.7	15.3	7.3	14.5	5.2
							10.5	3.5										
1	16.2	9.0	15.9	8.7	14.0	6.8	10.8	3.8	11.5	4.8	11.2	4.4	12.0	5.0	14.2	6.2	13.8	4.5
	17.0	9.8									10.8	4.0						
2	17.6	10.4	17.6	10.4	15.2	8.0	11.8	4.8	11.0	4.3	10.5	3.7	11.0	4.0	13.0	5.0	13.1	3.8
	17.6	10.4	17.8	10.6					10.5	3.8	10.5	3.7	10.4	3.4				
3	17.6	10.4	17.8	10.6	16.3	9.1	12.8	5.8	10.5	3.8	10.5	3.7	9.5	2.5	12.0	3.9	12.1	2.8
			16.7	9.5	16.8	9.6			10.5	3.8	11.0	4.2	9.5	2.5	11.5	3.4	12.1	2.8
4	16.3	9.1	16.0	8.8	16.8	9.6	14.2	7.2	10.8	4.1	11.7	4.9	11.0	4.0	11.5	3.3	11.3	2.0
					15.8	8.6									11.5	3.3	11.3	2.0
5	14.4	7.2	14.0	6.8	15.6	8.4	15.7	8.7	12.7	6.0	12.6	5.8	11.7	4.7	12.4	4.0	12.5	3.2
							16.5	9.5										
6	12.0	4.8	12.8	5.6	14.0	6.8	17.2	10.2	14.3	7.6	13.7	6.9	13.1	6.1	14.0	5.6	14.2	4.9
	10.8	3.6					17.2	10.2										
7	9.5	2.3	10.6	3.4	13.3	6.1	16.5	9.5	14.9	8.2	14.5	7.7	14.1	7.0	15.5	7.0	16.5	7.3
	9.5	2.3	10.0	2.8					15.2	8.5	15.0	8.2						
8	9.8	2.6	9.2	2.0	12.4	5.2	15.7	8.7	15.4	8.7	15.4	8.6	16.4	9.3	16.6	8.1	18.4	9.2
			9.2	2.0	12.0	4.9			15.4	8.7	15.4	8.6	16.5	9.3				
9	11.7	4.5	10.4	3.2	11.3	4.2	15.0	8.1	15.4	8.7	15.4	8.6	16.5	9.3	18.3	9.7	19.4	10.2
					11.3	4.2			14.6	7.9	15.2	8.4	16.5	9.3	19.4	10.8		
10	13.5	6.3	12.0	4.8	11.5	4.4	14.0	7.1	14.2	7.4	14.7	7.9	16.5	9.3	20.0	11.4	20.1	10.9
					11.8	4.7							16.5	9.2	20.0	11.4		
11	15.3	8.1	13.6	6.4	12.4	5.3	13.0	6.1	13.3	6.5	14.0	7.2	16.3	9.0	19.2	10.6	21.4	12.2
																	22.1	12.9
Midn't	16.7	9.5	14.8	7.6	12.8	5.7	12.5	5.7	12.4	5.6	12.6	5.8	15.0	7.7	18.0	9.3	22.1	12.9

From about the middle of May to the end of the series the corrections change very little from day to day, and are given below:—

May 16.	Correction	—7.2	
" 17.	"	—7.2	
" 18.	"	—7.2	
" 19.	"	—7.0	
" 20.	"	—6.7	
May 21.	Correction	—6.8	
" 22.	"	—7.0	
" 23.	"	—8.0	
" 24.	"	—9.3	

SERIES III.—TIDAL OBSERVATIONS FROM APRIL 20 TO AUGUST 3, 1854.

Hourly observations on the pulley-gauge. Adopted reading of mean level 7.0, expressed in units of the scale. Increasing numbers indicate rise of water.

	May, 1854.														June, 1854.			
Mean solar hour.	25th.	Ref. obs.	26th.	Ref. obs.	27th.	Ref. obs.	28th.	Ref. obs.	29th.	Ref. obs.	30th.	Ref. obs.	31st.	Ref. obs.	1st.	Ref. obs.	2d.	Ref. obs.
	19.8	10.6	17.4	8.5	21.2	12.5	19.0	10.7			19.0	11.5						
1	19.0	9.8	16.6	7.7	21.2	12.5	19.0	10.7	18.4	10.8	19.5	12.0	16.4	8.9	18.2	10.7	15.4	8.0
					19.6	10.9	18.6	10.4			18.6	11.1			18.4	10.9		
2	17.0	7.9	14.3	5.4	18.7	10.1	17.3	9.1	16.4	8.8	18.1	10.6	17.9	10.4	18.5	11.0	16.1	8.7
													18.5	11.0	18.5	11.0		
3	14.5	5.4	12.4	3.6	16.0	7.4	15.5	7.4	14.3	6.7	17.2	9.5	19.0	11.5	18.2	10.7	17.0	9.6
			11.8	3.0									19.0	11.5			17.2	9.8
4	12.0	2.9	11.5	2.7	14.7	6.1	12.4	4.3	12.1	4.5	16.1	8.6	18.2	10.7	17.8	10.3	17.2	9.8
	11.0	2.0	11.5	2.7													17.2	9.8
5	11.0	2.0	11.5	2.7	12.5	3.9	10.8	2.8	10.0	2.5	14.3	6.8	17.2	9.7	16.2	8.7	17.0	9.7
	11.0	2.0	11.5	2.7	11.2	2.6	10.0	2.0	9.0	1.5								
6	11.5	2.5	11.5	2.7	11.0	2.4	9.5	1.6	9.0	1.5	12.4	4.9	14.9	7.4	14.3	6.8	15.6	8.3
			11.8	3.0	11.0	2.4	9.5	1.6	9.0	1.5								
7	13.5	4.5	12.5	3.7	12.4	3.8	9.5	1.6	9.0	1.5	10.2	2.7	12.9	5.4	13.4	5.9	14.2	6.9
							9.5	1.6	9.0	1.5	10.0	2.5						
8	15.1	6.1	14.3	5.5	14.1	5.5	10.1	2.3	9.0	1.5	10.0	2.5	12.0	4.5	12.6	5.1	12.8	5.5
									9.0	1.5	10.0	2.5	11.2	3.7	12.0	4.5		
9	17.4	8.4	15.2	6.4	15.2	6.7	11.7	3.9	10.2	2.7	10.0	2.5	10.0	2.5	11.5	4.0	12.0	4.7
	18.2	9.2									11.3	3.8	10.0	2.5	11.5	4.0	11.3	4.0
10	19.0	10.0	16.3	7.5	17.3	8.8	13.0	5.2	12.4	4.9	12.4	4.9	10.5	3.0	11.5	4.0	11.0	3.7
	19.0	10.0			18.2	9.7									11.5	4.0	11.0	3.7
11	18.4	9.4	17.2	8.4	18.2	9.7	14.7	6.9	14.4	6.9	13.8	6.3	12,6	5.1	12.0	4.5	11.0	3.7
					18.0	9.5	15.4	7.6									11.5	4.2
Noon	16.0	7.0	18.4	9.6	17.5	9.0	16.5	8.7	15.5	8.0	14.9	7.4	13.7	6.2	13.0	5.5	11.8	4.5
			18.5	9.7			15.7	7.9	16.0	8.5								
1	15.0	6.0	18.5	9.7	16.6	8.1	15.1	7.3	16.0	8.5	15.3	7.8	14.8	7.3	14.5	7.0	12.4	5.1
			17.7	8.9					15.6	8.1	16.0	8.5	15.4	7.9				
2	14.0	5.0	17.1	8.3	14.2	5.7	13.5	5.7	15.1	7.6	16.0	8.5	16.0	8.5	14.6	7.1	12.8	5.5
											16.0	8.5	16.0	8.5				
3	13.2	4.2	16.0	7.2	12.3	3.8	11.7	3.9	14.2	6.7	16.0	8.5	16.0	8.5	15.0	7.5	13.5	6.2
					9.6	1.1	10.8	3.1			15.2	7.7	15.4	7.9	15.5	8.0		
4	12.0	3.0	14.8	6.0	9.0	0.5	10.0	2.3	12.3	4.8	14.2	6.7	15.0	7.5	15.5	8.0	14.4	7.2
	11.4	2.4			9.0	0.5	10.0	2.3							15.5	8.0	15.0	7.8
5	11.0	2.0	13.6	4.8	9.5	1.0	10.0	2.3	11.6	4.1	12.8	5.3	13.5	6.0	15.5	8.0	15.0	7.8
	11.0	2.0	13.0	4.2			10.0	2.3			11.2	3.7			15.2	7.7	14.3	7.1
6	11.0	2.0	12.2	3.4	10.0	1.5	11.3	3.6	10.2	2.7	10.0	2.5	12.7	5.2	15.0	7.6	14.0	6.8
	12.1	3.1	12.2	3.4					9.5	2.0	10.0	2.5						
7	13.3	4.3	12.2	3.4	10.4	1.9	12.3	4.6	9.1	1.6	10.0	2.5	11.7	4.2	14.2	6.8	13.4	6.2
			12.6	3.9					9.1	1.6	10.0	2.5	11.5	4.0				
8	15.7	6.8	13.2	4.5	12.0	3.6	14.2	6.5	9.1	1.6	11.0	3.5	11.0	3.5	13.0	5.6	12.8	5.6
									10.2	2.7			11.0	3.5				
9	17.4	8.5	15.3	6.6	14.2	5.8	15.0	7.3	11.3	3.8	13.0	5.5	11.0	3.5	12.0	4.6	12.4	5.2
													11.5	4.0	11.4	4.0	12.0	4.8
10	19.5	10.6	17.6	8.9	16.4	8.0	16.1	8.4	13.7	6.2	14.4	6.9	12.0	4.5	11.0	3.6	12.0	4.8
	19.7	10.8													11.5	4.1	12.0	4.8
11	19.7	10.8	19.4	10.7	18.1	9.8	17.4	9.7	16.2	8.7	15.1	7.6	14.2	6.7	12.2	4.8	12.0	4.8
			20.1	11.4	18.7	10.4	18.0	10.3									12.3	5.1
Midn't	19.7	10.8	20.1	11.4	19.0	10.7	18.6	10.9	17.4	9.9	16.2	8.7	15.8	8.3	14.3	6.9	12.7	5.5

May 25.	Correction	—9.0	
" 26.	"	—8.8	
" 27.	"	—8.5	
" 28.	"	—7.8	
" 29.	"	—7.5	
May 30.	Correction	—7.5	
" 31.	"	—7.5	
June 1.	"	—7.5	
" 2.	"	—7.3	

SERIES III.—TIDAL OBSERVATIONS FROM APRIL 20 TO AUGUST 3, 1854.

Hourly observations on the pulley-gauge. Adopted reading of mean level 7.0, expressed in units of the scale. Increasing numbers indicate rise of water.

June, 1854.

Mean solar hour.	3d.	Ref. obs.	4th.	Ref. obs.	5th.	Ref. obs.	6th.	Ref. obs.	7th.	Ref. obs.	8th.	Ref. obs.	9th.	Ref. obs.	10th.	Ref. obs.	11th.	Ref. obs.
																	18.0	9.5
1	14.2	7.1	13.0	6.3	12.4	6.0	12.5	6.1	12.3	5.6	12.8	5.5	---	---	16.4	8.2	19.0	10.5
							12.5	6.1									19.9	11.4
2	15.8	8.7	14.0	7.4	12.8	6.4	12.5	6.1	12.5	5.8	11.8	4.4	---	---	14.9	6.7	18.0	9.5
							12.9	6.5			11.4	4.0	---	---				
3	16.4	9.3	15.2	8.6	13.8	7.4	13.6	7.2	12.0	5.3	11.4	4.0	---	---	12.1	3.9	15.2	6.7
4	16.6	9.6	16.0	9.4	15.2	8.8	14.2	7.8	11.0	4.3	14.5	7.0	---	---	12.0	3.7	13.2	4.6
5	---	---	---	---	15.4	9.0	14.8	8.4	15.6	8.8	14.7	7.4	---	---	10.4	2.1	10.4	1.8
6	---	---	---	---	15.8	9.4	15.0	8.6	16.0	9.2	15.0	7.7	---	---	10.9	2.6	10.4	1.8
7	---	---	---	---	16.0	9.6	15.6	9.2	17.0	?	15.6	8.2	---	---	11.5	3.2	10.4	1.8
8	---	---	---	---	16.1	9.7	16.0	9.6	15.5	8.7	16.8	9.3	---	---	11.1	?	13.2	4.6
9	11.5	4.5	---	---	14.1	7.7	16.5	10.1	17.1	10.2	16.6	9.1	---	---	---	---	16.0	7.4
							15.5	9.1	16.8	9.9								
10	12.0	5.0	---	---	12.2	5.8	14.8	8.4	15.5	8.5	16.2	8.6	16.0	8.0	20.0	11.7	18.0	9.4
															19.2	10.9		
11	12.5	5.5	---	---	14.5	5.1	14.5	8.1	14.5	7.5	13.4	5.8	13.9	5.9	18.0	9.7	18.0	9.4
					11.3	4.9												
Noon	13.0	6.0	---	---	11.1	4.7	13.3	6.9	12.9	5.9	12.5	4.9	12.6	4.6	17.6	9.3	17.2	8.6
					11.1	4.7												
1	13.5	6.5	---	---	11.1	4.7	11.6	5.2	11.9	4.9	11.8	4.2	12.0	4.0	16.4	8.1	16.8	8.2
					11.2	4.8	10.8	4.4			10.4	2.7	10.3	2.3				
2	14.0	7.0	11.4	5.0	11.2	4.8	10.5	4.0	11.4	4.4	9.5	1.8	11.0	3.0	14.7	6.4	16.0	7.4
							10.5	4.0	10.5	3.5								
3	14.5	7.6	12.4	6.0	11.4	5.0	10.5	4.0	10.5	3.4	9.5	1.8	9.4	1.4	13.2	4.9	15.0	6.4
	15.0	8.1					10.9	4.4	11.5	4.4	9.8	2.1						
4	15.0	8.1	13.6	7.2	12.4	6.0	11.4	4.9	12.6	5.5	10.5	2.8	10.3	2.3	11.7	3.3	14.2	5.6
	15.0	8.1																
5	14.8	8.0	14.4	8.0	13.6	7.2	13.2	6.6	14.0	6.9	11.9	4.1	11.4	3.4	10.2	1.8	12.9	4.3
															9.6	1.2		
6	14.6	7.8	14.4	8.0	14.8	8.4	14.8	8.2	14.7	7.5	13.1	5.3	12.6	4.5	9.0	0.6	12.0	3.4
																	10.6	2.0
7	14.0	7.2	15.0	8.6	14.4	8.0	16.2	9.6	17.0	9.8	14.0	6.2	16.4	8.3	12.0	3.6	11.5	2.8
8	13.4	6.6	15.0	8.6	15.2	8.8	17.0	10.4	18.0	10.8	16.2	8.4	19.5	11.4	15.4	7.0	13.6	4.9
9	13.0	6.2	14.0	7.6	15.6	9.2	16.6	10.0	18.4	11.1	18.6	10.8	21.0	12.9	---	---	16.2	7.5
	12.0	5.2																
10	12.0	5.2	13.0	6.6	14.6	8.2	16.2	9.6	18.0	10.7	19.4	11.6	20.6	12.5	---	---	19.2	10.5
	12.0	5.2																
11	12.3	5.6	12.5	6.1	13.2	6.8	16.2	9.6	17.2	9.9	19.0	11.2	20.0	11.9	---	---	20.2	11.5
Midn't	13.0	6.3	12.0	5.6	12.6	6.2	15.2	8.6	14.0	6.7	18.0	10.2	---	---	---	---	21.4	12.6

June 3. Correction —7.0
" 6. " —6.4
" 9. " —8.0
" 10. " —8.3
" 11. " —8.6

June 4. Correction —6.4
" 7. " —7.0

June 5. Correction —6.4
" 8. " —7.6

The record on this day is defective.

Readings between the full hours are less frequent than before, and are generally given only near high or low water.

SERIES III.—TIDAL OBSERVATIONS FROM APRIL 20 TO AUGUST 3, 1854.

Hourly observations on the pulley-gauge. Adopted reading of mean level 7.0, expressed in units of the scale. Increasing numbers indicate rise of water.

June, 1854.

Mean solar hour.	12th.	Ref. obs.	13th.	Ref. obs.	14th.	Ref. obs.	15th.	Ref. obs.	16th.	Ref. obs.	17th.	Ref. obs.	18th.	Ref. obs.	19th.	Ref. obs.	20th.	Ref. obs.
			21.0	12.1			19.2	10.4										
1	22.0	13.2	21.0	12.1	21.0	12.1	20.1	11.3	16.0	7.3	17.3	8.6	14.4	6.1	14.0	6.2	13.5	5.8
	21.5	12.7			21.0	12.1											13.0	5.3
2	19.8	11.0	19.9	11.0	21.0	12.1	21.1	12.3	17.2	8.5	18.6	9.9	15.6	7.3	15.1	7.4	12.9	5.2
							21.1	12.3			19.2	10.5					12.9	5.2
3	18.5	9.7	18.2	9.3	20.2	11.3	21.1	12.3	19.0	10.3	20.0	11.4	17.0	8.7	15.9	8.2	14.0	5.3
							20.9	12.1	20.0	11.3								
4	15.2	6.4	18.0	9.1	19.6	10.7	20.2	11.5	20.4	11.7	19.9	11.3	18.2	9.9	16.2	8.6	14.0	6.2
5	12.5	3.7	13.2	4.3	15.3	6.4	16.3	7.6	19.0	10.3	17.6	9.0	18.4	10.2	18.0	10.4	15.6	7.8
6	10.4	1.6	11.6	2.7	12.2	3.3	14.4	5.7	16.8	8.1	16.4	7.8	18.0	9.8	18.1	10.5	16.4	8.6
7	10.4	1.6	10.0	1.1	10.5	1.6	11.5	2.8	14.3	5.6	14.2	5.6	17.5	9.3	18.0	10.4	17.6	9.8
8	13.2	4.4	10.0	1.1	10.5	1.6	10.8	2.1	12.8	4.1	12.4	3.8	17.0	8.8	17.8	10.2	17.7	9.9
			9.1	0.2			10.4	1.7			11.6	3.0						
9	15.5	6.7	10.0	1.1	12.6	3.7	10.0	1.3	11.4	2.7	11.4	2.8	13.4	5.3	15.6	8.0	17.6	9.8
							11.0	2.3	11.2	2.5								
10	16.6	7.8	12.2	3.3	14.0	5.1	12.0	3.3	11.4	2.5	12.2	3.6	12.5	4.4	15.0	7.4	16.5	8.7
11	18.6	9.8	16.4	7.5	16.0	7.1	14.5	5.8	13.0	4.3	12.6	4.0	11.6	3.6	14.0	6.4	14.8	7.0
	19.2	10.4											11.2	3.2				
Noon	17.6	8.8	18.4	9.5	17.6	8.7	16.2	7.5	14.6	5.9	14.5	5.9	11.4	3.4	13.0	5.4	14.5	6.7
			19.2	10.3	19.2	10.3	16.5	7.8										
1	15.8	7.0	19.2	10.3	19.1	10.2	17.2	8.5	15.9	7.2	15.9	7.3	12.0	4.0	12.0	4.4	14.0	6.2
			19.2	10.3			17.2	8.5	16.8	8.1					11.6	4.0		
2	13.8	5.0	18.9	10.0	19.1	10.2	17.2	8.5	17.6	8.9	17.3	8.7	13.3	5.3	12.0	4.4	13.6	5.8
							16.2	7.5	16.9	8.2	17.9	9.3						
3	13.0	4.2	17.6	8.7	17.4	8.5	15.5	6.8	16.2	7.5	17.5	8.9	16.6	8.6	13.0	5.4	13.0	5.2
																	12.2	4.4
4	11.6	2.8	16.2	7.3	16.0	7.1	15.0	6.3	15.5	6.8	17.0	8.4	16.3	8.3	14.0	6.4	12.4	4.6
													16.0	8.0				
5	10.3	1.5	14.8	5.9	14.2	5.3	13.4	4.7	14.8	6.1	16.6	8.0	18.5	10.5	15.0	7.4	14.0	6.1
	9.6	0.8											15.0	7.0				
6	9.2	0.4	14.2	5.3	13.0	4.1	12.6	3.9	14.6	5.9	16.1	7.5	14.3	6.3	16.5	8.9	15.0	7.1
	9.6	0.8			10.4	1.5												
7	10.2	1.4	14.0	5.1	10.4	1.5	11.6	3.9	14.2	5.5	15.8	7.2	13.2	5.2	17.4	9.8	16.7	8.8
					10.4	1.5	11.2	2.5							17.6	10.0		
8	12.4	3.6	10.0	1.1	10.2	1.3	11.0	2.3	12.8	4.1	15.2	6.7	13.6	5.6	17.4	9.8	17.8	9.9
			11.0	2.1	10.6	1.7	11.2	2.5										
9	15.0	6.2	12.0	3.1	11.0	2.1	11.4	2.7	12.4	3.7	14.2	5.7	14.3	6.3	16.8	9.1	18.4	10.5
10	18.5	9.7	15.0	6.1	12.4	3.6	13.6	4.9	13.0	4.3	13.4	4.9	15.0	?	15.5	7.8	18.5	10.5
11	21.0	12.2	18.0	9.1	15.0	6.2	15.0	6.3	14.0	5.3	13.0	4.6	14.0	6.2	14.5	6.8	16.9	8.9
Midn't	---	---	20.4	11.5	18.0	9.2	---	---	15.2	6.5	13.0	4.6	13.4	5.6	14.3	6.6	15.6	7.6

June 12. Correction —8.8
" 13. " —8.9
" 15. " —8.7
" 17. " —8.6
" 19. " —7.6

The record on this day is defective, the times being uncertain.

June 14. Correction —8.9
" 16. " —8.7
" 18. " —8.0
" 20. " —7.8

SERIES III.—TIDAL OBSERVATIONS FROM APRIL 20 TO AUGUST 3, 1854.

Hourly observations on the pulley-gauge. Adopted reading of mean level 7.0, expressed in units of the scale. Increasing numbers indicate rise of water.

June, 1854.

Mean solar hour.	21st.	Ref. obs.	22d.	Ref. obs.	23d.	Ref. obs.	24th.	Ref. obs.	25th.	Ref. obs.	26th.	Ref. obs.	27th.	Ref. obs.	28th.	Ref. obs.	29th.	Ref. obs.
							21.0	10.6									21.4	11.4
1	14.5	6.5	15.2	6.6	16.5	7.0	20.5	10.1	19.0	8.3	22.4	12.1	20.2	10.1	21.4	11.4	21.4	11.4
	14.2	6.2									22.4	12.1					21.4	11.4
2	13.8	5.8	13.9	5.3	14.7	5.2	18.0	7.6	17.0	6.3	20.0	9.7	20.2	10.1	21.4	11.4	21.4	11.4
	13.8	5.8																
3	13.8	5.8	11.5	2.9	13.8	4.3	15.8	5.3	16.0	5.3	17.6	7.3	18.5	8.4	19.1	9.1	20.0	10.0
	13.8	5.8	13.3	4.7	13.4	3.8	15.0	4.5										
4	14.9	5.9	---	---	13.2	3.6	14.2	3.6	14.1	3.5	15.0	4.8	17.0	6.9	16.3	6.3	18.0	8.0
5	14.4	6.3	---	---	14.0	4.3	14.2	3.6	13.0	2.4	12.2	2.0	12.0	1.9	15.3	5.3	16.6	6.6
6	15.7	7.6	---	---	14.6	4.9	15.1	4.4	13.4	2.8	13.4	3.2	12.2	2.1	14.4	4.4	15.5	5.5
7	16.3	8.2	---	---	15.0	5.2	15.3	4.6	14.0	3.4	13.8	3.7	12.8	2.7	13.8	3.8	13.9	3.9
8	17.2	9.1	16.7	7.6	15.6	5.8	15.5	4.7	14.5	3.9	14.4	4.3	13.4	3.3	13.2	3.2	13.6	3.6
	17.2	9.0													13.5	3.5	13.9	3.9
9	17.6	9.4	17.6	8.5	18.4	8.5	16.4	5.6	16.2	5.6	16.0	5.9	14.6	4.5	14.0	4.0	14.4	4.4
	17.2	9.0	19.0	9.9														
10	16.2	8.0	18.5	9.4	18.4	8.5	17.5	6.7	17.0	6.4	17.2	7.1	16.4	6.3	15.5	5.5	16.2	6.2
11	15.8	7.6	17.5	8.4	18.1	8.1	18.3	7.5	18.1	7.5	18.8	8.7	18.0	7.9	17.8	7.8	18.0	8.0
							18.5	7.7	18.8	8.2								
Noon	14.6	6.4	16.5	7.4	17.8	7.8	18.9	8.1	18.9	8.3	19.8	9.7	19.4	9.3	19.1	9.1	18.4	8.4
							18.9	8.1					19.9	9.8	19.2	9.2		
1	14.0	5.8	16.0	6.9	16.0	6.0	18.5	7.7	18.2	7.6	20.0	9.9	19.0	8.9	19.2	9.2	19.0	9.0
											19.0	8.9			19.2	9.2	19.1	9.1
2	13.0	4.8	15.4	6.3	15.5	5.5	15.9	5.1	16.5	5.9	18.2	8.1	17.6	7.5	18.6	8.6	19.1	9.1
	12.4	4.2															18.8	8.8
3	11.2	3.0	14.4	5.3	14.0	3.9	14.7	3.9	15.7	5.1	16.4	6.3	16.8	6.7	17.5	7.5	17.5	7.5
	11.9	3.7																
4	13.9	5.6	13.2	4.1	13.6	3.5	13.9	3.1	---	---	15.0	4.9	16.0	5.9	17.2	7.2	16.4	6.4
			12.8	3.7	13.5	3.3												
5	14.6	6.3	12.5	3.3	13.2	3.0	13.2	2.4	---	---	14.0	3.9	14.8	4.7	16.8	6.8	13.4	3.4
			13.0	3.8	13.2	2.9	12.8	2.0										
6	16.5	8.2	14.6	5.4	13.2	2.9	13.5	2.7	13.7	3.2	13.3	3.2	13.8	3.8	15.1	5.1	12.1	2.1
					14.2	3.9					12.5	2.4					12.0	2.0
7	18.4	10.0	17.2	7.9	15.0	4.7	15.0	4.2	13.6	3.1	13.0	2.9	13.8	3.8	12.8	2.8	12.6	2.6
													13.0	3.0	12.5	2.5		
8	19.5	11.1	18.0	8.7	16.0	5.7	17.0	6.2	15.0	4.5	15.0	4.9	13.2	3.2	13.1	3.1	13.5	3.6
9	20.0	11.6	19.0	9.6	19.0	8.7	19.0	8.2	18.0	7.5	19.4	9.3	15.0	5.0	15.1	5.1	15.2	5.3
	21.5	13.0	19.5	10.1														
10	20.5	12.0	20.0	10.6	21.0	10.6	21.0	10.2	20.2	9.8	22.2	12.1	17.5	7.5	17.2	7.2	16.7	6.8
			20.0	10.6			21.5	10.8										
11	18.5	10.0	19.8	10.3	21.4	11.0	22.0	11.3	21.5	11.1	22.4	12.3	20.0	10.0	19.2	9.2	17.8	8.0
					21.4	11.0	21.8	11.1										
Midn't	14.1	5.6	19.4	9.9	21.4	11.0	20.6	9.9	22.0	11.6	---	---	21.4	11.4	21.3	11.3	19.5	9.7

June 21. Correction — 8.2
" 23. " —10.0
" 25. " —10.6
" 27. " —10.1
" 28. " —10.0
" 29. " —10.0

June 22. Correction — 9.1
" 24. " —10.8
" 26. " —10.1

Some doubt about the time record in the afternoon.

SERIES III.—TIDAL OBSERVATIONS FROM APRIL 20 TO AUGUST 3, 1854.

Hourly observations on the pulley-gauge. Adopted reading of mean level 7.0, expressed in units of the scale. Increasing numbers indicate rise of water.

June, 1854.			July, 1854.																	
Mean solar hour.	30th.	Ref. obs.	1st.	Ref. obs.	2d.	Ref. obs.	3d.	Ref. obs.	4th.	Ref. obs.	5th.	Ref. obs.	6th.	Ref. obs.	7th.	Ref. obs.	9th.	Ref. obs.
													15.7	6.7				
1	19.0	9.2	18.5	9.0	20.6	11.0	14.5	5.9	16.3	7.6	15.2	6.5	15.0	6.0	17.0	7.8	15.5	8.3
													15.0	6.0	17.0	6.8		
2	20.8	11.0	19.8	10.3	21.0	11.3	16.3	7.7	16.9	8.2	15.6	6.9	15.0	6.0	15.8	5.6	13.0	5.8
													15.0	6.0	15.8	5.6		
3	21.0	11.2	20.7	11.2	21.4	11.7	17.3	8.7	17.4	8.7	16.8	8.1	15.0	6.0	15.8	5.6	11.0	3.9
	22.0	12.3	20.9	11.4			17.6	8.9					15.6	6.6	15.8	5.6		
4	20.4	10.7	21.0	11.5	21.4	11.7	17.8	9.1	18.6	9.9	17.3	8.6	15.6	6.6	15.8	5.6	9.8	2.7
			21.0	11.6			17.8	9.1							16.0	5.8	9.5	2.4
5	19.8	10.1	21.0	11.6	17.6	7.8	17.5	8.8	18.6	10.0	18.4	9.7	17.0	8.0	16.4	6.2	9.5	2.4
			20.7	11.3													9.5	2.5
6	18.0	8.4	19.5	10.1	15.7	5.9	17.0	8.2	18.6	10.0	18.6	9.9	17.6	8.5	17.2	7.0	9.8	2.8
									18.8	10.2	18.8	10.0						
7	17.0	7.4	17.1	7.7	14.4	4.6	16.3	7.5	18.8	10.2	18.9	10.1	18.2	9.1	18.8	8.6	10.5	3.5
									18.4	9.8	18.4	9.6	18.5	9.4	19.0	8.8		
8	15.0	5.4	15.7	6.3	12.7	4.5	15.7	6.9	17.6	9.0	18.4	9.6	18.5	9.4	19.4	9.2	12.4	5.4
	14.0	4.4											17.8	8.7	19.1	8.9		
9	13.5	3.9	13.5	4.1	12.0	3.8	14.0	5.2	15.0	6.4	18.2	9.4	17.0	7.8	18.5	8.3	13.8	6.8
	14.8	5.2	12.2	2.8	11.7	3.5	14.0	5.2										
10	16.1	6.5	12.0	2.6	11.4	2.2	13.6	4.8	14.0	5.4	17.0	8.2	16.2	7.0	16.8	6.6	15.4	8.4
			12.5	3.1	11.4	2.2	13.6	4.8	13.6	5.0							15.5	8.5
11	18.7	9.1	13.0	3.6	11.4	2.2	13.6	4.8	13.0	4.4	15.0	6.2	15.9	6.7	15.5	5.3	15.5	8.5
	18.9	9.3			11.4	2.2	15.0	6.2	13.0	4.4							14.9	7.9
Noon	19.0	9.4	15.4	6.0	11.9	3.7	16.5	7.7	13.1	4.5	14.0	5.2	14.0	4.8	15.5	5.3	14.3	7.3
	19.0	9.4									13.3	4.5	13.1	3.9				
1	18.8	9.2	17.2	7.8	12.2	3.9	18.3	?	13.2	4.6	13.1	4.3	13.1	3.9	14.4	4.2	13.2	6.2
											13.1	4.3	13.1	3.9				
2	17.0	7.4	18.1	8.7	13.4	5.1	16.2	7.4	14.0	5.4	13.1	4.3	13.1	3.9	13.3	3.1	11.2	4.3
											13.2	4.4	13.1	3.9	13.2	3.0		
3	15.8	6.2	18.3	8.9	14.4	6.1	17.2	8.4	15.3	6.7	13.4	4.6	13.4	4.2	13.2	3.0	9.1	2.2
															13.2	3.0	8.3	1.5
4	15.0	5.4	18.3	8.9	15.2	6.8	18.2	9.4	17.2	8.6	16.1	7.3	14.3	5.1	13.2	3.0	8.0	1.2
							18.4	9.6							13.7	3.5	8.0	1.3
5	14.0	4.4	18.7	9.3	15.6	7.2	18.6	9.8	17.4	8.7	17.5	8.7	17.3	8.1	14.2	4.0	8.0	1.3
			17.8	8.4	15.7	7.3	18.6	9.8							15.3		8.6	2.0
6	13.5	3.9	17.3	7.8	15.3	6.9	18.6	9.8	18.0	9.3	18.0	9.2	18.3	9.1		5.1	9.0	2.4
							18.3	9.5	18.5	9.8	18.7	9.9			16.6			
7	13.4	3.8	16.2	6.7	14.6	6.2	18.0	9.2	18.5	9.8	19.4	10.6	19.5	10.3		6.4	11.0	4.5
									18.5	9.8	19.4	10.5	19.9	10.7	17.4			
8	13.4	3.8	14.7	5.2	14.0	5.5	17.5	8.7	18.0	9.3	19.4	10.5	20.4	11.2		7.2	13.4	6.9
											19.4	10.5	20.4	11.2	18.0			
9	14.1	4.5	14.5	5.0	14.0	5.5	16.7	7.9	17.4	8.7	19.4	10.5	20.4	11.2		7.8	15.9	9.5
											19.2	10.3	20.4	11.2				
10	15.4	5.8	17.5	8.0	12.8	4.3	15.8	7.0	16.2	7.5	18.7	9.8	20.4	11.2	Readings irregular.		18.2	11.9
					12.4	3.9	15.6	6.9					20.1	10.9				
11	16.0	6.4	18.9	9.3	12.3	3.8	15.6	6.9	15.8	7.1	17.2	8.3	19.7	10.5			18.6	12.3
					12.3	3.8	15.6	6.9									18.7	12.5
Midn't	16.7	7.1	19.7	10.1	12.3	3.8	15.7	7.0	15.2	6.5	16.0	7.1	17.1	7.9			18.7	12.5

June 30. Correction —9.6

July 1. Correction —9.4

July 2. " —9.8 before 8 A. M., and —8.2 after 8 A. M.

" 3. " —8.8

" 4. " —8.6

" 5. " —8.8

" 6. " —9.2

" 7. " —9.2 Tide register out of order at 2 o'clock, changed index 1 foot; correction after [2 A. M. 10.2.

" 8. The readings appear irregular. Correction at noon —7.0, at midnight —6.2.

SERIES III.—TIDAL OBSERVATIONS FROM APRIL 20 TO AUGUST 3, 1854.

Hourly observations on the pulley-gauge. Adopted reading of mean level 7.0, expressed in units of the scale. Increasing numbers indicate rise of water.

July, 1854.

Mean solar hour.	10th.	Ref. obs.	11th.	Ref. obs.	12th.	Ref. obs.	13th.	Ref. obs.	14th.	Ref. obs.	15th.	Ref. obs.	18th.	Ref. obs.	19th.	Ref. obs.	20th.	Ref. obs.
	18.4	12.3	19.3	13.4	19.3	13.3	19.5	13.5										
1	16.8	10.7	19.0	13.1	19.3	13.3	19.6	13.6	17.0	11.0	18.1	?	---	---	---	---	20.8	6.1
					19.3	13.3	19.6	13.6	18.0	12.0	16.1	"						
2	14.1	8.1	17.0	11.0	19.0	13.0	19.0	13.0	18.6	12.6	13.2	"	---	---	---	---	20.5	5.8
																	20.4	5.6
3	12.5	6.5	14.0	8.0	16.5	10.5	17.8	11.8	18.4	12.4			---	---	---	---	20.4	5.6
																	20.5	5.7
4	10.0	4.0	12.1	6.1	12.0	6.0	16.3	10.3	17.3	11.3			---	---	---	---	20.8	5.9
	9.0	3.0																
5	8.2	2.2	9.1	3.1	10.1	4.1	14.0	8.0	15.0	9.0				?	19.1	4.6	20.4	5.5
	8.2	2.2													19.2	4.7		
6	8.2	2.2	8.0	2.0	7.8	1.8	10.2	4.2	---	---			Readings irregular.	"	19.4	4.8	21.2	6.3
	8.5	2.5	7.5	1.5	7.1	1.1												
7	9.0	3.0	7.8	1.8	7.0	1.0	7.5	1.5	---	---				"	20.3	5.7	22.1	7.2
	9.4	?	8.5	2.5	7.3	1.3	7.0	1.0										
8	6.6	---	9.0	3.0	8.2	2.2	7.0	1.0	---	---				"	21.2	6.6	22.2	7.3
							7.1	1.1										
9	7.2	---	11.5	6.5	10.5	4.5	8.0	2.0	7.8	1.8				"	22.2	7.6	23.0	8.1
									7.8	1.8					21.7	7.1	23.3	8.4
10	10.3	4.5	14.0	8.0	13.0	7.0	10.2	4.2	7.9	1.9				"	21.2	6.6	23.6	8.7
																	23.5	8.6
11	12.1	6.3	15.6	9.6	15.4	9.4	12.6	6.6	9.3	3.3				"	21.8	7.2	23.5	8.6
					16.1	10.1												
Noon	13.5	7.7	16.0	10.0	16.1	10.1	14.9	8.9	12.3	6.3			21.3	7.0	20.0	5.4	22.2	7.3
	14.0	8.2	16.1	10.1	16.0	10.0	15.9	9.9					20.2	5.9				
1	14.2	8.4	16.0	10.0	16.0	10.0	16.0	10.0	14.1	8.1			19.1	4.8	19.6	5.0	20.1	5.2
	13.1	7.3					16.0	10.0	14.4	8.4			19.1	4.8	19.0	4.4		
2	12.1	6.3	15.2	9.2	15.3	9.3	16.0	10.0	15.2	9.2			19.1	4.8	19.3	4.7	19.4	4.5
							15.1	9.1	15.2	9.2			19.3	5.0			19.7	4.8
3	10.2	4.4	13.2	7.2	13.2	7.2	14.2	8.2	15.2	9.2			20.2	5.9	19.3	4.7	20.4	5.5
									14.4	8.4								
4	8.0	2.2	10.0	4.0	11.0	5.0	13.3	7.3	14.3	8.3			21.3	7.0	20.0	5.4	21.2	6.3
	7.8	2.0																
5	7.0	1.2	8.7	2.7	10.0	4.0	---	---	13.0	7.0			22.1	7.7	21.1	6.5		
	7.0	1.2	7.8	1.8														
6	7.6	1.7	7.2	1.2	8.7	2.7	---	---	12.8	6.8			23.2	8.8	22.4	7.8		
			7.2	1.2	8.0	2.0							23.4	9.0				
7	10.1	4.2	7.5	1.5	7.2	1.2	9.0	3.0	---	---			23.6	9.2	23.6	9.0		
					7.2	1.2	8.7	2.7					23.6	9.2				
8	13.1	7.2	9.0	3.0	7.6	1.6	8.4	2.4	---	---			23.6	9.2	23.9	9.2		
													23.3	8.9	24.0	9.3		
9	15.0	9.1	10.5	4.5	9.2	3.2	---	---	8.5	2.5			22.9	8.5	24.0	9.3		
									8.9	2.9					23.4	8.7		
10	17.0	11.1	13.9	7.9	12.2	6.2	---	---	9.0	3.0			22.1	7.7	23.4	8.7		
11	18.6	12.7	16.8	10.8	16.8	10.8	---	---	11.5	5.5			21.4	7.0	23.4	8.7		
	19.0	13.1																
Midn't	19.5	13.6	19.0	13.0	18.2	12.2	---	---	13.2	7.2			20.3	5.9	21.3	6.6		

Readings become very irregular.

Readings irregular.

July 10. Correction — 5.8
" 12. " — 6.0
" 14. " — 6.0
" 18. " —14.3
" 20. " —14.9

July 11. Correction — 6.0
" 13. " — 6.0
" 15. " ?
" 19. " —14.6

SERIES III.—TIDAL OBSERVATIONS FROM APRIL 20 TO AUGUST 3, 1854.

Hourly observations on the pulley-gauge. Adopted reading of mean level 7.0, expressed in units of the scale. Increasing numbers indicate rise of water.

	July, 1854.								August, 1854.					
Mean solar hour.	28th.	Ref. obs.	29th.	Ref. obs.	30th.	Ref. obs.	31st.	Ref. obs.	1st.	Ref. obs.	2d.	Ref. obs.	3d.	Ref. obs.
1	Correction to readings not sufficiently known.		10.6	10.1	10.6	10.5	8.3	8.3	8.0	8.0	6.8	7.0	5.3	5.7
					11.2	11.1							5.5	5.9
2			11.3	10.8	11.2	11.1	8.6	8.6	8.4	8.4	8.0	8.2	6.0	6.4
			12.3	11.8	11.2	11.1			9.1	9.1				
3			12.5	12.0	11.2	11.1	9.3	9.3	9.3	9.3	8.7	8.9	6.5	6.9
			11.3	10.8	11.0	11.0								
4			10.2	9.7	10.8	10.8	10.6	10.6	9.3	9.3	9.0	9.3	7.3	7.7
									9.2	9.2			8.2	8.6
5			8.4	8.0	10.2	10.2	---	---	9.0	9.0	10.2	10.5	8.4	8.8
									9.0	9.0			8.4	8.8
6			6.1	5.7	8.5	8.5	---	---	9.0	9.0	9.1	9.4	8.4	8.8
													8.4	8.8
7			3.0	2.6	6.4	6.4	---	---	7.5	7.5	7.4	7.8	8.4	8.8
			2.3	1.9	5.1	5.1								
8			2.0	1.7	3.2	3.2	---	---	5.5	5.5	6.4	6.8	7.7	8.1
			2.0	1.7	3.2	3.2								
9			2.2	1.9	3.2	3.2	4.0	4.0	4.6	4.6	5.0	5.4	6.0	6.4
					3.3	3.3			4.4	4.4				
10			3.5	3.2	3.4	3.4	5.2	5.2	4.4	4.4	4.2	4.6	4.4	4.8
									4.4	4.4	4.1	4.5		
11			4.8	4.5	4.2	4.2	5.5	5.5	4.4	4.4	4.1	4.5	3.4	3.8
									4.4	4.4	4.1	4.5	3.4	3.8
Noon	8.3	7.6	7.2	6.9	6.1	6.1	6.2	6.2	4.4	4.4	4.1	4.5	3.4	3.8
	9.1	8.4							5.0	5.0	4.3	4.7	3.2	3.6
1	9.2	8.5	9.2	8.9	7.0	7.0	7.5	7.5	5.7	5.7	4.8	5.2	3.2	3.6
	9.3	8.6					8.0	8.0					3.2	3.6
2	9.3	8.6	10.2	9.9	8.3	8.3	9.0	9.0	7.0	7.0	5.9	6.3	3.2	3.6
	9.3	8.6			8.5	8.5	9.0	9.0					4.0	4.4
3	9.2	8.5	11.3	10.0	9.2	9.2	9.0	9.0	8.7	8.7	6.4	6.8	4.5	4.9
			11.4	11.2	9.0	9.0	9.0	9.0	9.5	9.5				
4	7.4	6.8	11.5	11.3	8.3	8.3	9.0	9.0	10.4	10.5	6.8	7.2	6.2	6.6
			11.0	10.8					10.4	10.5				
5	5.5	4.9	10.0	9.8	7.2	7.2	9.1	9.1	10.4	10.5	7.0	7.4	7.4	7.8
									10.4	10.5	8.2	8.6		
6	3.7	3.1	7.8	7.6	6.0	6.0	8.0	8.0	10.2	10.3	9.1	9.5	8.2	8.6
											9.0	9.4		
7	2.9	2.3	4.2	4.1	5.1	5.1	6.6	6.6	9.0	9.1	9.0	9.4	8.8	9.2
	2.7	2.1			4.3	4.3							9.0	9.4
8	2.6	2.0	3.4	3.3	4.1	4.1	5.4	5.4	7.4	7.5	9.0	9.4	9.0	9.4
	3.0	2.4			4.1	4.1	4.8	4.8					9.0	9.4
9	3.2	2.7	3.3	3.2	4.1	4.1	4.8	4.8	6.2	6.3	7.4	7.8	9.0	9.4
			4.0	3.9	5.0	5.0	4.8	4.8	6.0	6.1			9.0	9.4
10	5.4	4.9	4.0	3.9	5.2	5.2	4.8	4.8	6.0	6.1	6.2	6.6	8.2	8.6
							4.8	4.8	6.0	6.1				
11	6.4	5.9	6.0	5.9	6.4	6.4	4.8	4.8	6.2	6.4	5.8	6.2	7.3	7.7
							5.1	5.1						
Midn't	9.0	8.5	8.0	7.9	---	---	5.6	5.6	6.5	6.7	5.6	6.0	6.0	6.4

Between the 20th and 27th of July the observations do not appear sufficiently regular to promise any reliable results.

July 28. Correction —0.7 July 29. Correction —0.3 July 30. Correction 0.0
" 31. " 0.0 Aug. 1. " —0.0 Aug. 2. " +0.4
Aug. 3. " +0.4 After this date the observations are irregular.

On the 5th the rope slipped off the wheel.

Aug. 8. The brig was released from the ice cradle at 10 A. M., rising suddenly 2½ feet. She resumed this position upon very slight disturbance of the external ice, and is now on an even keel for the first time in eleven months. The brig was frozen in and fast since the 9th of September, 1853.

Aug. 10. The high-water mark was cut on the island by Mr. McGary.

Aug. 11. The warping of the ships was commenced. Tidal observations were resumed on the 12th. The register is kept in fathoms and feet.

SERIES IV.—TIDAL OBSERVATIONS FROM SEPTEMBER 7 TO OCTOBER 22, 1854.

Hourly observations on the pulley-gauge. Adopted reading of mean level 7.0, expressed in units of the scale. Increasing numbers indicate rise of water.

September, 1854.

Mean solar hour.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	16th.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th.	27th.
1	---	10.0	13.5	13.0	10.0	10.0	8.0	6.0	---	5.0	7.0	9.0	9.0	10.0	11.2	12.0	11.0	13.0	13.0	10.0
2	---	5.0	13.5	11.0	11.0	14.0	9.0	7.0	---	5.0	6.0	8.0	7.5	8.0	9.0	10.0	10.0	14.0	11.0	12.0
3	---	2.0	11.0	7.0	11.0	11.0	10.0	4.0	---	6.0	6.0	7.0	5.0	6.0	4.0	7.0	8.0	10.0	10.0	10.0
4	---	—1.0	7.0	4.7	9.0	9.0	9.0	3.0	---	7.0	5.0	5.0	3.0	5.0	3.0	3.0	6.0	7.0	8.0	8.0
5	---	—1.7	5.0	3.0	7.0	6.0	6.0	4.0	---	8.0	6.0	5.0	2.0	4.0	2.0	0.0	3.5	4.0	6.0	4.0
6	---	—1.7	3.0	1.0	5.0	4.0	4.0	5.0	---	9.0	7.0	7.0	4.0	5.0	3.0	—0.7	2.0	3.0	3.0	2.0
7	---	—1.0	2.2	—1.0	3.0	2.0	0.0	6.0	---	9.0	9.0	8.0	6.0	6.0	5.0	2.0	2.0	2.0	0.0	0.0
8	---	0.0	1.0	—1.0	0.0	0.0	1.0	8.0	---	9.0	8.5	10.0	7.0	7.0	6.0	4.0	2.0	0.0	1.0	—1.0
9	---	2.0	4.0	0.0	0.0	1.0	2.0	9.0	---	8.0	7.5	10.0	8.0	8.5	8.0	7.0	5.0	1.0	3.0	1.0
10	---	9.0	5.0	4.0	2.0	3.0	3.0	10.0	---	6.0	9.0	9.5	9.0	10.0	10.0	10.0	10.0	3.0	4.0	3.0
11	---	14.0	6.5	---	4.0	4.0	5.0	4.0	4.0	5.0	7.0	8.5	9.5	11.5	12.5	11.0	12.0	6.0	7.0	6.0
Noon	---	12.0	11.0	---	7.0	7.0	6.0		4.0	5.0	6.5	8.0	---	10.0	13.0	13.0	13.0	12.5	10.0	9.0
1	---	11.0	13.0	9.0	9.0	3.0	8.0		5.0	5.0	6.0	7.5	---	9.0	10.0	11.0	12.0	13.0	12.0	10.0
			14.0																	
2	---	10.0	10.0	11.0	10.0	4.0	9.0		7.0	6.0	5.5	7.0	---	6.0	8.0	10.0	10.0	12.0	13.0	12.0
3	---	8.0	7.0	9.0	8.0	9.0	9.0		8.0	7.0	5.0	6.7	4.0	0.0	6.0	7.0	9.0	11.0	11.0	13.0
4	---	6.0	4.0	6.0	9.0	10.0	9.0		9.0	8.0	7.0	6.5	2.0	1.0	3.0	5.0	6.0	7.0	9.0	10.0
5	---	4.0	2.0	---	10.0	8.0	9.0		8.0	9.0	8.0	6.0	3.0	1.5	1.0	1.0	3.0	6.0	6.0	9.0
6	---	2.0	0.0	---	10.5	4.0	6.0		7.0	10.0	9.0	5.0	4.0	3.0	2.0	0.0	2.0	4.0	4.0	7.0
7	---	1.0	—0.5	---	9.0	1.0	4.0		8.0	10.0	10.0	8.0	6.0	4.0	3.0	0.0	1.0	2.0	3.0	3.0
8	---	0.0	—0.5	---	5.0	0.0	3.0		9.0	10.4	10.5	11.0	8.0	7.0	5.0	4.0	2.0	0.0	0.0	0.0
9	11.0	5.0	4.9	2.0	1.5	1.5	4.0		10.0	10.0	10.5	11.5	10.0	9.5	7.5	---	5.0	5.0	1.0	1.0
10	13.0	8.0	6.0	1.0	3.0	3.0	5.0		9.0	10.0	12.0	12.0	12.0	12.0	11.5	---	8.0	8.0	4.0	4.0
11	14.5	11.0	10.0	7.0	7.0	5.6	5 4		8.0	10.4	11.0	12.6	13.0	14.0	10.0	---	9.0	11.0	7.0	6.0
Midn't	14.2	13.0	12.0	10.0	8.6	7.0	7.0		6.6	9.0	10.0	11.6	11.0	13.0	9.0	---	10.0	12.0	9.5	8.0

Observations irregular.

Sept. 1854. / October, 1854.

Mean solar hour.	28th.	29th.	30th.	1st.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	15th.	17th.	18th.	19th.	20th.	21st.	22d.
1	9.0	8.0	---	9.0	---	6.0	10.0	12.0	14.0	8.0	13.0	10.0	8.5	6.0	---	5.0	---	6.0	5.0	---
2	12.0	10.0	---	8.0	---	4.0	7.0	10.0	12.2	7.0	12.0	---	14.5	7.0	---	4.0	---	4.0	4.0	---
3	13.0	9.0	8.0	6.0	---	0.0	5.0	7.0	7.0	4.0	10.0	9.0	10.0	8.0	3.0	3.0	1.0	3.0	0.5	1.0
4	10.0	8.0	9.0		---	—1.2	3.0	4.0	5.0	2.0	7.0	8.0	7.0	10.0	4.0	4.0	0.0	2.0	0.0	0.0
5	9.0	8.0	8.0		---	—1.0	—1.0	2.0	2.0	1.0	4.0	4.0	5.0	9.0	5.0	6.0	2.0	1.0	1.0	0.5
6	5.5	7.0	7.0		---	0.0	0.4	1.0	1.0	0.0	0.0	2.0	4.0	8.0	6.0	6.4	3.0	3.0	2.0	1.5
7	3.0	6.0	6.0		4.0	4.0	4.0	1.0	0.0	0.0	1.0	1.0	3.0	7.0	7.0	7.0	6.0	5.0	3.0	1.0
8	1.0	4.0	5.0		5.0	7.0	7.0	5.0	—1.0	0.5	1.5	0.0	2.0	6.0	8.0	8.0	9.0	7.0	6.0	3.0
9	2.0	3.0	5.0		10.0	10.0	10.0	8.5	7.0	7.0	2.5	2.0	3.5	5.0	9.0	11.0	12.0	10.0	8.0	7.0
10	3.0	2.0	4.0		10.0	11.0	11.5	11.5	9.0	10.0	5.0	5.5	5.0	4.0	10.0	10.0	11.5	11.0	11.0	10.0
11	7.0	4.0	3.0		9.0	12.0	12.0	13.0	11.2	10.0	7.0	11.0	6.0	3.0	8.0	8.0	10.0	12.0	12.0	13.0
Noon	9.0	6.0	4.0		8.0	13.0	12.0	14.0	13.0	12.0	10.0	13.0	8.0	4.0	6.0	7.0	8.0	10.0	12.0	13.0
1	12.0	7.0	6.0		6.0	7.0	12.0	13.0	13.0	13.0	13.0	14.0	10.0	5.2	5.0	6.0	7.5	8.0	10.0	12.0
2	10.0	9.0	7.0		4.0	4.0	8.5	9.0	12.0	14.0	14.0	13.0	13.0	5.0	4.0	5.0	4.0	3.0	7.0	9.0
3	11.0	10.0	8.0		2.0	2.0	7.0	5.0	8.0	9.0	12.5	12.0	14.0	6.0	3.0	2.0	1.0	0.5	4.0	4.0
4	12.0	11.5	9.0		0.0	0.0	3.0	3.0	3.0	7.0	9.0	10.0	14.0	7.0	4.0	2.0	1.0	0.0	2.0	1.5
5	10.0	11.0	16.0		0.0	—2.0	1.0	0.0	2.0	5.0	8.0	7.0	11.0	8.0	5.0	3.0	2.0	1.0	0.0	0.0
6	8.0	11.0	10.0		5.0	3.0	0 0	0.0	1.0	3.0	4.0	4.0	9.0	9.0	7.0	4.0	6.0	3.0	1.0	1.0
7	6.0	9.0	9.0		9.0	7.0	—0.5	2.0	0.0	1.0	2.0	3.0	7.4	9.0	7.0	7.0	7.0	4.0	1.0	3.0
8	4.0	6.0	8.0		10.0	9.0	0.0	5.0	1.0	0.0	0.5	2.0	6.0	10.0	7.0	9.5	8.0	7.0	3.0	7.0
9	2.0	3.0	7.0		12.0	13.0	9.0	7.0	4.0	3.0	3.0	3.0	4.0	8.0	8.0	12.0	9.0	8.0	7.0	10.0
10	3.0	4.0	5.5		13.0	13.2	12.0	10.0	6.0	5.5	4.0	4.0	6.0	6.0	11.0	10.0	10.0	9.0	10.0	12.0
11	5.0	5.5	5.0		14.0	14.0	14.0	13.6	9.0	8.0	7.0	7.0	8.0	5.0	8.0	7.0	10.0	9.0	12.0	13.0
Midn't	6.0	5.5	4.5		13.0	14.0	13.6	14.0	10.0	11.0	10.0	10.0	10.0	7.0	7.0	6.0	11.0	11.0	11.0	11.0

Soundings irregular.

NOTE.—The above numbers were taken from the record, converting the fathoms into feet and deducting 8, in order to reduce the mean level of 15 feet to the adopted level of comparison of 7 feet. The observations are taken with the sounding line; bottom weedy.

Sept. 8. Some doubt about the time between 1 and 5 P. M.

After October 22 the soundings are too irregular, and later observations with the pulley-gauge too much affected by changes of the index.

This last series is considerably inferior in accuracy to the three preceding series.

Reduction of Tides, Van Rensselaer Harbor, 1853–'54.

Having given the tidal record in a form ready for use, the observations next require to be properly tabulated for the purpose of deducing empirically their laws, and for comparison with theory. In the United States Coast Survey two blank forms are in use for this tabulation; they have in their essential part been adopted as suitable for the Van Rensselaer Harbor tides, and were used with permission of the Superintendent of the Survey. They are strictly applicable only for such cases where the diurnal inequality is comparatively small, or is at least not approximating to the production of single day tides. In order to show, at a glance, the general character of the tides under discussion, they were plotted a second time, and are given in Plates I, II, and III; the observations having previously been referred to the same mean level. From these diagrams it appears that the diurnal inequality is not of so great an effect as to render the use of the ordinary method of reduction unavailable; on the other hand, it is sufficiently large to require a special discussion for time and height. The extension of the series of observations over a whole year must be considered as a fortunate circumstance, since the results thereby gain considerably in accuracy over others deduced only from a few disconnected lunations.

The tidal record would not be complete without the observations for direction and force of the wind, and for atmospheric pressure; the reader will find these records in my discussion of the meteorological material of the expedition, in Vol. XI, Smithsonian Contributions to Knowledge, 1859.

The following pages contain the first tabulation of the preceding record, viz: column 1 contains the date, civil reckoning, adopted for convenience sake. Column 2 gives the apparent time (civil reckoning) of the moon's superior and inferior transit over the Van Rensselaer meridian, obtained by adding nine minutes to the time of transit at Greenwich, allowing for a difference of longitude of $4^h\ 43\frac{1}{2}^m$ W. The mean time was converted into apparent time by applying the equation of time. The time for the lower transit was obtained by taking the mean of the time of the preceding and following upper transit. Columns 3 and 4 contain the apparent time of high and low water, taken from the record; in some cases a graphical method was resorted to, to obtain the instant of these phases with greater precision. The equation of time has been applied to the mean time in which the observations are expressed. Columns 5 and 6 contain the lunitidal interval between the time of high water and low water, and the time of the transit of the moon immediately preceding, though in some cases, owing to the half-monthly inequality, it may be the second preceding, the establishment being about $11\frac{1}{2}$ hours. This transit of comparison has been called transit *F* by Mr. Lubbock.[1] The next columns, 7 and 8, give the height of high and low water, extracted from the preceding abstract. The remaining columns contain the moon's parallax and declination at noon.

[1] See an Elementary Treatise on the Tides, by J. W. Lubbock, Esq., London, 1839.

TABLE FOR THE REDUCTION OF TIDES.—NO. 1.

Showing the times of High and Low Water, and the Heights of High and Low Tides; together with the time of the Moon's passing the Meridian of the place, and the Lunitidal Intervals, at Van Rensselaer Harbor during the months of October 10, 1853, to October 22, 1855.

SERIES I.—FROM OCTOBER 10 TO DECEMBER 28, 1853.

Date. 1853.	Moon passes the meridian. Appar. time.		Apparent time of H. water.		Apparent time of L. water.		Lunitidal interval. H. water.		Lunitidal interval. L. water.		Height of H. water.		Height of L. water.		Moon's parallax at noon.		Moon's declination at noon.	
	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.	Ft.	Dec.	Ft.	Dec.	Min.	Dec.	Degree.	Dec.
Oct. 9	6	28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
" 10	6	57	8	13	11	13	13	45	16	45	8	0	4	7	58	4	—23	8
	7	26	6	13	...	...	11	16	...	...	9	2	...	...				
" 11	7	54	7	58	1	43	12	32	18	46	6	7	4	4	57	8	—20	9
	8	22	7	43	1	13	11	49	17	47	9	5	4	8				
" 12	8	47	8	13	1	43	11	51	17	49	7	9	4	0	57	3	—17	0
	9	12	9	29	2	43	12	42	18	21	10	0	4	2				
" 13	9	37	9	59	3	14	12	47	18	27	9	1	3	7	56	7	—12	3
	10	02	10	14	3	59	12	37	18	47	10	9	3	1				
" 14	10	24	10	14	4	14	12	12	18	37	9	8	2	7	56	3	— 7	1
	10	47	10	44	3	59	12	20	17	57	11	3	2	7				
" 17	0	13	...	...	...	...	...	...	...	...	...	...	...	...	54	9	+ 8	9
	0	35	11	45	5	15	11	10	17	02	10	7	1	5				
" 18	0	57	...	...	6	00	...	...	17	25	...	...	1	8	54	5	+13	7
	1	18	...	...	6	30	...	...	17	33	12	3	2	0				
" 19	1	40	0	30	6	45	11	12	17	27	11	5	1	6	54	3	+17	9
	2	02	1	15	7	15	11	35	17	35	12	4	1	9				
" 20	2	25	1	15	5	45	11	13	15	43	11	5	5	7	54	2	+21	3
	2	48	1	45	9	00	11	20	18	35	11	9	2	7				
" 21	3	12	1	30	7	45	10	42	16	57	9	9	2	8	54	1	+23	8
	3	36	3	15	8	30	12	03	17	18	11	1	4	4				
" 22	4	00	1	15	9	16	9	39	17	40	10	5	3	4	54	2	+25	2
	4	25	3	16	8	46	11	16	16	46	9	9	4	5				
" 23	4	51	3	16	8	31	10	51	16	06	10	3	3	9	54	4	+25	5
	5	16	4	16	10	16	11	25	17	25	10	4	5	2				
" 24	5	42	3	31	8	31	10	15	15	15	8	7	4	5	54	8	+24	7
	6	07	5	46	...	...	12	04	...	...	9	7	...	...				
" 25	6	32	5	01	0	16	10	54	18	34	7	1	5	4	55	4	+22	6
	6	57	8	16	10	46	13	44	16	39	8	5	5	2				
" 26	7	22	7	46	0	31	12	49	17	59	7	0	5	2	56	1	+19	5
	7	46	8	46	0	46	13	24	17	49	9	2	6	1				
" 27	8	11	8	16	1	46	12	30	18	24	8	1	4	8	57	0	+15	3
	8	35	8	46	0	46	12	35	17	00	9	8	5	5				
" 28	8	59	...	...	3	01	...	...	18	50	9	3	4	5	57	9	+10	3
	9	23	9	46	3	46	12	47	19	11	10	8	5	1				
" 29	9	47	9	46	4	01	12	23	19	02	10	7	3	4	58	8	+ 4	6
	10	11	10	46	4	16	12	59	18	53	11	4	4	9				
" 30	10	36	12	01	3	46	13	50	17	59	11	6	2	9	59	7	— 1	5
	11	01	10	46	5	16	12	10	19	05	11	7	3	9				
" 31	11	26	11	31	4	16	12	30	17	40	12	0	1	6	60	4	— 7	7
	11	52	12	16	5	01	12	50	18	00	12	2	1	9				
Nov. 1	...	...	11	46	4	46	11	54	17	20	12	3	2	7	60	8	—13	6
	0	19	11	16	7	01	10	57	19	09	11	6	3	6				
" 2	0	48	...	...	7	01	...	...	18	42	...	...	0	9	61	0	—18	7
	1	16	0	16	7	16	11	28	18	28	14	3	0	1				
" 3	1	46	1	16	7	16	12	00	18	00	11	8	0	0	60	9	—22	7
	2	16	1	31	8	46	11	45	19	00	14	2	1	5				
" 4	2	47	1	16	8	01	11	00	17	45	11	6	0	3	60	5	—25	0
	3	19	...	...	8	01	...	...	17	14	...	...	1	6				
" 5	3	50	1	16	8	31	9	57	17	12	10	1	0	7	59	9	—25	6
	4	22	2	46	8	46	10	56	16	56	13	0	1	8				
" 6	4	52	4	01	9	01	11	39	16	39	9	1	2	3	59	1	—24	5
	5	23	4	46	10	31	11	54	17	39	10	9	2	6				
" 7	5	52	3	46	10	16	10	23	16	53	8	2	3	2	58	4	—21	9
	6	21	4	31	...	...	10	39	...	...	10	7	...	...				

SERIES I.—FROM OCTOBER 10 TO DECEMBER 28, 1853.

Date 1853.	Moon passes the meridian. Appar. time.		Apparent time of H. water.		Apparent time of L. water.		Lunitidal interval. H. water.		Lunitidal interval. L. water.		Height of L. water.		Height of H. water.		Moon's parallax at noon.		Moon's declination at noon.	
	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.	Ft.	Dec.	Ft.	Dec.	Min.	Dec.	Degree.	Dec.
Nov. 8	6	48	5	16	0	16	10	55	18	24	7	8	3	5	57	6	—18	1
	7	14	6	46	0	16	11	58	17	55	10	4	4	9				
" 9	7	38	7	16	0	46	12	02	17	58	8	1	4	0	56	9	—13	5
	8	02	7	31	1	16	11	53	18	02	11	0	4	4				
" 10	8	25	8	46	0	46	12	44	17	08	9	8	4	3	56	3	— 8	4
	8	48	9	46	2	31	13	21	18	29	10	7	5	5				
" 11	9	09	10	01	2	46	13	13	18	21	9	5	2	3	55	7	— 3	1
	9	31	9	31	3	31	12	22	18	43	11	8	4	2				
" 12	9	52	10	01	4	16	12	30	19	07	11	2	2	8	55	2	+ 2	3
	10	13	9	46	3	31	11	54	18	00	11	5	3	8				
" 13	10	34	10	16	4	46	12	03	18	54	11	5	2	6	54	8	+ 7	5
	10	54	11	15	6	15	12	41	20	02	11	0	2	5				
" 14	11	15	10	45	5	0	11	51	18	26	12	7	2	1	54	5	+12	4
	11	37	10	45	5	30	11	30	18	36	9	8	2	9				
" 15	11	59	11	30	5	30	11	53	18	15	13	3	0	7	54	2	+16	8
	...	...	12	00	6	30	12	01	18	53	13	0	3	5				
" 16	0	21	12	30	5	0	12	09	17	01	13	6	0	4	54	1	+20	5
	0	44	11	45	7	15	11	01	18	54	10	9	3	1				
" 17	1	07	...	...	7	0	...	...	18	16	...	...	1	3	54	0	+23	2
	1	31	0	30	6	45	11	23	17	38	13	0	3	1				
" 18	1	55	0	45	7	15	11	14	17	44	13	7	—0	1	54	0	+25	0
	2	20	1	15	8	15	11	20	18	20	12	1	1	2				
" 19	2	44	1	14	7	14	10	54	16	54	9	8	1	9	54	1	+25	7
	3	09	1	44	8	14	11	00	17	30	13	0	2	3				
" 20	3	34	1	44	8	14	10	35	17	05	9	1	2	6	54	4	+25	2
	3	59	2	14	8	59	10	40	17	25	11	5	3	6				
" 21	4	24	2	29	7	59	10	30	16	00	8	0	3	2	54	7	+23	5
	4	49	2	44	11	14	10	20	18	50	10	7	3	6				
" 22	5	14	2	49	8	44	10	00	15	55	7	4	5	1	55	3	+20	7
	5	37	3	43	11	13	10	29	17	59	10	1	3	7				
" 23	6	01	6	13	10	28	12	36	16	51	7	1	6	6	55	9	+16	9
	6	25	4	43	...	...	10	42	...	...	9	9	...	...				
" 24	6	48	8	13	0	43	13	48	18	32	8	5	3	7	56	8	+12	3
	7	11	6	43	0	13	11	55	17	48	9	5	3	4				
" 25	7	34	7	48	0	43	12	37	17	55	8	8	3	7	57	7	+ 7	0
	7	56	6	57	1	42	11	23	18	31	10	3	6	9				
" 26	8	20	8	42	1	12	12	45	17	38	9	4	4	2	58	6	+ 1	2
	8	44	8	27	2	42	12	07	18	46	9	9	4	3				
" 27	9	08	9	42	3	42	12	58	19	22	10	9	2	7	59	6	— 4	9
	9	33	9	12	4	12	12	04	19	28	11	2	3	4				
" 28	9	58	10	12	4	12	12	39	19	04	12	0	2	2	60	5	—10	9
	10	24	11	11	4	41	13	13	19	08	12	5	2	6				
" 29	10	51	11	41	4	41	13	17	18	43	13	8	0	7	61	0	—16	5
	11	20	10	56	4	11	12	05	17	47	10	7	1	2				
" 30	11	50	10	56	4	41	11	36	17	50	13	7	0	1	61	4	—21	1
	...	...	...	...	5	26	...	...	18	06	...	...	1	7				
Dec. 1	0	21	0	11	5	41	12	21	17	51	10	8	—1	2	61	4	—24	3
	0	53	0	11	6	26	11	50	18	05	12	8	—0	3				
" 2	1	25	0	10	6	10	11	17	17	17	9	5	—2	1	61	0	—25	7
	1	58	1	10	7	10	11	45	17	45	13	6	0	0				
" 3	2	30	1	10	7	10	11	12	17	12	9	4	—0	4	60	4	—25	2
	3	03	1	55	8	40	11	25	18	10	12	8	—0	1				
" 4	3	32	1	54	6	39	10	51	15	36	8	3	0	1	59	6	—22	9
	4	03	2	09	9	09	10	37	17	37	13	7	1	6				
" 5	4	31	2	39	8	54	10	36	16	51	9	1	1	3	58	7	—19	4
	5	00	3	39	9	39	11	08	17	08	11	1	1	0				
" 6	5	26	3	09	8	24	10	09	15	24	6	1	2	3	57	7	—14	9
	5	52	4	24	11	39	10	58	18	13	10	3	1	0				
" 7	6	14	6	38	...	...	12	46	...	...	6	8	...	...	56	9	— 9	8
	6	38	7	53	0	08	13	39	18	16	10	6	3	4				
" 8	7	00	6	23	1	08	11	45	18	54	7	6	3	5	56	1	— 4	4
	7	22	...	...	0	38	...	...	18	00	...	...	2	9				
" 9	7	42	8	37	1	07	13	15	18	07	11	2	3	6	55	4	+ 1	0
	8	04	8	07	2	07	12	25	18	45	11	8	5	2				
" 10	8	25	9	37	2	07	13	33	18	25	11	1	5	3	54	9	+ 6	3
	8	46	9	07	2	07	12	42	18	03	9	2	5	3				

Series I.—From October 10 to December 28, 1853.

Date. 1853.	Moon passes the meridian. Appar. time.		Apparent time of H. water.		Apparent time of L. water.		Lunitidal interval. H. water.		Lunitidal interval. L. water.		Height of H. water.		Height of L. water.		Moon's parallax at noon.		Moon's declination at noon.	
	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.	Ft.	Dec.	Ft.	Dec.	Min.	Dec.	Degree.	Dec.
Dec. 11	9	06	9	51	3	36	13	05	19	11	9	5	1	7	54	5	+11	2
	9	27	9	36	3	36	12	30	18	50	7	8	1	8				
" 12	9	49	11	06	4	06	13	39	19	00	9	9	0	3	54	2	+15	7
	10	10	11	06	4	36	13	17	19	09	9	6	2	8				
" 13	10	31	10	35	4	05	12	35	18	16	11	0	3	5	54	0	+19	6
	10	54	10	20	4	35	11	49	18	25	8	6	2	8				
" 14	11	17	11	05	4	35	12	11	18	04	12	5	2	3	53	9	+22	6
	11	41	11	05	6	05	11	48	19	11	8	9	2	4				
" 15	...	...	...	...	5	05	...	...	17	48	...	...	2	4	53	9	+24	7
	0	06	1	04	6	04	13	23	18	23	13	2	5	5				
" 16	0	30	0	04	5	04	11	58	16	58	12	5	3	4	54	0	+25	6
	0	55	0	19	7	19	11	49	18	49	12	8	1	6				
" 17	1	20	0	34	6	03	11	39	17	08	7	5	2	7	54	2	+25	4
	1	44	...	...	5	18	...	...	15	58	...	...	0	6				
" 18	2	09	1	03	7	03	11	19	17	19	...	...	...	...	54	5	+24	0
	2	34	...	...	...	...	...	...	...	...	...	...	...	...				
" 19	2	58	2	03	7	32	11	29	17	58	...	...	...	...	54	8	+21	5
	3	22	1	32	8	02	10	34	17	04	...	...	...	...				
" 20	3	46	2	17	8	32	10	55	17	10	10	9	1	4	55	3	+18	0
	4	09	2	47	6	02	11	01	14	16	10	4	...	...				
" 21	4	32	3	02	8	31	10	53	16	22	11	6	4	5	55	9	+13	7
	4	54	3	46	9	31	11	14	16	59	11	5	4	4				
" 22	5	17	4	31	9	16	11	37	16	22	9	1	5	1	56	5	+ 8	7
	5	39	4	31	11	01	11	14	17	44	11	6	4	2				
" 23	6	01	5	31	11	30	11	52	17	51	7	5	3	1	57	4	+ 3	2
	6	24	4	30	11	30	10	29	17	29	8	8	2	9				
" 24	6	47	7	00	...	...	12	36	...	...	7	8	...	...	58	3	— 2	6
	7	10	6	30	0	00	11	43	17	36	9	3	4	6				
" 25	7	34	8	00	1	15	12	50	18	28	8	0	2	4	59	2	— 8	5
	7	59	7	30	0	15	11	56	17	05	7	3	4	1				
" 26	8	23	8	29	1	44	12	30	18	10	11	5	3	2	60	0	—14	1
	8	50	8	14	2	44	11	51	18	45	9	2	4	8				
" 27	9	18	9	28	1	59	12	38	17	36	11	2	1	8	60	7	—19	1
	9	46	9	28	3	58	12	10	19	08	9	1	2	9				
" 28	10	16	10	13	3	28	12	27	18	10	11	6	1	9	61	2	—22	9
	10	48	10	58	4	58	12	42	19	12	10	6	4	9				

Series II.—From January 28 to April 7, 1854.

Jan. 27	10	58	...	...	...	...	...	...	...	...	...	...	...	...	60	7	—25	0
	11	30	...	...	...	...	...	...	...	...	...	...	...	...				
" 28	...	...	0	17	5	17	13	19	18	19	10	6	1	0	60	4	—22	5
	0	01	0	17	6	17	12	47	18	47	12	4	2	6				
" 29	0	31	0	17	6	17	12	16	18	16	11	9	1	3	59	9	—18	6
	1	01	0	2	8	02	11	31	19	31	13	3	—1	8				
" 30	1	27	0	16	6	01	11	15	17	00	9	0	0	5	59	1	—13	7
	1	55	1	16	7	46	11	49	18	19	13	9	—0	4				
" 31	2	20	0	46	7	16	10	51	17	21	9	7	—0	3	58	2	— 8	1
	2	45	1	16	8	16	10	56	17	56	13	7	1	5				
Feb. 1	3	08	2	46	8	46	12	01	18	01	11	1	1	3	57	3	— 2	4
	3	32	2	46	9	01	11	38	17	53	12	9	2	1				
" 2	3	54	4	01	9	01	12	29	17	29	10	0	2	0	56	4	+ 3	3
	4	16	2	46	10	01	10	52	18	07	10	6	0	3				
" 3	4	38	4	01	8	46	11	45	16	30	8	5	3	4	55	6	+ 8	7
	5	00	3	46	9	31	11	08	16	53	8	6	2	2				
" 4	5	21	4	46	9	01	11	46	16	01	9	2	3	8	55	0	+13	6
	5	43	5	16	12	16	11	55	18	55	8	9	3	8				
" 5	6	06	6	16	12	16	12	33	18	33	10	5	5	0	54	5	+17	8
	6	28	5	16	11	46	11	10	17	40	10	7	4	5				
" 6	6	51	8	16	11	46	13	48	17	18	9	5	3	8	54	3	+21	3
	7	14	8	01	11	16	13	10	16	25	7	2	3	7				
" 7	7	38	7	46	...	...	12	32	...	...	9	4	...	...	54	1	+23	9
	8	02	7	31	3	01	11	53	19	47	8	2	5	8				

SERIES II.—FROM JANUARY 28 TO APRIL 7, 1854.

Date. 1854.	Moon passes the meridian. Appar. time.		Apparent time of H. water.		Apparent time of L. water.		Lunitidal interval. H. water.		Lunitidal interval. L. water.		Height of H. water.		Height of L. water.		Moon's parallax at noon.		Moon's declination at noon.	
	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.	Ft.	Dec.	Ft.	Dec.	Min.	Dec.	Degree.	Dec.
Feb. 8	8	26	10	01	2	46	13	59	19	08	9	5	4	7	54	1	+25	4
	8	50	9	15	3	15	12	49	19	13	6	7	3	3				
" 9	9	15	10	15	3	15	13	25	18	49	9	7	3	8	54	3	+25	7
	9	41	9	45	4	45	12	30	19	55	7	2	3	3				
" 10	10	06	10	15	6	15	12	34	21	00	9	2	3	7	54	6	+24	9
	10	32	11	45	5	15	13	39	19	34	6	6	1	5				
" 11	10	57	11	45	5	00	13	13	18	54	10	5	1	3	54	9	+22	8
	11	22	11	45	4	45	12	48	18	13	7	7	1	8				
" 12	11	46	10	45	5	00	11	23	18	03	11	5	2	8	55	4	+19	8
	...	...	11	15	6	30	11	29	19	08	8	4	2	3				
" 13	0	10	11	15	5	45	11	05	17	59	12	6	0	7	55	8	+15	6
	0	33	10	45	5	15	10	12	17	05	10	6	4	1				
" 14	0	58	...	...	6	46	...	...	18	13	...	...	2	4	56	3	+10	7
	1	21	0	46	7	16	11	48	18	18	13	6	2	6				
" 15	1	44	0	31	6	46	11	10	17	25	11	8	3	2	56	8	+ 5	3
	2	06	1	16	7	46	11	32	18	02	12	9	4	1				
" 16	2	29	0	16	7	46	10	10	17	40	13	1	2	2	57	3	— 0	3
	2	51	2	01	8	16	11	32	17	47	13	1	2	3				
" 17	3	14	3	16	7	16	12	25	16	25	12	6	3	9	57	7	— 6	0
	3	37	...	...	9	16	...	...	18	02	11	7	0	3				
" 18	4	00	3	01	9	01	11	24	17	24	10	6	2	7	58	2	—11	7
	4	24	2	16	9	16	10	16	17	16	10	2	3	0				
" 19	4	49	3	16	10	46	10	52	18	22	11	3	4	5	58	7	—16	8
	5	16	3	16	10	16	10	27	17	27	10	7	3	0				
" 20	5	42	3	46	9	16	10	30	16	00	10	8	5	5	59	1	—20	9
	6	10	3	46	...	...	10	04	...	...	10	7	...	...				
" 21	6	39	...	...	...	...	...	...	...	...	...	...	...	...	59	5	—24	1
	7	09	...	...	11	46	...	...	17	36	...	...	4	3				
" 22	7	40	...	...	...	...	...	...	...	...	...	...	...	...	59	8	—25	7
	8	10	7	46	4	16	12	06	21	07	9	1	4	7				
" 23	8	41	10	16	2	46	14	06	19	06	10	7	4	1	59	9	—25	6
	9	12	8	41	4	46	12	05	20	36	8	9	5	7				
" 24	9	45	9	17	1	17	12	05	16	36	10	3	3	3	59	9	—23	7
	10	15	10	17	3	47	12	32	18	35	9	7	2	8				
" 25	10	45	10	17	3	47	12	02	17	52	11	2	2	8	59	6	—20	3
	11	13	10	47	4	17	12	02	18	02	10	4	2	0				
" 26	11	41	12	47	4	47	13	34	18	02	11	9	1	0	59	2	—15	7
	...	...	11	47	6	02	12	06	18	49	11	3	3	0				
" 27	0	07	11	47	5	02	11	40	17	21	12	7	—0	4	58	6	—10	3
	0	33	11	47	6	02	11	14	17	55	10	3	—0	9				
" 28	0	57	12	32	6	17	11	35	17	44	13	0	0	1	57	9	— 4	5
	1	22	11	47	7	02	10	25	18	05	12	4	1	1				
March 1	1	45	...	...	7	02	...	...	17	40	...	...	0	5	57	1	+ 1	4
	2	09	1	32	8	47	11	47	19	02	12	9	1	3				
" 2	2	31	1	18	7	48	11	09	17	39	12	0	2	5	56	4	+ 7	0
	2	53	1	33	9	18	11	02	18	47	13	0	1	9				
" 3	3	15	2	03	8	18	11	10	17	25	10	6	2	5	55	7	+12	2
	3	38	2	18	9	03	11	03	17	48	10	9	1	5				
" 4	4	00	3	03	7	48	11	25	16	10	11	1	3	9	55	0	+16	7
	4	23	2	48	8	48	10	48	16	48	11	1	1	0				
" 5	4	46	3	48	8	48	11	25	16	25	9	2	3	1	54	6	+20	5
	5	09	3	03	9	48	10	17	17	02	10	1	3	9				
" 6	5	32	4	18	10	03	11	09	16	54	10	5	6	1	54	3	+23	4
	5	56	5	19	10	34	11	47	17	02	9	6	4	1				
" 7	6	22	4	49	10	49	10	53	16	53	8	8	5	8	54	2	+25	3
	6	47	...	...	...	...	...	...	...	...	...	...	...	...				
" 9	8	03	...	...	...	...	...	...	...	...	...	...	...	...			+25	5
	8	28	...	...	...	...	...	...	...	...	...	...	...	...				
" 10	8	53	9	49	4	21	13	21	20	18	9	9	3	9	54	9	+23	8
	9	18	10	50	4	35	13	57	20	07	8	8	5	0				
" 11	9	42	10	50	4	35	13	32	19	42	10	6	5	4	55	4	+21	0
	10	08	...	...	...	...	...	...	...	...	...	...	...	...				
" 14	11	43	...	...	...	...	...	...	...	...	...	...	...	...			+ 7	1
	0	06	12	21	...	...	12	15	...	...	11	2	...	...				

Series II.—From January 28 to April 7, 1854.

Date. 1854.	Moon passes the meridian. Appar. time.		Apparent time of H. water.		Apparent time of L. water.		Lunitidal interval. H. water.		Lunitidal interval. L. water.		Height of H. water.		Height of L. water.		Moon's parallax at noon.		Moon's declination at noon.	
	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.	Ft.	Dec.	Ft.	Dec.	Min.	Dec.	Degree.	Dec.
Mar. 15	0	29	11	21	6	21	10	52	18	15	12	7	2	3	57	6	+ 1	2
	0	52	...	...	8	06	...	...	19	37	...	...	2	7				
" 16	1	15	0	36	8	21	11	44	19	29	10	5	3	2	58	1	— 4	6
	1	38	1	21	6	36	12	06	17	21	8	4	3	0				
" 17	2	02	1	36	8	21	11	58	18	43	12	0	0	7	58	5	—10	5
	2	26	...	...	8	21	...	...	18	19	10	4	1	2				
" 18	2	52	1	52	9	22	11	26	18	56	12	1	1	6	58	8	—15	8
	3	18	1	52	8	07	11	00	17	15	9	5	3	1				
" 19	3	44	2	22	7	52	11	04	16	34	12	3	2	7	59	0	—20	4
	4	12	2	37	8	37	10	53	16	53	10	7	2	6				
" 20	4	40	4	22	...	...	12	10	...	...	12	4	...	...	59	2	—23	8
" 22	7	11	...	...	...	...	...	...	...	...	...	...	...	...			—26	0
" 23	7	42	7	23	...	...	12	12	...	...	9	5	...	...	59	2	—24	6
	8	12	8	23	1	53	12	41	18	42	8	5	5	3				
" 24	8	42	7	54	2	09	11	42	18	27	10	2	4	8	59	0	—21	6
	9	11	10	39	2	24	13	57	18	12	9	2	5	3				
" 25	9	39	9	54	3	54	12	43	19	12	10	3	5	1	58	7	—17	5
	10	05	9	54	3	54	12	15	18	43	9	6	4	3				
" 26	10	31	9	24	4	24	11	19	18	45	11	7	3	8	58	3	—12	4
	10	55	11	24	4	39	12	53	18	34	11	4	3	4				
" 27	11	19	10	54	4	54	11	59	18	23	11	9	2	2	57	8	— 6	7
	11	43	11	25	5	25	12	06	18	30	10	9	1	3				
" 28	...	...	11	25	5	55	11	42	18	36	12	0	2	0	57	3	— 0	8
	0	07	...	...	6	25	...	...	18	42	...	...	—1	3				
" 29	0	29	0	40	6	25	12	33	18	18	12	0	3	5	56	7	+ 4	9
	0	52	0	40	6	25	12	11	17	56	14	5	—0	2				
" 30	1	14	1	55	7	55	13	03	19	03	12	5	3	3	56	1	+10	4
	1	36	0	0	7	41	10	46	18	27	13	5	1	3				
" 31	1	59	1	41	7	56	12	05	18	20	11	5	1	5	55	5	+15	3
	2	22	1	56	8	56	11	57	18	57	13	0	3	3				
April 4	5	11	...	...	...	...	...	...	...	...	...	...	...	...	54	3	+26	1
	5	36	3	57	10	12	10	46	17	01	9	3	4	2				
" 5	6	01	5	42	10	42	12	06	17	06	9	7	5	0	54	3	+26	1
	6	27	5	42	10	42	11	41	16	41	6	9	5	7				
" 6	6	52	6	28	...	...	12	01	...	...	8	8	...	...	54	6	+24	8
	7	17	8	58	2	28	14	06	20	01	6	7	6	0				
" 7	7	41	8	13	0	0	12	56	17	08	8	5	5	5	55	0	+22	3
	8	07	9	58	2	28	14	17	19	11	7	5	5	5				

Series III.—From April 20 to August 3, 1854.

April 19	6	17	...	...	...	...	...	...	...	...	...	...	...	...				
" 20	6	45	...	...	...	...	...	...	...	...	...	...	...	...	58	8	—22	6
	7	13	6	01	0	16	11	16	17	59	8	1	5	1				
" 21	7	41	7	31	0	31	12	18	17	46	10	0	4	5	58	4	—18	7
	8	07	7	46	1	31	12	05	18	18	7	2	4	0				
" 22	8	35	8	02	1	17	11	55	17	36	10	4	4	0	57	9	—13	8
	8	59	9	47	3	17	13	12	19	10	9	8	4	0				
" 23	9	24	8	17	3	02	11	18	18	27	10	7	4	1	57	4	— 8	5
	9	47	19	17	4	32	12	53	19	33	9	6	1	8				
" 24	10	10	9	02	3	32	11	15	18	08	11	1	2	5	57	0	— 2	6
	10	32	9	32	4	32	11	22	18	45	9	9	1	7				
" 25	10	54	...	02	5	32	11	30	19	22	12	2	1	6	56	4	+ 3	1
	11	16	...	...	5	04	...	...	18	32	...	...	1	8				
" 26	11	38	...	...	4	02	...	...	17	08	...	...	2	6	56	0	+ 8	7
	12	00	0	02	6	32	12	46	19	16	12	0	0	1				
" 27	...	...	1	02	6	47	13	24	19	09	11	5	1	0	55	5	+13	8
	0	22	0	32	5	02	12	32	17	02	12	2	2	2				
" 28	0	45	...	...	5	03	...	...	16	41	...	...	2	0	55	0	+18	3
	1	09	1	03	7	03	12	18	18	18	11	6	2	0				
" 29	1	33	0	33	7	33	11	24	18	24	13	0	2	1	54	7	+21	9
	1	56	0	03	5	33	10	30	16	00	12	0	1	5				

SERIES III.—FROM APRIL 20 TO AUGUST 3, 1854.

Date. 1854.	Moon passes the meridian. Appar. time.		Apparent time of H. water.		Apparent time of L. water.		Lunitidal interval. H. water.		Lunitidal interval. L. water.		Height of H. water.		Height of L. water.		Moon's parallax at noon.		Moon's declination at noon.	
	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.	Ft.	Dec.	Ft.	Dec.	Min.	Dec.	Degree.	Dec.
April 30	2	20	0	03	5	33	10	07	15	37	12	9	1	9	54	4	+24	5
	2	45	0	33	5	17	10	13	14	57	11	3	1	7				
May 1	3	09	1	18	9	03	10	33	18	18	12	6	3	9	54	2	+26	0
	3	34	0	33	7	03	9	24	15	54	9	4	3	7				
" 2	3	59	2	33	9	03	10	59	17	29	12	4	1	8	54	2	+26	3
	4	25	2	33	8	33	10	34	16	34	10	3	4	3				
" 3	4	50	3	48	9	03	11	23	16	38	9	6	5	3	54	3	+25	4
	5	15	3	03	9	03	10	13	16	13	9	1	6	5				
" 4	5	39	4	33	...	...	11	18	...	...	10	5	...	...	54	6	+23	4
	6	04	...	...	...	...	...	...	...	...	...	...	...	...				
" 6	7	14	...	...	...	...	...	...	...	...	...	...	...	...	55	6	+16	3
	7	38	...	...	...	...	...	...	...	...	...	...	...	...				
" 7	8	02	6	34	0	49	10	56	17	35	8	9	6	0	56	4	+11	4
	8	25	9	34	2	04	13	32	18	26	7	9	3	6				
" 8	8	48	8	34	1	04	12	09	17	02	11	5	5	2	57	3	+ 6	0
	9	10	10	19	4	04	13	31	19	39	8	1	2	7				
" 9	9	33	8	34	2	04	11	24	17	16	11	3	4	4	58	1	0	0
	9	56	9	04	3	19	11	31	18	09	9	4	1	8				
" 10	10	19	10	49	5	34	12	53	20	01	8	9	2	0	58	5	— 6	0
	10	43	12	04	3	34	13	45	17	38	11	8	2	2				
" 11	11	09	11	04	4	34	12	21	18	15	10	5	1	9	59	7	—12	0
	11	35	10	49	5	04	11	40	18	21	13	7	1	3				
" 12	12	02	12	04	5	49	12	29	18	40	11	0	1	0	60	2	—17	4
	...	...	11	34	4	34	11	32	16	59	13	1	0	9				
" 13	0	30	10	49	...	...	10	19	...	...	12	4	...	...	60	5	—22	0
	1	00	11	04	5	19	10	04	16	49	13	6	1	3				
" 14	1	30	...	...	...	...	...	...	...	...	...	...	...	...	60	6	—25	0
	2	01	0	4	6	19	10	34	16	49	11	3	0	8				
" 15	2	33	0	49	7	34	10	48	17	33	13	9	1	7	60	4	—26	3
	3	05	1	49	8	19	11	16	17	46	12	3	0	5				
" 16	3	38	0	49	8	04	9	44	16	59	12	4	1	8	60	0	—25	8
	4	09	2	34	7	19	10	56	15	41	10	4	2	3				
" 17	4	41	2	49	9	04	10	40	16	55	12	8	1	8	59	4	—23	5
	5	10	2	49	8	19	10	08	15	38	10	6	2	0				
" 18	5	40	3	49	10	49	10	39	17	39	12	5	1	8	58	8	—19	8
	6	07	3	49	9	19	10	09	15	39	9	6	4	2				
" 19	6	34	5	19	...	...	11	12	...	...	11	7	...	...	58	1	—15	0
	6	59	6	19	0	04	11	45	17	57	10	2	3	0				
" 20	7	24	7	19	0	34	12	20	18	00	9	8	5	2	57	5	— 9	7
	7	47	8	34	3	04	13	10	20	05	8	7	3	8				
" 21	8	10	7	34	2	19	11	47	18	55	11	1	4	4	56	9	— 4	0
	8	32	8	34	2	34	12	24	18	47	8	6	3	7				
" 22	8	55	8	04	1	34	11	32	17	24	10	6	3	4	56	3	+ 1	6
	9	16	9	04	3	19	12	09	18	47	9	3	2	5				
" 23	9	38	8	04	3	04	10	48	18	09	11	3	3	5	55	8	+ 7	3
	9	59	10	19	4	19	12	41	19	03	11	4	3	3				
" 24	10	21	8	48	4	48	10	49	19	10	9	9	4	0	55	3	+12	4
	10	43	11	48	4	18	13	27	18	19	12	9	2	0				
" 25	11	05	10	18	5	03	11	35	18	42	10	0	2	0	54	9	+17	1
	11	28	11	03	5	33	11	58	18	50	10	8	2	0				
" 26	11	51	12	45	5	03	13	17	17	58	9	7	2	7	54	6	+20	9
	...	...	12	45	6	33	12	54	19	05	12	5	3	4				
" 27	0	15	10	48	6	18	10	33	18	27	9	7	2	4	54	3	+23	9
	0	39	...	...	4	18	...	...	16	03	...	...	0	5				
" 28	1	04	0	33	6	48	11	54	18	09	10	7	1	6	54	1	+25	7
	1	29	0	03	4	48	10	59	15	44	8	7	2	3				
" 29	1	54	0	03	7	03	10	34	17	34	10	9	1	5	54	0	+26	3
	2	19	0	48	7	18	10	54	17	24	8	5	1	6				
" 30	2	44	1	03	8	18	10	44	17	59	12	0	2	5	54	0	+25	8
	3	09	2	18	6	48	11	34	16	04	8	5	2	5				
" 31	3	34	3	18	9	18	12	09	18	09	11	5	2	5	54	2	+24	1
	3	59	2	33	8	33	10	59	16	59	8	5	3	5				
June 1	4	22	2	18	9	47	10	19	17	48	11	0	4	0	54	5	+21	4
	4	47	4	17	10	02	11	55	17	40	8	0	3	6				

SERIES III.—FROM APRIL 20 TO AUGUST 3, 1854.

Date. 1854.	Moon passes the meridian. Appar. time.		Apparent time of H. water.		Apparent time of L. water.		Lunitidal interval. H. water.		Lunitidal interval. L. water.		Height of H. water.		Height of L. water.		Moon's parallax at noon.		Moon's declination at noon.	
	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.	Ft.	Dec.	Ft.	Dec.	Min.	Dec.	Degree.	Dec.
June 2	5	09	4	02	10	32	11	15	17	45	9	8	3	7	54	9	+17	6
	5	32	4	47	10	17	11	38	17	08	7	8	4	8				
" 3	5	54	...	...	...	...	...	...	...	...	9	6	4	5	55	5	+13	1
	6	16	4	02	10	02	10	08	16	08	8	1	5	2				
" 4	6	38	...	...	...	...	...	...	...	...	9	4	...	...	56	3	+ 8	0
	7	00	7	32	12	02	12	54	17	24	8	6	5	6				
" 5	7	22	8	02	...	...	13	02	...	...	9	7	...	...	57	2	+ 2	3
	7	44	9	02	0	32	13	40	17	32	9	2	4	7				
" 6	8	07	9	02	1	32	13	18	18	10	10	1	6	1	58	2	— 3	6
	8	30	8	02	2	32	11	55	18	48	10	4	4	0				
" 7	8	54	9	02	4	02	12	32	19	55	10	2	4	3	59	0	— 9	5
	9	18	9	02	3	02	12	08	18	32	11	1	3	4				
" 8	9	44	8	01	2	47	10	43	17	53	9	3	4	0	59	9	—15	2
	10	10	10	01	2	31	12	17	17	13	11	6	1	8				
" 9	10	38	...	...	...	...	...	...	...	...	...	...	...	...	60	6	—20	1
	11	07	9	01	3	01	10	23	16	51	12	9	1	4				
" 10	11	38	10	01	5	01	10	54	18	23	11	7	2	1	61	1	—23	9
	...	...	13	31	6	01	13	53	18	54	11	4	0	6				
" 11	0	10	10	31	6	01	10	21	18	23	9	4	1	8	61	2	—26	0
	0	43	13	01	6	31	12	18	18	21	13	2	2	0				
" 12	1	16	11	31	6	31	10	15	17	48	10	4	1	6	61	1	—26	2
	1	49	...	...	6	31	...	...	17	15	12	2	0	4				
" 13	2	21	...	...	8	30	...	...	18	41	...	...	0	2	60	6	—24	5
	2	52	1	00	8	00	10	39	17	39	10	3	1	1				
" 14	3	24	1	30	7	30	10	38	16	38	12	1	1	6	60	0	—21	0
	3	53	0	30	8	00	9	06	16	36	10	3	1	3				
" 15	4	23	2	30	9	00	10	37	17	07	12	3	1	3	59	2	—16	5
	4	49	1	30	8	00	9	07	15	37	8	5	2	3				
" 16	5	16	4	0	9	45	11	11	16	56	11	7	2	5	58	3	—11	2
	5	40	2	0	9	00	8	44	15	44	8	9	3	7				
" 17	6	04	3	0	9	00	9	20	15	20	11	4	2	8	57	4	— 5	4
	6	27	2	30	11	29	8	26	17	25	9	3	4	6				
" 18	6	49	4	59	11	29	10	32	17	02	10	2	3	2	56	7	+ 0	4
	7	11	4	59	11	59	10	10	17	10	10	5	5	6				
" 19	7	33	5	59	...	...	10	48	...	...	10	5	...	...	56	0	+ 6	0
	7	54	7	29	1	29	11	56	18	18	10	0	4	0				
" 20	8	16	7	59	2	14	12	05	18	41	9	9	5	2	55	4	+11	3
	8	37	9	29	3	29	13	13	19	35	10	5	4	4				
" 21	8	59	8	59	2	44	13	22	18	28	9	4	5	8	54	9	+16	6
	9	22	9	29	2	59	12	30	18	22	13	0	3	0				
" 22	9	44	9	28	2	58	12	06	17	59	9	9	2	9	54	5	+20	1
	10	07	10	13	4	58	12	29	19	36	10	6	3	3				
" 23	10	31	9	28	3	58	11	21	18	14	8	5	3	6	54	3	+23	2
	10	55	11	28	5	43	12	57	19	36	11	0	2	9				
" 24	11	19	12	13	4	28	13	18	17	57	8	1	3	6	54	1	+25	4
	11	44	10	58	5	28	11	39	18	33	11	3	2	0				
" 25	...	...	11	58	4	58	12	14	17	39	8	3	2	4	54	0	+26	3
	0	10	...	...	6	58	...	...	19	14	...	...	3	1				
" 26	0	35	1	13	4	58	13	03	16	48	12	1	2	0	53	9	+26	0
	0	59	0	57	6	27	12	22	17	52	9	9	2	4				
" 27	1	24	...	...	4	57	...	...	15	58	12	3	1	9	54	0	+24	6
	1	49	0	27	7	27	11	03	18	03	9	8	3	0				
" 28	2	13	0	57	7	57	11	08	18	08	11	4	3	2	54	2	+22	1
	2	37	0	57	7	27	10	44	17	14	9	2	2	5				
" 29	3	00	1	12	7	57	10	35	17	20	11	4	3	6	54	5	+18	6
	3	24	1	42	6	27	10	42	15	27	9	1	2	0				
" 30	3	46	3	27	8	57	12	03	17	33	12	3	3	9	54	9	+14	3
	4	08	0	12	7	27	8	26	15	41	9	4	3	8				
July 1	4	30	4	42	9	57	12	34	17	49	11	6	2	6	55	5	+ 9	4
	4	52	4	57	8	57	12	27	16	27	9	3	5	0				
" 2	5	12	3	26	10	41	10	34	17	49	11	7	2	2	56	2	+ 4	0
	5	33	5	26	11	26	12	14	18	14	7	3	3	8				
" 3	5	55	4	11	10	26	10	38	16	53	9	1	4	8	57	0	— 1	7
	6	17	5	26	10	56	11	21	17	01	9	8	6	9				
" 4	6	39	6	41	11	11	12	24	16	54	10	2	4	4	57	9	— 7	5
	7	02	6	56	...	...	12	17	...	...	9	8	...	...				

Series III.—From April 20 to August 3, 1854.

Date. 1854.	Moon passes the meridian. Appar. time.		Apparent time of H. water.		Apparent time of L. water.		Lunitidal interval. H. water.		Lunitidal interval. L. water.		Height of H. water.		Height of L. water.		Moon's parallax at noon.		Moon's declination at noon.	
	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.	Ft.	Dec.	Ft.	Dec.	Min.	Dec.	Degree.	Dec.
July 5	7	26	6	56	0	26	11	54	17	47	10	1	6	5	58	8	—13	1
	7	51	7	56	1	26	12	30	18	24	10	6	4	3				
" 6	8	18	7	41	1	56	11	50	18	30	9	4	6	0	59	7	—18	3
	8	45	8	56	1	26	12	38	17	35	11	2	3	9				
" 7	9	14	7	55	2	55	11	10	18	37	9	2	5	6	60	5	—22	5
	9	43	...	...	3	10	...	...	18	25	...	...	3	0				
" 8	10	15	...	...	...	...	...	...	...	...	...	...	...	...	61	1	—25	3
	10	47	...	...	...	...	...	...	...	...	...	...	...	...				
" 9	11	20	10	40	4	40	11	53	18	25	8	5	2	4	61	4	—26	3
	11	54	11	40	4	25	12	20	17	38	12	5	1	2				
" 10	...	...	12	55	5	25	12	51	18	05	8	4	2	2	61	4	—25	4
	0	27	11	55	5	10	11	28	17	26	13	6	1	2				
" 11	1	00	12	25	6	25	11	25	17	58	10	1	1	5	61	0	—22	5
	1	31	12	55	6	10	11	24	17	10	13	3	1	2				
" 12	2	02	11	40	6	55	9	38	17	24	10	1	1	0	60	3	—18	3
	2	31	...	...	7	10	...	...	17	08	...	...	1	2				
" 13	3	00	1	10	7	40	10	39	17	09	13	6	1	0	59	5	—12	9
	3	26	1	25	7	55	10	25	16	55	10	0	2	4				
" 14	3	52	1	55	9	10	10	29	17	44	12	6	1	8	58	5	— 7	2
	4	15	2	24	8	54	10	32	17	02	9	2	2	5				
" 15	4	39	...	...	...	...	...	...	...	...	...	...	...	...	57	6	— 1	2
" 17	6	31	...	...	...	...	...	...	...	...	...	...	...	...			+10	2
" 18	6	53	...	...	...	...	...	...	...	...	...	...	...	...	55	3	+15	1
	7	16	7	24	1	24	12	31	18	53	9	2	4	8				
" 19	7	38	8	54	...	...	13	38	...	...	7	6	4	6	54	7	+19	3
	8	01	8	39	1	24	13	01	18	08	9	3	4	4				
" 20	8	24	9	54	2	39	13	53	19	01	8	7	5	6	54	4	+22	6
	...	...	...	...	1	54	...	...	17	53	...	...	4	5				
" 27	2	04	...	...	...	...	...	...	...	...	...	...	...	...			+15	3
" 28	2	26	...	...	...	...	...	...	...	...	...	...	...	...	55	2	+10	4
	2	48	1	54	7	54	11	28	17	28	8	6	2	0				
" 29	3	09	2	54	8	09	12	06	17	21	12	0	1	7	55	7	+ 5	2
	3	30	3	54	8	54	12	45	17	45	11	3	3	2				
" 30	3	51	2	09	8	24	10	39	16	54	11	1	3	2	56	3	— 0	4
	4	13	2	54	8	24	11	03	16	33	9	2	4	1				
" 31	4	34	...	...	...	...	...	...	...	...	10	6	4	0	56	9	— 6	1
	4	56	2	39	9	39	10	05	17	05	9	0	4	8				
Aug. 1	5	19	3	24	10	39	10	28	17	43	9	3	4	4	57	7	—11	6
	5	43	4	39	9	54	11	20	16	35	10	5	6	1				
" 2	6	07	4	54	11	09	11	11	17	26	10	5	4	5	58	5	—16	8
	6	32	5	54	...	...	11	47	...	...	9	5	...	...				
" 3	6	59	5	54	0	54	11	22	18	47	8	8	5	7	59	3	—21	3
	7	27	8	24	1	09	13	25	18	37	9	4	3	6				

Series IV.—From September 7 to October 22, 1854.

Sept. 7	0	23	...	...	...	...	...	...	...	...	...	...	...	...	59	3	— 5	7
	0	47	11	2	...	...	10	15	...	...	14	5	...	...				
" 8	1	12	11	2	5	32	9	50	16	45	14	0	—1	7	58	5	+ 0	5
	1	36	...	...	8	02	...	...	18	50	...	...	0	0				
" 9	2	01	1	32	8	02	11	56	18	26	13	5	1	0	57	7	+ 6	6
	2	24	1	32	7	32	11	31	17	31	14	0	—0	5				
" 10	2	47	1	03	7	33	10	39	17	09	13	0	—1	0	56	9	+12	3
	3	10	2	03	10	03	11	16	19	16	11	0	1	0				
" 11	3	33	2	33	8	33	11	23	17	23	11	0	0	0	56	1	+17	2
	3	57	...	...	9	03	...	...	17	30	10	5	1	5				
" 12	4	22	2	04	8	03	10	07	16	06	14	0	0	0	55	4	+21	2
	4	46	4	03	8	03	11	41	15	41	10	0	0	0				
" 13	5	11	3	04	7	04	10	18	14	18	10	0	0	0	54	8	+24	2
	5	35	3	34	8	04	10	23	14	53	9	0	3	0				
" 14	6	00	2	04	...	...	8	29	...	...	7	0	...	...	54	5	+26	1
	6	25	...	...	...	...	...	...	...	...	...	...	...	...				
" 15	6	52	...	...	...	...	...	...	...	...	...	...	...	...			+26	7
	7	17	...	...	...	...	...	...	...	...	...	...	...	...				

SERIES IV.—FROM SEPTEMBER 7 TO OCTOBER 22, 1854.

Date. 1854.	Moon passes the meridian. Appar. time.		Apparent time of				Lunitidal interval.				Height of				Moon's parallax at noon.		Moon's declination at noon.	
			H. water.		L. water.		H. water.		L. water.		H. water.		L. water.					
	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.	Ft.	Dec.	Ft.	Dec.	Min.	Dec.	Degree.	Dec.
Sept. 16	7	43	...	...	11	35	...	...	16	18	...	...	5	0	54	2	+26	1
	8	08	...	...	...	...	...	...	...	...	10	0	...	...				
" 17	8	34	7	06	1	36	11	58	17	53	9	0	5	0	54	3	+24	4
	8	58	8	06	0	06	11	32	15	58	10	4	5	0				
" 18	9	22	...	...	4	06	...	...	19	32	9	0	5	0	54	5	+21	5
	9	47	10	06	3	06	12	44	18	08	12	0	5	0				
" 19	10	09	8	36	4	36	10	49	19	14	10	0	5	0	54	9	+17	7
	10	33	11	06	6	06	12	57	20	19	12	6	5	0				
" 20	10	55	...	...	5	07	...	...	18	58	...	...	2	0	55	3	+13	1
	11	17	11	07	4	07	12	12	17	34	13	0	2	0				
" 21	11	39	11	07	5	07	11	50	18	12	11	5	4	0	55	8	+ 7	8
	...	...	11	07	3	07	11	28	15	50	14	0	0	0				
" 22	12	00	...	...	5	07	...	...	17	28	...	...	2	0	56	4	+ 2	2
	0	22	0	07	5	07	12	07	17	07	13	0	1	0				
" 23	0	45	1	08	6	08	12	46	17	46	12	0	—0	7	56	9	— 3	6
	1	07	0	08	6	38	11	23	17	53	13	0	0	0				
" 24	1	29	1	08	7	08	12	01	18	01	11	0	2	0	57	4	— 9	5
	1	52	0	08	7	08	10	39	17	39	13	0	1	0				
" 25	2	15	2	08	8	08	12	16	18	16	14	0	0	0	57	9	—14	9
	2	39	1	08	8	08	10	53	17	53	13	0	0	0				
" 26	3	06	1	09	7	09	10	30	16	30	13	0	0	0	58	3	—19	7
	3	32	2	09	8	09	11	03	17	03	13	0	0	0				
" 27	3	59	2	09	8	09	10	37	16	37	12	0	—1	0	58	6	—23	5
	4	27	3	09	8	09	11	10	16	10	13	0	0	0				
" 28	4	56	3	09	8	09	10	42	15	42	13	0	1	0	58	9	—26	0
	5	25	4	09	9	09	11	13	16	13	12	0	2	0				
" 29	5	57	2	10	10	10	8	45	16	45	10	0	2	0	59	2	—26	8
	6	28	4	10	9	10	10	13	15	13	11	5	3	0				
" 30	6	59	4	10	11	10	9	42	16	42	9	0	3	0	59	4	—25	8
	7	30	5	40	12	10	10	41	17	11	10	0	4	5				
Oct. 1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	59	5	—23	3
" 3	10	20	...	...	...	...	...	...	...	...	...	...	...	...			—14	2
" 4	10	45	9	41	...	...	11	21	...	...	10	0	...	...	59	0	— 8	3
	11	10	11	11	4	41	12	26	18	21	14	0	0	0				
" 5	11	36	12	12	4	11	13	02	17	26	13	0	—1	2	58	6	— 2	0
	11	59	11	42	5	12	12	06	18	02	14	0	—2	0				
" 6	0	22	12	12	5	12	12	13	17	36	12	0	—1	0	57	9	+ 4	3
	...	...	11	12	7	12	10	50	19	13	14	0	—0	5				
" 7	0	46	...	...	6	42	...	...	18	20	...	...	1	0	57	3	+10	2
	1	09	0	12	5	42	11	26	16	56	14	0	0	0				
" 8	1	33	0	12	8	12	11	03	19	03	14	0	—1	0	56	6	+15	5
	1	57	0	43	7	13	11	10	17	40	13	0	0	0				
" 9	2	21	0	13	6	43	10	16	16	46	10	0	0	0	55	9	+20	0
	2	45	2	13	8	13	11	52	17	52	14	0	0	0				
" 10	3	10	1	13	6	13	10	28	15	28	13	0	0	0	55	3	+23	4
	3	35	2	13	8	13	11	03	17	03	14	0	0	5				
" 11	4	00	1	13	8	13	9	38	16	38	10	0	0	0	54	8	+25	7
	4	25	1	13	8	13	9	13	16	13	14	0	2	0				
" 12	4	51	2	13	8	13	10	48	15	48	14	5	2	0	54	5	+26	8
	5	17	3	44	9	14	10	53	16	23	14	0	4	0				
" 14	6	58	...	...	...	...	...	...	...	...	...	...	...	...	54	3	+25	3
" 15	7	23	...	...	11	14	...	...	16	16	10	0	3	0	54	4	+22	7
	7	47	8	14	11	14	12	51	15	51	10	0	5	0				
" 16	8	01	...	...	...	...	...	...	...	...	...	...	...	...	54	8	+19	2
	8	34	...	...	...	...	...	...	...	...	...	...	...	...				
" 17	8	57	10	15	3	15	13	41	19	14	10	0	3	0	55	2	+14	8
	9	19	10	15	3	15	13	18	18	41	11	0	3	0				
" 18	9	41	9	15	3	15	11	56	18	18	11	0	3	0	55	7	+ 9	7
	10	02	9	15	3	45	11	34	18	26	12	0	2	0				
" 19	10	24	9	15	4	15	11	13	18	34	12	0	0	0	56	4	+ 4	2
	10	46	...	...	3	45	...	...	17	43	11	0	1	0				
" 20	11	08	11	15	5	15	12	29	18	51	12	0	1	0	57	0	— 1	6
	11	30	12	15	4	15	13	07	17	29	11	0	0	0				
" 21	11	53	11	45	4	15	12	15	17	07	12	0	0	0	57	7	— 7	6
	...	...	11	15	5	15	11	22	17	45	12	0	0	0				
" 22	0	17	11	45	4	15	11	28	16	22	13	0	0	0	58	3	—13	4
	0	41	11	45	5	15	11	04	16	58	13	0	0	0				

The second form, or Table No. 2, for reduction of tides, is specially arranged to obtain the establishment and the half-monthly inequality in time and height. The first part is arranged in reference to the observed high waters; the second part, in reference to the low waters. That the inequality in time and height should also be made out from the low water, is specially important for stations where either the observations are of short extent, or else where difficulties tend to render the observations less accurate. The discussion of the low waters could not be omitted in our case. The headings to the columns of Table No. 2, explain the arrangement sufficiently. The results from the upper and lower transit of the moon are kept separate. (It need hardly be remarked that, in certain months, the sun's or moon's lower transit can be observed at Van Rensselaer Harbor.)

TABLE FOR THE REDUCTION OF TIDES.—No. 2.

Showing the Interval between the App. Time of the Moon's Superior Transit and the Time of High Water, and also the Heights of High Water, at Van Rensselaer Harbor, from Four Series of Observations made between October 10, 1853, and October 22, 1854.

0h to 1h.							1h to 2h.							2h to 3h.						
Moon's transit. App. time.		Lunitidal interval. H. water.		Height of H. water.		No. of observations and series.	Moon's transit. App. time.		Lunitidal interval. H. water.		Height of H. water.		No. of observations and series.	Moon's transit. App. time.		Lunitidal interval. H. water.		Height of H. water.		No. of observations and series.
H.	M.	H.	M.	Ft.	Dec.		H.	M.	H.	M.	Ft.	Dec.		H.	M.	H.	M.	Ft.	Dec.	
0	57	...	...	12	3		1	40	11	35	12	4		2	25	11	20	11	9	
0	19	10	57	11	6		1	16	12	00	11	8		2	16	11	00	11	6	I.
0	21	12	09	13	6	I.	1	07	11	23	13	0	I.	2	44	11	00	13	0	
0	53	11	17	9	5		1	55	11	20	12	1		2	58	10	34	...	...	
0	30	11	49	12	8		1	58	11	12	9	4								
														2	45	12	01	11	1	
0	01	12	16	11	9		1	01	11	15	9	0		2	29	11	32	13	1	
0	10	11	05	12	6		1	55	10	51	9	7		2	09	11	09	12	0	II.
0	58	11	48	13	6		1	44	11	32	12	9	II.	2	53	11	10	10	6	
0	33	11	14	10	3	II.	1	22	10	25	12	4		2	02	...	...	10	4	
0	29	10	52	12	7		1	15	12	06	8	4		2	52	11	00	9	5	
0	07	12	33	12	0		1	36	12	05	11	5								
0	52	13	03	12	5									2	45	10	33	12	6	
							1	09	11	24	13	0		2	33	11	16	12	3	
0	30	10	19	12	4		1	56	10	07	12	9		2	19	10	44	12	0	
0	39	11	54	10	7		1	30	10	34	11	3		2	21	10	39	10	3	III.
0	10	10	21	9	4	III.	1	29	10	34	10	9	III.	2	37	10	35	11	4	
0	10	13	03	12	1		1	16	10	15	10	4		2	02	9	38	10	1	
0	59	...	...	12	3		1	49	11	08	11	4		2	48	12	06	12	0	
							1	00	11	25	10	1								
0	22	12	46	12	0									2	01	11	31	14	0	
0	46	11	26	14	0	IV.	1	12	9	50	14	0		2	47	11	16	11	0	IV.
0	41	11	04	13	0		1	07	12	01	11	0	IV.	2	39	10	30	13	0	
							1	52	12	16	14	0		2	21	11	52	14	0	
							1	33	11	10	13	0								
MEANS.																				
0	29	11	40	...	...	18	1	29	11	12	...	...	22	2	32	11	04	...	...	20
0	31	...	...	12	1	20	1	29	...	...	11	6	22	2	29	...	...	11	8	20

TABLE FOR THE REDUCTION OF TIDES —No. 2.

Showing the Interval between the App. Time of the Moon's Superior Transit and the Time of High Water, and also the Heights of High Water, at Van Rensselaer Harbor, from Four Series of Observations made between October 10, 1853, and October 22, 1854.

3h to 4h.							4h to 5h.							5h to 6h.						
Moon's transit. App. time.		Lunitidal interval. H. water.		Height of H. water.		No. of observations and series.	Moon's transit. App. time.		Lunitidal interval. H. water.		Height of H. water.		No. of observations and series.	Moon's transit. App. time.		Lunitidal interval. H. water.		Height of H. water.		No. of observations and series.
H.	M.	H.	M.	Ft.	Dec.		H.	M.	H.	M.	Ft.	Dec.		H.	M.	H.	M.	Ft.	Dec.	
3	12	12	03	11	1	I.	4	00	11	16	9	9	I.	5	42	12	04	9	7	I.
3	19	9	57	10	1		4	51	11	25	10	4		5	23	10	23	8	2	
3	34	10	40	11	5		4	22	11	39	9	1		5	14	10	29	10	1	
3	03	10	51	8	3		4	24	10	20	10	7		5	00	10	09	6	1	
3	46	11	01	10	4		4	03	10	36	9	1		5	52	12	46	6	8	
							4	32	11	14	11	5		5	17	11	14	11	6	
3	32	12	29	10	0	II.	4	16	11	45	8	5	II.	5	00	11	46	9	2	II.
3	14	...	...	11	7		4	00	10	16	10	2		5	43	12	33	10	5	
3	38	11	25	11	1		4	49	10	27	10	7		5	42	10	04	10	7	
3	44	10	53	10	7		4	23	11	25	9	2		5	09	11	09	10	5	
3	34	10	59	12	4	III.								5	56	10	53	8	8	
3	38	10	56	10	4		4	25	11	23	9	6	III.	5	36	12	06	9	7	
3	09	12	09	11	5		4	41	10	08	10	6								
3	59	10	19	11	0		4	47	11	15	9	8		5	15	11	18	10	5	III.
3	24	9	06	10	3		4	23	9	07	8	5		5	40	10	09	9	6	
3	24	12	03	12	3		4	08	12	34	11	6		5	32	...	...	9	6	
3	00	10	25	10	0		4	52	10	34	11	7		5	16	8	44	8	9	
3	52	10	32	9	2		4	13	...	...	10	6		5	33	10	38	9	1	
3	30	10	39	11	1		4	56	10	28	9	3		5	43	11	11	10	5	
3	33	...	...	10	5	IV.	4	22	11	41	10	0	IV.	5	11	10	23	9	0	IV.
3	32	10	37	12	0		4	27	10	42	13	0		5	25	8	45	10	0	
3	10	11	03	14	0		4	00	9	13	14	0								
							4	51	10	53	14	0								
MEANS.																				
3	30	10	57	...	...	19	4	27	10	52	...	...	21	5	27	10	53	...	...	19
3	29	...	...	10	9	21	4	27	...	...	10	5	22	5	27	...	...	9	5	20
The highest and lowest value of the interval balance nearly.														The criterion rejects no value of the interval, the two high and two low values balance nearly.						

TABLE FOR THE REDUCTION OF TIDES.—No. 2.

Showing the Interval between the App. Time of the Moon's Superior Transit and the Time of High Water, and also the Heights of High Water, at Van Rensselaer Harbor, from Four Series of Observations made between October 10, 1853, and October 22, 1854.

6h to 7h.							7h to 8h.							8h to 9h.						
Moon's transit. App. time.		Lunitidal interval. H. water.		Height of H. water.		No. of observations and series.	Moon's transit. App. time.		Lunitidal interval. H. water.		Height of H. water.		No. of observations and series.	Moon's transit. App. time.		Lunitidal interval. H. water.		Height of H. water.		No. of observations and series.
H.	M.	H.	M.	Ft.	Dec.		H.	M.	H.	M.	Ft.	Dec.		H.	M.	H.	M.	Ft.	Dec.	
6	28	13	45	8	0	I.	7	26	12	32	6	7	I.	8	22	11	51	7	9	I.
6	32	13	44	8	5		7	22	13	24	9	2		8	11	12	35	9	8	
6	21	10	55	7	8		7	14	12	02	8	1		8	59	12	47	10	8	
6	01	10	42	9	9		7	34	11	23	10	3		8	02	12	44	9	8	
6	48	11	55	9	5		7	22	13	15	11	2		8	48	13	13	9	5	
6	38	11	45	7	6		7	34	11	56	7	3		8	20	12	07	9	9	
6	01	10	29	8	8		7	14	12	32	9	4	II.	8	04	13	33	11	1	
6	47	11	43	9	3		7	40	12	06	9	1		8	46	13	05	9	5	
6	28	13	48	9	5	II.	7	42	12	41	8	5		8	23	11	51	9	2	
6	27	12	01	8	8		7	17	12	56	8	5		8	02	13	59	9	5	II.
6	45	11	16	8	1	III.	7	41	12	05	7	2	III.	8	50	13	25	9	7	
6	34	11	45	10	2		7	38	10	56	8	9		8	41	12	05	8	9	
6	16	...	...	9	4		7	24	13	10	8	7		8	28	13	21	9	9	
6	04	8	26	9	3		7	00	13	02	9	7		8	42	13	57	9	2	
6	49	10	10	10	5		7	44	13	18	10	1		8	35	13	12	9	8	III.
6	17	12	24	10	2		7	33	11	56	10	0		8	25	12	09	11	5	
6	53	12	31	9	2		7	02	11	54	10	1		8	10	12	24	8	6	
6	32	11	22	8	8		7	51	11	50	9	4		8	55	12	09	9	3	
							7	38	13	01	9	3		8	30	12	32	10	2	
6	28	9	42	9	0	IV.	7	43	...	...	10	0	IV.	8	16	13	13	10	5	
							7	23	12	51	10	0		8	59	12	30	13	0	
														8	45	11	10	9	2	
														8	34	11	32	10	4	IV.
														8	57	13	18	11	0	
MEANS.																				
6	30	11	35	...	...	18	7	28	12	26	...	...	20	8	32	12	42	...	...	24
6	29	...	...	9	1	19	7	29	...	...	9	1	21	8	32	...	...	9	9	24
Peirce's criterion rejects the value 8h 26m, new mean—																				
6	31	11	45	...	...	17														

TABLE FOR THE REDUCTION OF TIDES.—No. 2.

Showing the Interval between the App. Time of the Moon's Superior Transit and the Time of High Water, and also the Heights of High Water, at Van Rensselaer Harbor, from Four Series of Observations made between October 10, 1853, and October 22, 1854.

9h to 10h.							10h to 11h.							11h to 12h.						
Moon's transit. App. time.		Lunitidal interval. H. water.		Height of H. water.		No. of observations and series.	Moon's transit. App. time.		Lunitidal interval. H. water.		Height of H. water.		No. of observations and series.	Moon's transit. App. time.		Lunitidal interval. H. water.		Height of H. water.		No. of observations and series.
H.	M.	H.	M.	Ft.	Dec.		H.	M.	H.	M.	Ft.	Dec.		H.	M.	H.	M.	Ft.	Dec.	
9	12	12	47	9	1	I.	10	02	12	12	9	8	I.	11	26	12	50	12	2	I.
9	47	12	59	11	4		10	36	12	10	11	7		11	37	11	53	13	3	
9	31	12	30	11	2		10	13	12	03	11	5		11	50	12	21	10	8	
9	08	12	04	11	2		10	54	11	51	12	7		11	41	13	23	13	2	
9	58	13	13	12	5		10	51	12	05	10	7		11	32	11	23	11	5	II.
9	27	13	39	9	9		10	10	12	25	11	0		11	41	12	06	11	3	
9	18	12	10	9	1		10	54	12	11	12	5		11	19	12	06	10	9	
							10	16	12	42	10	6								
9	41	12	34	9	2	II.	10	58	13	19	10	6	II.	11	38	13	24	11	5	III.
9	45	12	32	9	7		10	32	13	13	10	5		11	35	12	29	11	0	
9	18	13	32	10	6		10	45	12	02	10	4		11	05	11	58	10	8	
9	39	12	15	9	6		10	31	12	53	11	4		11	51	12	54	12	5	
														11	07	10	54	11	7	
9	24	12	53	9	6	III.	10	10	11	22	9	9	III.	11	19	11	39	11	3	
9	10	11	24	11	3		10	43	12	21	10	5		11	54	12	51	8	4	
9	56	12	53	8	9		10	21	13	27	12	9								
9	38	12	41	11	4		10	31	12	57	11	0		11	39	11	28	14	0	IV.
9	18	10	43	9	3		10	47	11	53	8	5		11	10	13	02	13	0	
9	44	12	29	10	6									11	59	12	13	12	0	
9	22	12	44	12	0	IV.	10	09	12	57	12	6	IV.	11	08	13	07	11	0	
9	41	11	34	12	0		10	55	12	12	13	0		11	53	11	22	12	0	
							10	20	11	21	10	0								
							10	24	...	...	11	0								
MEANS.																				
9	31	12	30	...	...	19	10	32	12	23	...	...	20	11	32	12	17	...	...	19
9	31	...	...	10	4	19	10	31	...	...	11	1	21	11	32	...	...	11	7	19
The value 10h 43m is rejected by Peirce's criterion, and there is no corresponding high value to balance it; the new mean becomes—																				
9	32	12	36	...	...	18														

TABLE FOR THE REDUCTION OF TIDES.—No. 2.

Showing the Interval between the App. Time of the Moon's Inferior Transit and the Time of High Water, and also the Heights of High Water, at Van Rensselaer Harbor, from Four Series of Observations made between October 10, 1853, and October 22, 1854.

0^h to 1^h.							1^h to 2^h.							2^h to 3^h.						
Moon's transit. App. time.		Lunitidal interval. H. water.		Height of H. water.		No. of observations and series.	Moon's transit. App. time.		Lunitidal interval. H. water.		Height of H. water.		No. of observations and series.	Moon's transit. App. time.		Lunitidal interval. H. water.		Height of H. water.		No. of observations and series.
H.	M.	H.	M.	Ft.	Dec.		H.	M.	H.	M.	Ft.	Dec.		H.	M.	H.	M.	Ft.	Dec.	
0	35	11	10	10	7	I.	1	18	11	12	11	5	I.	2	02	11	13	11	5	I.
0	48	11	28	14	3		1	46	11	45	14	2		2	48	10	42	9	9	
0	44	11	01	10	9		1	31	11	14	13	7		2	20	10	54	9	8	
0	21	11	50	12	8		1	25	11	45	13	6		2	30	11	25	12	8	
0	06	11	58	12	5		1	44	11	19	...	...		2	34	11	29	...	...	
0	55	11	39	7	5															
0	31	11	31	13	3	II.	1	27	11	49	13	9	II.	2	20	10	56	13	7	II.
0	33	10	12	10	6		1	21	11	10	11	8		2	06	10	10	13	1	
0	07	11	40	12	7		1	45	11	47	12	9		2	51	12	25	12	6	
0	57	11	35	13	0		1	38	11	58	12	0		2	31	11	02	13	0	
0	06	12	15	11	2		1	14	10	46	13	5		2	26	11	26	12	1	
0	52	11	44	10	5		1	59	11	57	13	0								
0	29	12	11	14	5		1	33	10	30	12	0	III.	2	20	10	13	11	3	III.
							1	00	10	04	13	6		2	01	10	48	13	9	
0	00	12	32	12	2	III.	1	04	10	59	8	7		2	44	11	34	8	5	
0	45	12	18	11	6		1	54	10	54	8	5		2	52	10	38	12	1	
0	02	11	32	13	1		1	49	...	...	12	2		2	13	10	44	9	2	
0	15	10	33	9	7		1	24	11	03	9	8		2	31	10	39	13	6	
0	43	12	18	13	2		1	31	11	24	13	3		2	26	11	28	8	6	
0	35	12	22	9	9															
0	27	11	28	13	6		1	36	11	56	13	5	IV.	2	24	10	39	13	0	IV.
							1	29	10	39	13	0		2	15	10	53	13	0	
0	47	10	15	14	5	IV.	1	09	11	03	14	0		2	45	10	28	13	0	
0	00	12	07	13	0		1	57	10	16	10	0								
0	45	11	23	13	0															
0	22	10	50	14	0															
0	17	11	28	13	0															
MEANS.																				
0	29	11	34	...	...	25	1	31	11	13	...	...	21	2	27	10	59	...	...	20
0	29	...	...	12	2	25	1	31	...	...	12	3	21	2	27	...	...	11	8	19

TABLE FOR THE REDUCTION OF TIDES.—No. 2.

Showing the Interval between the App. Time of the Moon's Inferior Transit and the Time of High Water, and also the Heights of High Water, at Van Rensselaer Harbor, from Four Series of Observations made between October 10, 1853, and October 22, 1854.

3h to 4h.							4h to 5h.							5h to 6h.						
Moon's transit. App. time.		Lunitidal interval. H. water.		Height of H. water.		No. of observations and series.	Moon's transit. App. time.		Lunitidal interval. H. water.		Height of H. water.		No. of observations and series.	Moon's transit. App. time.		Lunitidal interval. H. water.		Height of H. water.		No. of observations and series.
H.	M.	H.	M.	Ft.	Dec.		H.	M.	H.	M.	Ft	Dec.		H.	M.	H.	M.	Ft.	Dec.	
3	36	9	39	10	5	I.	4	25	10	51	10	3	I.	5	16	10	15	8	7	I.
3	50	10	56	13	0		4	52	11	54	10	9		5	52	10	39	10	7	
3	09	10	35	9	1		4	49	10	00	7	4		5	37	12	36	7	1	
3	59	10	30	8	0		4	31	11	08	11	1		5	26	10	58	10	3	
3	32	10	37	13	7		4	09	10	53	11	6		5	39	11	52	7	5	
3	22	10	55	10	9		4	54	11	37	9	1								
3	08	11	38	12	9	II.	4	38	11	08	8	6	II.	5	21	11	55	8	9	II.
3	54	10	52	10	6		4	24	10	52	11	3		5	16	10	30	10	8	
3	37	11	24	10	6		4	00	10	48	11	1		5	32	11	47	9	6	
3	15	11	03	10	9		4	46	10	17	10	1		5	11	10	46	9	3	
3	18	11	04	12	3		4	12	12	10	12	4								
3	09	9	24	9	4	III.	4	50	10	13	09	1	III.	5	10	10	39	12	5	III.
3	59	10	34	10	3		4	09	10	40	12	8		5	09	11	38	7	8	
3	05	9	44	12	4		4	22	11	55	8	0		5	54	10	08	8	1	
3	34	10	59	8	5		4	49	11	11	11	7		5	40	9	20	11	4	
3	53	10	37	12	3		4	30	12	27	9	3		5	12	12	14	7	3	
3	00	10	42	9	1		4	34	10	05	9	0		5	55	11	21	9	8	
3	46	8	26	9	4									5	19	11	20	10	5	
3	26	10	29	12	6		4	46	10	18	10	0	IV.	5	35	8	29	7	0	IV.
3	09	12	45	11	3		4	56	11	13	12	0		5	57	10	13	11	5	
3	51	11	03	9	2		4	25	10	48	14	5								
3	10	11	23	11	0	IV.														
3	57	10	07	14	0															
3	06	11	03	13	0															
3	59	11	10	13	0															
3	35	9	38	10	0															

MEANS.

3	31	10	40	...	...	26	4	33	11	01	...	...	20	5	30	10	56	...	...	18
3	31	...	...	11	1	26	4	33	...	...	10	5	20	5	30	...	...	9	4	18

The two greatest deviations from the mean, viz., $8^h\ 26^m$ and $12^h\ 45^m$, nearly balance in the mean, hence no value was rejected.

The criterion rejects no value of the interval; the low value $8^h\ 29^m$ is so near the limit of rejection and not balanced in the mean that I prefer to reject it.

5	30	11	04	...	...	17

TABLE FOR THE REDUCTION OF TIDES —No. 2.

Showing the Interval between the App. Time of the Moon's Inferior Transit and the Time of High Water, and also the Heights of High Water, at Van Rensselaer Harbor, from Four Series of Observations made between October 10, 1853, and October 22, 1854.

6h to 7h.							7h to 8h.							8h to 9h.						
Moon's transit. App. time.		Lunitidal interval. H. water.		Height of H. water.		No. of observations and series.	Moon's transit. App. time.		Lunitidal interval. H. water.		Height of H. water.		No. of observations and series.	Moon's transit. App. time		Lunitidal interval. H. water.		Height of H. water.		No. of observations and series.
H.	M.	H.	M.	Ft.	Dec.		H.	M.	H.	M.	Ft.	Dec.		H.	M.	H.	M.	Ft.	Dec.	
6	57	11	16	9	2	I.	7	54	11	49	9	5	I.	8	47	12	42	10	0	I.
6	07	10	54	7	1		7	46	12	30	8	1		8	35	...	...	9	3	
6	57	12	49	7	0		7	38	11	53	11	0		8	25	13	21	10	7	
6	48	11	58	10	4		7	11	12	37	8	8		8	44	12	58	10	9	
6	25	13	48	8	5		7	56	12	46	9	4		8	25	12	42	9	2	
6	14	13	39	10	6		7	42	12	25	11	8		8	50	12	38	11	2	
6	24	12	36	7	8		7	10	12	50	8	0								
							7	59	12	30	11	5		8	26	12	49	6	7	II.
6	06	11	10	10	7	II.								8	10	14	06	10	7	
6	51	13	10	7	2		7	38	11	53	8	2	II.	8	53	13	57	8	8	
6	01	11	41	6	9		7	11	12	12	9	5		8	12	11	42	10	2	
6	52	14	06	6	7		7	41	14	17	7	5								
6	07	11	12	11	7	III.	7	13	12	18	10	0	III.	8	07	11	55	10	4	III.
6	59	12	20	9	8		7	47	11	47	11	1		8	59	11	18	10	7	
6	38	12	54	8	6		7	22	13	40	9	2		8	02	13	32	7	9	
6	27	10	32	10	2		7	11	10	48	10	5		8	48	13	31	8	1	
6	39	12	17	9	8		7	54	12	05	9	9		8	32	11	32	10	6	
6	07	11	47	9	5		7	26	12	30	10	6		8	07	11	55	10	4	
6	59	13	25	9	4		7	16	13	38	7	6		8	54	12	08	11	1	
														8	37	12	22	9	4	
														8	18	12	38	11	2	
6	59	10	41	10	0	IV.	...	...	...	...	...	...	IV.	8	01	13	53	8	7	
6	58	...	...	10	0															
														8	08	11	58	9	0	IV.
														8	58	...	...	9	0	
														8	34	13	41	10	0	
MEANS.																				
6	33	12	13	...	...	19	7	33	12	28	...	...	18	8	29	12	44	...	...	21
6	34	...	...	9	1	20	7	33	...	...	9	6	18	8	30	...	...	9	7	23
There are two high and two low values, viz., 14h 06m, 13h 48m, and 10h 32m, 10h 41m, nearly balancing each other; there was, therefore, no rejection required.							The high and low values in the interval balance.													

TABLE FOR THE REDUCTION OF TIDES.—No. 2.

Showing the Interval between the App. Time of the Moon's Inferior Transit and the Time of High Water, and also the Heights of High Water, at Van Rensselaer Harbor, from Four Series of Observations made between October 10, 1853, and October 22, 1854.

9h to 10h.							10h to 11h.							11h to 12h.						
Moon's transit. App. time.		Lunitidal interval. H. water.		Height of H. water.		No. of observations and series.	Moon's transit. App. time.		Lunitidal interval. H. water.		Height of H. water.		No. of observations and series.	Moon's transit. App. time.		Lunitidal interval. H. water.		Height of H. water.		No. of observations and series.
H.	M.	H.	M.	Ft.	Dec.		H.	M.	H.	M.	Ft.	Dec.		H.	M.	H.	M.	Ft.	Dec.	
9	37	12	37	10	9	I.	10	24	12	20	11	3	I.	11	01	12	30	12	0	I.
9	23	12	23	10	7		10	11	13	50	11	6		11	52	11	54	12	3	
9	09	12	22	11	8		10	34	12	41	11	0		11	15	11	30	9	8	
9	52	11	54	11	5		10	24	13	17	13	8		11	59	12	01	13	0	
9	33	12	39	12	0		10	31	11	49	8	6		11	20	11	36	13	7	
9	06	12	30	7	8									11	17	11	48	8	9	
9	49	13	17	9	6		10	06	13	39	6	6	II.							
9	46	12	27	11	6		10	57	12	48	7	7		11	30	12	47	12	4	II.
							10	15	12	02	11	2		11	46	11	29	8	4	
9	15	12	30	7	2	II.	10	05	11	19	11	7		11	13	13	34	11	9	
9	12	12	05	10	3		10	55	11	59	11	9		11	43	11	42	12	0	
9	11	12	43	10	3															
							10	32	11	30	12	2	III.	11	16	12	46	12	0	III.
9	47	11	15	11	1	III.	10	19	13	45	11	8		11	09	11	40	13	7	
9	33	11	31	9	4		10	43	11	35	10	0		11	28	13	17	9	7	
9	16	10	48	11	3		10	38	10	23	12	9		11	38	13	53	11	4	
9	59	10	49	9	9		10	07	11	21	8	5		11	44	12	14	8	3	
9	44	12	17	11	6		10	55	13	18	8	1		11	20	12	20	12	5	
9	22	12	06	9	9															
							10	45	12	26	14	0	IV.	11	17	11	50	11	5	IV.
9	47	10	49	10	0	IV.	10	02	11	13	12	0		11	36	12	06	14	0	
9	19	11	56	11	0		10	46	12	29	12	0		11	30	12	15	12	0	
MEANS.																				
9	30	12	03	...	...	19	10	29	12	18	...	...	19	11	28	12	16	...	...	19
9	30	...	...	10	4	19	10	29	...	...	10	9	19	11	28	...	...	11	5	19

There being three low and but one high value in the interval, it seemed preferable to adopt a mean resulting after the rejection of 10h 48m, viz:—

9	30	12	07	...	...	18

TABLE FOR THE REDUCTION OF TIDES.—No. 2.

Showing the Interval between the App. Time of the Moon's Superior Transit and the Time of Low Water, and also the Heights of Low Water, at Van Rensselaer Harbor, from Four Series of Observations made between October 10, 1853, and October 22, 1854.

0h to 1h.							1h to 2h.							2h to 3h.						
Moon's transit. App. time.		Lunitidal interval. L. water.		Height of L. water.		No. of observations and series.	Moon's transit. App. time.		Lunitidal interval. L. water.		Height of L. water.		No. of observations and series.	Moon's transit. App. time.		Lunitidal interval. L. water.		Height of L. water.		No. of observations and series.
H.	M.	H.	M.	Ft.	Dec.		H.	M.	H.	M.	Ft.	Dec.		H.	M.	H.	M.	Ft.	Dec.	
0	13	17	02	1	5	I.	1	40	17	35	1	9	I.	2	25	18	35	2	7	I.
0	57	17	33	2	0		1	16	18	00	0	0		2	16	17	45	0	3	
0	19	18	42	0	9		1	07	17	38	3	1		2	44	17	30	2	3	
0	21	18	54	3	1		1	55	18	20	1	2		2	58	17	04	...	...	
0	53	17	17	—2	1		1	58	17	12	—0	4								
0	30	18	49	1	6		1	20	15	58	0	6		2	45	18	01	1	3	II.
														2	29	17	47	2	3	
0	01	18	16	1	3	II.	1	01	17	00	0	5	II.	2	09	17	39	2	5	
0	10	17	05	4	1		1	55	17	21	—0	3		2	53	17	25	2	5	
0	58	18	18	2	6		1	44	18	02	4	1		2	02	18	19	1	2	
0	33	17	44	0	1		1	22	17	40	0	5		2	52	17	15	3	1	
0	29	19	37	2	7		1	15	17	21	3	0								
0	07	18	18	3	5		1	36	18	20	1	5		2	45	18	18	3	9	III.
0	52	19	03	3	3									2	33	17	46	0	5	
							1	09	18	24	2	1	III.	2	19	17	59	2	5	
0	22	16	41	2	0	III.	1	56	15	37	1	9		2	21	17	39	1	1	
0	30	16	49	1	3		1	30	16	49	0	8		2	37	17	20	3	6	
0	39	18	09	1	6		1	29	17	34	1	5		2	02	17	08	1	2	
0	10	18	21	2	0		1	16	17	15	0	4		2	48	17	21	1	7	
0	10	16	48	2	0		1	49	18	08	3	2								
0	59	15	58	1	9		1	00	17	10	1	2		2	01	17	31	—0	5	IV.
														2	47	19	16	1	0	
0	22	17	46	—0	7	IV.	1	12	18	50	0	0	IV.	2	39	16	30	0	0	
0	46	16	56	0	0		1	07	18	01	2	0		2	21	17	52	0	0	
							1	52	18	16	0	0								
							1	33	17	40	0	0								
MEANS.																				
0	30	17	49	...	...	21	1	29	17	34	...	...	23	2	31	17	43	...	...	21
0	30	...	...	1	7	21	1	29	...	...	1	3	23	2	30	...	...	1	7	20
The highest and lowest value of the intervals balance in the mean, hence no value is rejected.							The low value 15h 37m is rejected, hence new mean—													
							1	28	17	39	...	...	22							

TABLE FOR THE REDUCTION OF TIDES.—No. 2.

Showing the Interval between the App. Time of the Moon's Superior Transit and the Time of Low Water, and also the Heights of Low Water, at Van Rensselaer Harbor, from Four Series of Observations made between October 10, 1853, and October 22, 1854.

3h to 4h.							4h to 5h.							5h to 6h.						
Moon's transit. App. time.		Lunitidal interval. L. water.		Height of L. water.		No. of observations and series.	Moon's transit. App. time.		Lunitidal interval. L. water.		Height of L. water.		No. of observations and series.	Moon's transit. App. time.		Lunitidal interval. L water.		Height of L. water.		No. of observations and series.
H.	M.	H.	M.	Ft.	Dec.		H.	M.	H.	M.	Ft.	Dec.		H.	M.	H.	M.	Ft.	Dec.	
3	12	17	18	4	4	I.	4	00	16	46	4	5	I.	5	42	18	34	5	4	I.
3	19	17	12	0	7		4	51	17	25	5	2		5	23	16	53	3	2	
3	34	17	25	3	6		4	22	16	39	2	3		5	14	17	59	3	7	
3	03	15	36	0	1		4	24	18	50	3	6		5	00	15	24	2	3	
3	46	14	16	...	...		4	03	16	51	1	3		5	52	18	16	3	4	
							4	32	16	59	4	4		5	17	17	44	4	2	
3	32	17	29	2	0	II.	4	16	16	30	3	4	II.	5	00	16	01	3	8	II.
3	14	18	02	0	3		4	00	17	16	3	0		5	43	18	33	5	0	
3	38	16	10	3	9		4	49	17	27	3	0		5	09	16	54	6	1	
3	44	16	53	2	6		4	23	16	25	3	1		5	56	16	53	5	8	
														5	36	17	06	5	0	
3	34	17	29	1	8	III.	4	25	16	38	5	3	III.	5	40	15	39	4	2	III.
3	38	15	41	2	3		4	41	15	38	2	0		5	32	...	...	4	5	
3	09	18	09	2	5		4	47	17	45	3	7		5	16	15	44	3	7	
3	59	17	48	4	0		4	23	15	37	2	3		5	33	16	53	4	8	
3	24	16	36	1	3		4	08	17	49	2	6		5	43	17	26	4	5	
3	24	17	33	3	9		4	52	17	49	2	2								
3	00	16	55	2	4		4	13	...	...	4	0								
3	52	17	02	2	5		4	56	17	43	4	4		5	11	14	53	3	0	IV.
3	30	16	54	3	2									5	25	16	45	2	0	
3	33	17	30	1	5	IV.	4	22	15	41	0	0	IV.							
3	32	16	37	—1	0		4	27	15	42	1	0								
3	10	17	03	0	5		4	00	16	13	2	0								
							4	51	16	23	4	0								

MEANS.

3	28	16	56	...	...	21	4	27	16	52	...	...	21	5	27	16	55	...	...	17
3	27	...	...	2	1	20	4	27	...	...	3	1	22	5	27	...	...	4	1	18

The low values 14h 16m is rejected, hence new mean—

3	28	17	04	...	...	20

The high value 18h 50m is in a measure balanced by two low values, 15h 37m and 15h 37m.

The low value 14h 53m is rejected, hence new mean—

5	27	17	02	...	...	16

TABLE FOR THE REDUCTION OF TIDES.—No. 2.

Showing the Interval between the App. Time of the Moon's Superior Transit and the Time of Low Water, and also the Heights of Low Water, at Van Rensselaer Harbor, from Four Series of Observations made between October 10, 1853, and October 22, 1854.

6h to 7h.							7h to 8h.							8h to 9h.						
Moon's transit. App. time.		Lunitidal interval. L. water.		Height of L. water.		No. of observations and series.	Moon's transit. App. time.		Lunitidal interval. L. water.		Height of L. water.		No. of observations and series.	Moon's transit. App. time.		Lunitidal interval. L. water.		Height of L. water.		No. of observations and series.
H.	M.	H.	M.	Ft.	Dec.		H.	M.	H.	M.	Ft.	Dec.		H.	M.	H.	M.	Ft.	Dec.	
6	28	16	45	4	7	I.	7	26	17	47	4	8	I.	8	22	18	21	4	2	I.
6	32	17	59	5	2		7	22	18	24	4	8		8	11	18	50	4	5	
6	21	17	55	4	9		7	14	18	02	4	4		8	59	19	02	3	4	
6	01	18	32	3	7		7	34	17	38	4	2		8	02	18	29	5	5	
6	48	17	55	3	7		7	22	18	45	5	2		8	48	18	43	4	2	
6	38	18	00	2	9		7	34	18	10	3	2		8	20	19	22	2	7	
6	01	17	29	2	9									8	04	18	03	5	3	
6	47	18	28	2	4		7	14	19	47	5	8	II.	8	46	18	50	1	8	
							7	40	19	06	4	1		8	23	17	36	1	8	
6	28	17	18	3	8	II.	7	42	18	27	4	8								
6	27	20	01	6	0		7	17	19	11	5	5		8	02	19	13	3	3	II.
														8	50	19	55	3	3	
6	45	17	46	4	5	III.	7	41	17	36	4	0	III.	8	41	16	36	3	3	
6	34	18	00	5	2		7	38	18	26	3	6		8	28	20	07	5	0	
6	04	17	25	4	6		7	24	18	55	4	4		8	42	19	12	5	1	
6	49	17	10	5	6		7	00	17	32	4	7								
6	17	16	54	4	4		7	44	18	48	4	0		8	35	18	27	4	1	III.
6	53	...	...	4	6		7	33	18	41	5	2		8	25	19	39	2	7	
6	32	18	37	3	6		7	02	18	24	4	3		8	10	17	24	3	4	
							7	51	17	35	3	9		8	55	18	09	3	5	
6	28	16	42	3	0	IV.	7	38	19	01	5	6		8	30	18	32	3	4	
														8	16	18	28	5	8	
							7	43	17	53	5	0	IV.	8	59	17	59	2	9	
							7	23	15	51	5	0		8	45	18	25	3	0	
														8	34	19	32	5	0	
														8	01	19	14	3	0	IV.
														8	57	18	18	3	0	
MEANS.																				
6	28	17	49	...	...	17	7	29	18	17	...	...	21	8	30	18	15	...	...	25
6	29	...	...	4	2	18	7	29	...	...	4	6	21	8	30	...	...	3	7	25
The high value 20h 01m is rejected, hence new mean—							The low value 15h 51m is rejected, hence new mean—													
6	28	17	42	...	...	16	7	29	18	24	...	...	20							

TABLE FOR THE REDUCTION OF TIDES.—No. 2.

Showing the Interval between the App. Time of the Moon's Superior Transit and the Time of Low Water, and also the Heights of Low Water, at Van Rensselaer Harbor, from Four Series of Observations made between October 10, 1853, and October 22, 1854.

9h to 10h.							10h to 11h.							11h to 12h.						
Moon's transit. App. time.		Lunitidal interval. L. water.		Height of L. water.		No. of observations and series.	Moon's transit. App. time.		Lunitidal interval. L. water.		Height of L. water.		No. of observations and series.	Moon's transit. App. time.		Lunitidal interval. L. water.		Height of L. water.		No. of observations and series.
H.	M.	H.	M.	Ft.	Dec.		H.	M.	H.	M.	Ft.	Dec.		H.	M.	H.	M.	Ft.	Dec.	
9	12	18	47	3	1		10	02	17	57	2	7		11	26	17	20	2	7	
9	47	17	59	2	9		10	36	17	40	1	6		11	37	18	53	3	5	I.
9	31	18	00	3	8		10	13	20	02	2	5		11	50	17	51	—1	2	
9	08	19	04	2	2	I.	10	54	18	36	2	9	I.	11	41	18	23	5	5	
9	58	18	43	0	7		10	51	17	50	0	1								
9	27	19	09	2	8		10	10	18	25	2	8		11	22	19	08	2	3	
9	18	18	10	1	9		10	54	19	11	2	4		11	41	17	21	—0	4	II.
														11	19	18	36	2	0	
9	41	19	34	1	5		10	58	18	19	1	0								
9	45	17	52	2	8	II.	10	32	18	13	1	8	II.	11	38	19	09	1	0	
9	39	18	45	3	8		10	45	18	02	1	0		11	35	16	59	0	9	
							10	31	18	23	2	2		11	05	17	58	2	7	
9	24	18	08	2	5									11	51	18	27	2	4	III.
9	10	18	09	1	8		10	10	19	22	1	6		11	07	18	54	0	6	
9	56	17	38	2	2		10	54	17	08	2	6		11	19	17	39	2	4	
9	38	19	10	4	0	III.	10	43	18	21	1	3		11	54	17	26	1	2	
9	18	17	13	1	8		10	21	18	42	2	0	III.							
9	44	18	14	3	6		10	10	16	51	1	4		11	39	17	28	2	0	
							10	31	17	57	3	6		11	10	18	02	—2	0	
9	22	19	14	5	0	IV.	10	47	17	38	1	2		11	59	19	13	—0	5	IV.
9	41	18	34	0	0									11	08	17	07	0	0	
							10	09	18	58	2	0		11	53	16	22	0	0	
							10	55	18	12	4	0	IV.							
							10	20	18	21	0	0								
							10	24	18	51	1	0								
MEANS.																				
9	32	18	28	...	...	18	10	32	18	19	...	...	22	11	32	18	01	...	...	19
9	32	...	...	2	6	18	10	32	...	...	1	9	22	11	32	...	...	1	3	19

TABLE FOR THE REDUCTION OF TIDES.—No. 2.

Showing the Interval between the App. Time of the Moon's Inferior Transit and the Time of Low Water, and also the Heights of Low Water, at Van Rensselaer Harbor, from Four Series of Observations made between October 10, 1853, and October 22, 1854.

0h to 1h.							1h to 2h.							2h to 3h.						
Moon's transit. App. time.		Lunitidal interval. L. water.		Height of L. water.		No. of observations and series.	Moon's transit. App. time.		Lunitidal interval. L. water.		Height of L. water.		No. of observations and series.	Moon's transit. App. time.		Lunitidal interval. L. water.		Height of L. water.		No. of observations and series.
H.	M.	H.	M.	Ft.	Dec.		H.	M.	H.	M.	Ft.	Dec.		H.	M.	H.	M.	Ft.	Dec.	
0	35	17	25	1	8	I.	1	18	17	27	1	6	I.	2	02	15	43	5	7	I.
0	48	18	28	0	1		1	46	19	00	1	5		2	48	16	57	2	8	
0	44	18	16	1	3		1	31	17	44	—0	1		2	47	17	14	1	6	
0	21	18	05	—0	3		1	25	17	45	0	0		2	20	16	54	1	9	
0	06	16	58	3	4		1	44	17	19	...	...		2	30	18	10	—0	1	
0	55	17	08	2	7									2	34	17	58	...	...	
0	31	19	31	—1	8	II.	1	27	18	19	—0	4	II.	2	20	17	56	1	5	II.
0	33	18	13	2	4		1	21	17	25	3	2		2	06	17	40	2	2	
0	07	17	55	—0	9		1	45	19	02	1	3		2	51	16	25	3	9	
0	57	18	05	1	1		1	38	18	43	0	7		2	31	18	47	1	9	
0	06	18	15	2	3		1	14	18	27	1	3		2	26	18	56	1	6	
0	52	19	29	3	2		1	59	18	57	3	3								
0	29	17	56	—0	2		1	33	16	00	1	5	III.	2	20	14	57	1	7	III.
							1	04	15	44	2	3		2	01	17	33	1	7	
0	00	17	02	2	2	III.	1	54	17	24	1	6		2	44	16	04	2	5	
0	45	18	18	2	0		1	49	18	41	0	2		2	52	16	38	1	6	
0	15	16	03	0	5		1	24	18	03	3	0		2	13	17	14	2	5	
0	43	17	48	1	6		1	31	17	24	1	0		2	31	17	09	1	0	
0	35	17	52	2	4									2	26	17	28	2	0	
0	27	17	58	1	5		1	36	18	26	1	0	IV.	2	24	17	09	—1	0	IV.
							1	29	17	39	1	0		2	15	17	53	0	0	
0	47	16	45	—1	7	IV.	1	09	19	03	—1	0		2	45	15	28	0	0	
0	00	17	07	1	0		1	57	16	46	0	0								
0	45	17	53	0	0															
0	22	18	20	1	0															
0	17	16	58	0	0															

MEANS.

0	30	17	50	...	...	24	1	33	17	52	...	...	21	2	28	17	09	...	...	21
0	30	...	...	1	1	24	1	33	...	...	1	1	20	2	28	...	...	1	7	20

The two high and two low values of the intervals nearly balance in the mean.

The value $15^h\ 44^m$ is rejected, hence new mean—

1	34	17	58	...	...	20

The lowest value $14^h\ 33^m$ is rejected, hence—

2	28	17	15	...	...	20

TABLE FOR THE REDUCTION OF TIDES.—No. 2.

Showing the Interval between the App. Time of the Moon's Inferior Transit and the Time of Low Water, and also the Heights of Low Water, at Van Rensselaer Harbor, from Four Series of Observations made between October 10, 1853, and October 22, 1854.

3h to 4h.							4h to 5h.							5h to 6h.						
Moon's transit. App. time.		Lunitidal interval. L. water.		Height of L. water.		No. of observations and series.	Moon's transit. App. time.		Lunitidal interval. L. water.		Height of L. water.		No. of observations and series.	Moon's transit. App. time.		Lunitidal interval. L. water.		Height of L. water.		No. of observations and series.
H.	M.	H.	M.	Ft.	Dec.		H.	M.	H.	M.	Ft.	Dec.		H.	M.	H.	M.	Ft.	Dec.	
3	36	17	40	3	4	I.	4	25	16	06	3	9	I.	5	16	15	15	4	5	I.
3	50	16	56	1	8		4	52	17	39	2	6		5	52	18	24	3	5	
3	09	17	05	2	6		4	49	15	55	5	1		5	37	16	51	6	6	
3	59	16	00	3	2		4	31	17	08	1	0		5	26	18	13	1	0	
3	32	17	37	1	6		4	09	16	22	4	5		5	39	17	51	3	1	
3	22	17	10	1	4		4	54	16	22	5	1								
														5	21	18	55	3	8	II.
3	08	17	53	2	1	II.	4	38	16	53	2	2	II.	5	16	16	00	5	5	
3	54	18	07	0	3		4	24	18	22	4	5		5	32	17	02	4	1	
3	37	17	24	2	7		4	00	16	48	1	0		5	11	17	01	4	2	
3	15	17	48	1	5		4	46	17	02	3	9								
3	18	16	34	2	7									5	10	17	39	1	8	III.
							4	50	16	13	6	5	III.	5	09	17	08	4	8	
3	09	15	54	3	7	III.	4	09	16	55	1	8		5	54	16	08	5	2	
3	59	16	34	4	3		4	22	17	40	3	6		5	40	15	20	2	8	
3	05	16	59	1	8		4	49	16	56	2	5		5	12	18	14	3	8	
3	34	16	59	3	5		4	30	16	27	5	0		5	55	17	01	6	9	
3	53	17	07	1	3		4	34	17	05	4	8		5	19	16	35	6	1	
3	00	15	27	2	0															
3	46	15	41	3	8		4	46	14	18	0	0	IV.	5	57	15	13	3	0	IV.
3	26	17	44	1	8		4	56	16	13	2	0								
3	09	17	45	3	2		4	25	15	48	2	0								
3	51	16	33	4	1															
3	10	17	23	0	0	IV.														
3	57	16	03	0	0															
3	06	17	03	0	0															
3	59	16	10	0	0															
3	35	16	38	0	0															
MEANS.																				
3	31	16	56	...	...	26	4	34	16	38	...	...	19	5	30	16	59	...	...	17
3	31	...	...	2	0	26	4	34	...	...	3	3	19	5	30	...	...	4	2	17
							The value 14h 18m is rejected, hence new mean—							The three highest and three lowest values of the intervals balance in the mean.						
							4	34	16	45	...	...	18							

TABLE FOR THE REDUCTION OF TIDES.—No. 2.

Showing the Interval between the App. Time of the Moon's Inferior Transit and the Time of Low Water, and also the Heights of Low Water, at Van Rensselaer Harbor, from Four Series of Observations made between October 10, 1853, and October 22, 1854.

6h to 7h.							7h to 8h.							8h to 9h.						
Moon's transit. App. time.		Lunitidal interval. L. water.		Height of L. water.		No. of observations and series.	Moon's transit. App. time.		Lunitidal interval. L. water.		Height of L. water.		No. of observations and series.	Moon's transit. App. time.		Lunitidal interval. L. water.		Height of L. water.		No. of observations and series.
H.	M.	H.	M.	Ft.	Dec.		H.	M.	H.	M.	Ft.	Dec.		H.	M.	H.	M.	Ft.	Dec.	
6	57	18	46	4	4	I.	7	54	17	49	4	0	I.	8	47	18	27	3	7	I.
6	07	16	39	5	2		7	46	17	00	5	5		8	35	19	11	5	1	
6	57	17	49	6	1		7	38	17	08	4	3		8	25	18	21	2	3	
6	48	17	58	4	0		7	11	18	31	6	9		8	44	19	28	3	4	
6	25	17	48	3	4		7	56	18	46	4	3		8	25	19	11	1	7	
6	14	18	54	3	5		7	00	18	07	3	6		8	50	19	08	2	9	
6	24	17	36	4	6		7	42	18	25	5	3								
							7	10	17	05	4	1		8	26	18	49	3	8	II.
6	06	17	40	4	5	II.	7	59	18	45	4	8		8	10	20	36	5	7	
6	51	16	25	3	7									8	03	20	18	3	9	
6	10	17	36	4	3		7	38	19	08	4	7	II.	8	53	19	42	5	4	
6	01	16	41	5	7		7	09	21	07	4	7		8	12	18	12	5	3	
6	52	17	08	5	5		7	11	18	42	5	3								
														8	07	19	10	4	0	III.
6	17	17	59	5	1	III.	7	13	18	18	4	0	III.	8	59	19	33	1	8	
6	07	17	57	3	0		7	14	17	35	6	0		8	02	17	02	5	2	
6	59	20	05	3	8		7	47	18	47	3	7		8	48	17	16	4	4	
6	38	17	24	5	6		7	22	18	10	6	1		8	32	18	47	2	5	
6	27	17	02	3	2		7	11	18	18	4	0		8	07	19	55	4	3	
6	39	17	47	6	5		7	54	19	35	4	4		8	54	17	53	4	0	
6	31	18	53	4	8		7	26	18	30	6	0		8	37	18	22	3	0	
6	07	18	47	5	7		7	16	18	08	4	4		8	18	18	37	5	6	
														8	01	17	53	4	5	
6	59	17	11	4	5	IV.	7	17	16	18	5	0	IV.	8	08	15	58	5	0	IV.
6	58	16	16	3	0									8	58	18	08	5	0	
														8	34	18	41	3	0	
MEANS.																				
6	31	17	45	...	...	22	7	28	18	18	...	...	21	8	29	18	41	...	...	24
6	31	...	...	4	6	22	7	28	...	...	4	8	21	8	29	...	...	4	0	24
The high value 20h 05m is rejected, hence new mean—							The high value 21h 07m is rejected, hence new mean—							The low value 15h 58m is rejected, hence new mean—						
6	30	17	39	...	...	21	7	29	18	10	...	...	20	8	30	18	48	...	...	23

TABLE FOR THE REDUCTION OF TIDES.—No. 2.

Showing the Interval between the App. Time of the Moon's Inferior Transit and the Time of Low Water, and also the Heights of Low Water, at Van Rensselaer Harbor, from Four Series of Observations made between October 10, 1853, to October 22, 1855.

9h to 10h.							10h to 11h.							11h to 12h.						
Moon's transit. App. time.		Lunitidal interval. L. water.		Height of L. water.		No. of observations and series.	Moon's transit. App. time.		Lunitidal interval. L. water.		Height of L. water.		No. of observations and series.	Moon's transit. App. time.		Lunitidal interval. L. water.		Height of L. water.		No. of observations and series.
H.	M.	H.	M.	Ft.	Dec.		H.	M.	H.	M.	Ft.	Dec.		H.	M.	H.	M.	Ft.	Dec.	
9	37	18	37	2	7	I.	10	11	19	05	3	9	I.	11	01	18	00	1	9	I.
9	23	18	53	4	9		10	34	18	26	2	1		11	52	19	09	3	6	
9	09	19	07	2	8		10	24	17	47	1	2		11	15	18	15	0	7	
9	52	18	54	2	6		10	31	18	04	2	3		11	59	17	01	0	4	
9	33	19	08	2	6									11	20	18	06	1	7	
9	06	19	00	0	3		10	06	18	54	1	3	II.	11	17	17	48	2	4	
9	49	18	16	3	5		10	57	18	03	2	8								
9	46	19	12	4	9		10	15	18	02	2	0		11	30	18	47	2	6	II.
							10	05	18	34	3	4		11	46	17	59	0	7	
9	15	21	00	3	7	II.	10	55	18	30	1	3		11	13	18	49	3	0	
9	12	18	35	2	8									11	43	18	42	—1	3	
9	11	18	43	4	3		10	32	18	32	1	8	III.							
							10	19	18	15	1	9		11	16	19	16	0	1	III.
9	47	18	45	1	7	III.	10	43	18	50	2	0		11	09	18	40	1	0	
9	33	20	01	2	0		10	38	18	23	2	1		11	28	19	05	3	4	
9	16	19	03	3	3		10	07	19	36	2	9		11	38	18	23	1	8	
9	59	18	19	2	0		10	55	18	33	2	0		11	44	19	14	3	1	
9	22	19	36	3	3		10	15	18	25	2	4		11	20	18	05	2	2	
9	47	20	19	5	0	IV.	10	33	17	34	2	0	IV.	11	17	15	50	0	0	IV.
9	19	18	26	2	0		10	45	17	26	—1	2		11	36	17	36	—1	0	
							10	02	17	43	1	0		11	30	17	45	0	0	
							10	46	17	29	0	0								
MEANS.																				
9	30	19	06	...	...	18	10	29	18	19	...	...	20	11	28	18	14	...	...	19
9	30	...	...	3	0	18	10	29	...	...	1	9	20	11	28	...	...	1	4	19
The highest value 21h 00m is rejected, hence new mean—														The low value 15h 50m is rejected, hence new mean—						
9	30	19	00	...	...	17								11	28	18	21	...	...	18

The preceding tables (No. 2) contain the individual and mean values for interval and height, for high and low water, and the moon's upper and lower transit. The mean, in some cases, was improved by the application of Peirce's criterion for the rejection of doubtful observations; a few other rejections were made, as stated, in order to obtain a well-balanced mean; of 982 observations of the interval, but 17 were thus rejected.

Half-monthly Inequality.—For the comparison of the observed with the theoretical values, it is customary to use the forms of the equilibrium theory or of the wave theory,[1] certain modifications being necessary to produce an agreement between these theories with observation. According to the equilibrium theory the formula for the position of the pole of the tidal spheroid is:

$$tan.\ 2\,\theta' = -\frac{h\ sin.\ 2\,\phi}{h' + h\ cos.\ 2\,\phi},$$

where h and h' are the elevations of the spheroid due to the sun and moon respectively, ϕ the angular distance of the moon from the sun and θ' the angular distance of the pole of the spheroid (or of high water) from the moon's place. In reality, however, the pole of this spheroid follows the moon at a certain distance, the mean value λ' of which is known as the "mean establishment" (also fundamental hour, corrected establishment), and which corresponds to a distance of the sun and moon of $\phi - \alpha$ instead of ϕ. This retroposition of the theoretical tide has been called the age of the tide. For the comparison of the observed and computed values for the half-monthly inequality *in time*, we have the formula:[2]

$$tan.\ 2\,(\theta' - \lambda') = -\frac{h\ sin.\ 2\,(\phi - \alpha)}{h' + h\ cos.\ 2\,(\phi - \alpha)}.$$

This inequality goes through its period twice in each month. Proper values have to be found for the ratio $\frac{h}{h'}$ and the angle α.

The observations of 480 *high waters* furnish us with the following values, derived from the preceding tabulation on form No. 2:—

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[1] An account of the Equilibrium, Laplace's and the Wave Theories, will be found in the Encyclopædia of Astronomy, forming a portion of the Encyclopædia Metropolitana, London, 1848; article "On Tides and Waves," by G. B. Airy, Esq., Astronomer Royal.

[2] Phil. Trans. Royal Society, 1834, Part I. On the Empirical Laws of the Tides in the Port of London, with some Reflections on the Theory; by the Rev. W. Whewell.

See also Phil. Trans. Royal Society, 1836, Part I. Researches on the Tides, fourth series: On the Empirical Laws of the Tides in the Port of Liverpool. By the Rev. W. Whewell.

From ☾'s upper transit.			From ☾'s lower transit.			From ☾'s upper and lower transit.		
Apparent solar time of moon's transit.	Lunitidal interval.	No. of observations.	Apparent solar time of moon's transit.	Lunitidal interval.	No. of observations.	Apparent solar time of moon's transit.	Lunitidal interval.	No. of observations.
0^h 29^m	11^h 40^m	18	0^h 29^m	11^h 34^m	25	0^h 29^m	11^h 37^m	43
1 29	11 12	22	1 31	11 13	21	1 30	11 12	43
2 32	11 04	20	2 27	10 59	20	2 30	11 01	40
3 30	10 57	19	3 31	10 40	26	3 30	10 47	45
4 27	10 52	21	4 33	11 01	20	4 30	10 56	41
5 27	10 53	19	5 30	11 04	17	5 29	10 58	36
6 31	11 45	17	6 33	12 13	19	6 32	11 59	36
7 28	12 26	20	7 33	12 28	18	7 30	12 27	38
8 32	12 42	24	8 29	12 44	21	8 30	12 43	45
9 32	12 36	18	9 30	12 07	18	9 31	12 22	36
10 32	12 23	20	10 29	12 18	19	10 30	12 21	39
11 32	12 17	19	11 28	12 16	19	11 30	12 16	38
Mean and sum	11 44	237	Mean and sum	11 43	243	Mean and sum	11 43.3	480

The mean establishment resulting from the observed times of 480 high waters at Van Rensselaer Harbor is therefore 11^h 43.3^m, referred to the moon's transit immediately preceding and corresponding to a mean horizontal parallax of the moon and sun, and to the moon's and sun's declination of 16° nearly. The mean interval corresponds to the moon's transit of 0^h 21^m nearly, indicating that the epoch would have come out 0^h 0^m if transit E (see An Elementary Treatise on the Tides, by J. W. Lubback, Esq., London, 1839) or that immediately preceding transit F had been used.

In like manner we obtain the following table from the observed times of 485 *low waters* at Van Rensselaer Harbor:—

From ☾'s upper transit.			From ☾'s lower transit.			From ☾'s upper and lower transit.		
Apparent solar time of moon's transit.	Lunitidal interval.	No. of observations.	Apparent solar time of moon's transit.	Lunitidal interval.	No. of observations.	Apparent solar time of moon's transit.	Lunitidal interval.	No. of observations.
0^h 30^m	17^h 49^m	21	0^h 30^m	17^h 50^m	24	0^h 30^m	17^h 50^m	45
1 28	17 39	22	1 34	17 58	20	1 31	17 48	42
2 31	17 43	21	2 28	17 15	20	2 30	17 29	41
3 28	17 04	20	3 31	16 56	26	3 30	16 59	46
4 27	16 52	21	4 34	16 45	18	4 30	16 49	39
5 27	17 02	16	5 30	16 59	17	5 29	17 00	33
6 28	17 42	16	6 30	17 39	21	6 30	17 40	37
7 29	18 24	20	7 29	18 10	20	7 29	18 17	40
8 30	18 15	25	8 29	18 48	23	8 30	18 31	48
9 32	18 28	18	9 30	19 00	17	9 31	18 43	35
10 32	18 19	22	10 29	18 19	20	10 30	18 19	42
11 32	18 01	19	11 28	18 21	18	11 30	18 11	37
Mean and sum	17 46	241	Mean and sum	17 50	244	Mean and sum	17 48.0	485

The mean establishment resulting from the observed times of 485 low waters is 17^h 48.0^m, referred to the moon's transit immediately preceding low water, and the same to which the preceding high water has been referred; the difference between the two mean intervals is 6^h 04.7^m.

To obtain a numerical expression for the half-monthly inequality in time, the value for α should be determined so as to furnish, in particular, good results for

$5^h\ 30^m$, $6^h\ 30^m$, $7^h\ 30^m$, where the curve is steepest; the value $\frac{h}{h'}$ is obtained from the greatest range of the inequality determined, for a first approximation, by a graphical process. I find from the observed high waters $\alpha = 0^h\ 21^m$ or $5°\ 15'$, and from the low waters $\alpha = 0^h\ 50^m$ or $12°\ 30'$. Range of inequality, from the high waters, $1^h\ 51^m$ or $27°\ 48'$, the *sin.* of which is 0.4649, and for the low waters, range $1^h\ 54^m$ or $28°\ 30'$, the *sin.* of which is 0.4771; hence the expression for the half-monthly inequality *in time* becomes

From the observed high waters $tan.\ 2(\theta'-175°\ 49'.5) = -\dfrac{0.4649\ sin.\ 2(\phi-5°\ 15')}{1+0.4649\ cos.\ 2(\phi-5°\ 15')}$

" " " low waters $tan.\ 2(\theta'-267°\ 00') = -\dfrac{0.4771\ sin.\ 2(\phi-12°\ 30')}{1+0.4771\ cos.\ 2(\phi-12°\ 30')}$

These expressions furnish us with the following comparison:—

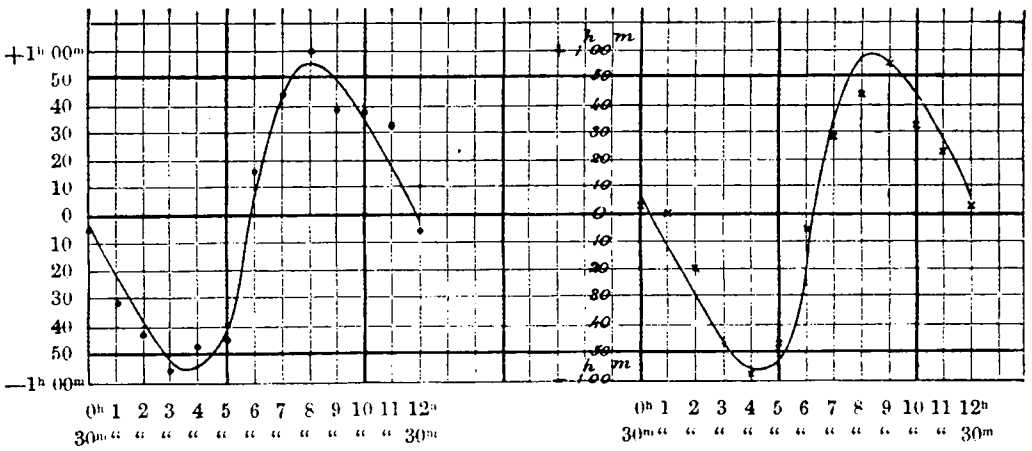
HALF-MONTHLY INEQUALITY IN TIME.

From high waters.				From low waters.			
Apparent solar time of moon's transit.	Observed.	Computed.	Difference.	Apparent solar time of moon's transit.	Observed.	Computed.	Difference.
$0^h\ 29^m$	-6^m	-3^m	-3^m	$0^h\ 30^m$	$+2^m$	$+6^m$	-4^m
1 30	−31	−22	− 9	1 31	0	−13	+13
2 30	−42	−39	− 3	2 30	−19	−31	+12
3 30	−56	−52	− 4	3 30	−49	−47	− 2
4 30	−47	−55	+ 8	4 30	−59	−56	− 3
5 29	−45	−38	− 7	5 29	−48	−52	+ 4
6 32	+16	+ 8	+ 8	6 30	− 8	−18	+10
7 30	+44	+46	− 2	7 29	+29	+33	− 4
8 30	+60	+56	+ 4	8 30	+43	+56	−13
9 31	+39	+48	− 9	9 31	+55	+54	+ 1
10 30	+38	+34	+ 4	10 30	+31	+42	−11
11 30	+33	+16	+17	11 30	+23	+25	− 2

Considering that the times of high and low water are only observed to the nearest half hour and for some time to the nearest hour, the agreement as shown above and by the diagrams, seems to be satisfactory.

Observed and computed half-monthly inequality in time for observations.

Of the high waters. Of the low waters.



In the above diagram, the observed values are indicated by dots; the computed values are represented by curves. From the times we have seen the mean value $\frac{h}{h'}$ $\left(\text{or } \frac{S''}{M''} \text{ of the wave theory and } (A) \text{ of Lubbock's}\right) = 0.471$, and $\alpha = 0^h\ 36^m$; hence, the age of the tide, or the time requisite for the moon to increase its right ascension by that amount, becomes $\frac{36}{48}$ days, or 18 hours.

Half-monthly Inequality in Height.—The theoretical expression for the half monthly inequality in height of high water is:

$$\eta = \sqrt{\{h'^2 + h^2 + 2\,h'h \cos.\ 2\,\phi\}}\,[1]$$

where η expresses the height of the pole of the equilibrium spheroid above the mean level of the surface; for its application, and according to the wave theory, it must be changed to:

$$\eta = \sqrt{\{h'^2 + h^2 + 2h'h \cos.\ 2\,(\phi - \alpha)\}}\,[2]$$

The following table contains the results of the observations from the high and low waters, and the moon's superior and inferior transit:

From superior transits.			From inferior transits.			Means.	
Moon's transit.	Height of high water.	Number.	Moon's transit.	Height of high water.	Number.	Height of high water.	Number.
	Feet.			Feet.		Feet.	
$0^h\ 31^m$	12.1	20	$0^h\ 29^m$	12.2	25	12.1	45
1 29	11.6	22	1 31	12.3	21	11.9	43
2 29	11.8	20	2 27	11.8	19	11.8	39
3 29	10.9	21	3 31	11.1	26	11.0	47
4 27	10.5	22	4 33	10.5	20	10.5	42
5 27	9.5	20	5 30	9.4	18	9.5	38
6 29	9.1	19	6 34	9.1	20	9.1	39
7 29	9.1	21	7 33	9.6	18	9.3	39
8 32	9.9	24	8 30	9.7	23	9.8	47
9 31	10.4	19	9 30	10.4	19	10.4	38
10 31	11.1	21	10 29	10.9	19	11.0	40
11 32	11.7	19	11 28	11.5	19	11.6	38
		248			247	10.67	495

From superior transits.			From inferior transits.			Means.	
Moon's transit.	Height of low water.	Number.	Moon's transit.	Height of low water.	Number.	Height of low water.	Number.
	Feet.			Feet.		Feet.	
$0^h\ 30^m$	1.7	21	$0^h\ 30^m$	1.1	24	1.4	45
1 29	1.3	23	1 33	1.1	20	1.2	43
2 30	1.7	20	2 28	1.7	20	1.7	40
3 27	2.1	20	3 31	2.0	26	2.0	46
4 27	3.1	22	4 34	3.3	19	3.2	41
5 27	4.1	18	5 30	4.2	17	4.1	35
6 29	4.2	18	6 31	4.6	22	4.4	40
7 29	4.6	21	7 28	4.8	21	4.7	42
8 30	3.7	25	8 29	4.0	24	3.8	49
9 32	2.6	18	9 30	3.0	18	2.8	36
10 32	1.9	22	10 29	1.9	20	1.9	42
11 32	1.3	19	11 28	1.4	19	1.4	38
		247			250	2.72	497

[1] See Phil. Trans. Royal Soc., 1834 and 1836.

[2] Encyclopædia Metropolitana, Tides and Waves, Art. (535). The expression given by Mr. Lubbock is:

$$h = D + (E)\left\{\left(1 + \frac{g}{c}\right)(A)\cos.\,(2\downarrow - 2\uparrow) + \left(1 + \frac{g'}{c}\right)\cos.\,2\downarrow\right\};$$

for which see his treatise.

The values for h', h and α were found from the maxima and minima values of the inequality, viz., for the high water:

$$y = \sqrt{\{10.6^2 + 1.5^2 + 31.8 \cos. 2(\phi - 15°)\}};$$

for the low waters:

$$y' = \sqrt{\{2.95^2 + 1.75^2 - 5.16 \cos. 2(\phi - 15)\}};$$

These expressions may be changed to

$$y = 10.6 + 1.5 \cos. 2(\phi - 15°), \text{ and } y' = 2.7 - 1.7 \cos. 2(\phi - 15°);$$

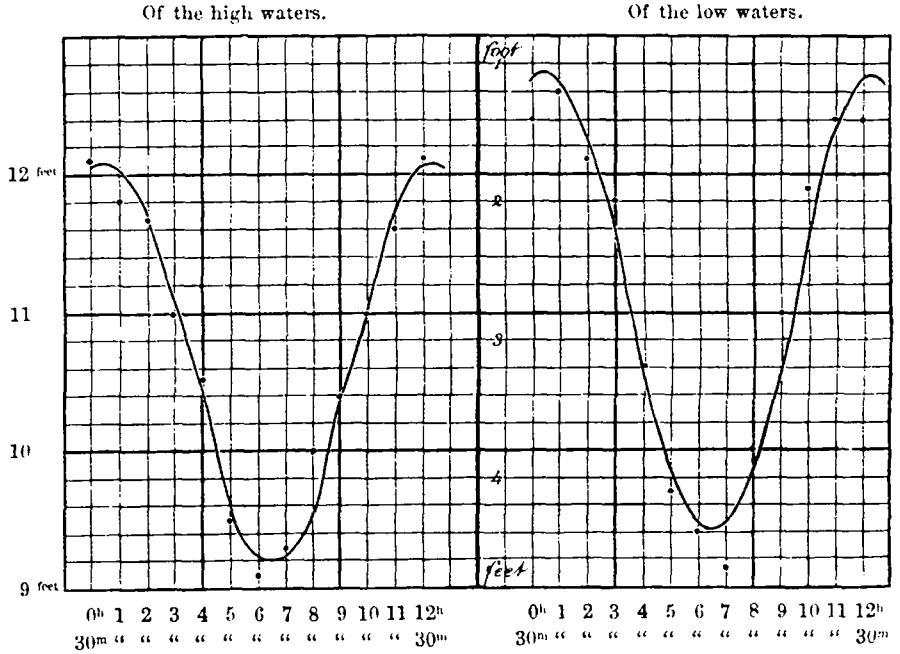
they leave the following differences between the computed and observed values:—

Moon's transit.	Height of high water.			Height of low water.		
	Computed.	Observed.	Difference.	Computed.	Observed.	Difference.
0^h 30^m	12.1	12.1	0.0	1.1	1.4	+0.3
1 30	12.0	11.9	−0.1	1.1	1.2	+0.1
2 30	11.7	11.8	+0.1	1.5	1.7	+0.2
3 30	11.0	11.0	0.0	2.3	2.0	−0.3
4 30	10.2	10.5	+0.3	3.1	3.2	+0.1
5 30	9.5	9.5	0.0	3.9	4.1	+0.2
6 30	9.1	9.1	0.0	4.3	4.4	+0.1
7 30	9.2	9.3	+0.1	4.3	4.7	+0.4
8 30	9.5	9.8	+0.3	3.9	3.8	−0.1
9 30	10.2	10.4	+0.2	3.1	2.8	−0.3
10 30	11.0	11.0	0.0	2.3	1.9	−0.4
11 30	11.7	11.6	−0.1	1.5	1.4	−0.1

The differences may be considered within the uncertainty of the observations. The annexed diagram shows the comparison given above:—

Observed and computed half-monthly inequality in height from observations.

Of the high waters. Of the low waters.



From the inequality in height $\frac{h}{h'}$ or $\frac{S'''}{M'''}$ (notation of the wave theory) $= 0.367$

whereas from the inequality in times $\frac{h}{h'}$ or $\frac{S''}{M''}$ . . . . $= 0.471$

The ratio[1] of the solar to the lunar tide is deduced with more exactness from the inequality in times, and the above value is certainly greater than the average value deduced at more southern stations. One of the reasons why this ratio is not constant, and which probably applies here, is given in (538, β) (Tides and Waves), viz.: If tides are communicated by different channels to the same port, the proportion of the solar and lunar waves will depend on the length of those channels. This explanation would require a polar tide to enter through Kennedy Channel, to combine with the principal tide which passes up Baffin's Bay, and enters by Smith's Straits. According to the equilibrium theory, there should be no tide at the pole, and but a small tide in latitude 78½°; but it is the tide wave propagated from the Atlantic, which is felt in this part of the polar regions. With regard to α, its value as found by the heights is more accurate than that found by the times; the latter gave $\alpha = 9°$, the former 15° (the same from high and low waters). Adopting 15°, the retard or age of the tide becomes 1¼ day, by which interval the spring and neap tides follow the syzygies and quadratures, respectively. The time-value of α is here smaller than the height-value, which is more in accordance with theory than the opposite, as observed at a number of places on the coast of England (543 and 546, Tides and Waves). Compared with other values of α, the Van Rensselaer value appears somewhat smaller than an average at more southern stations.

We have further, mean rise and fall of tides at Van Rensselaer Bay 7.9 feet, range of spring tides 11.1 feet, and range of neap tides 4.7 feet. These numbers are averages from the discussions of 9½ lunations, and obtain without regard to the diurnal inequality, which will be investigated further on.

Effect of the Changes in the Moon's Declination and Parallax on the half-monthly Inequality, in Time.—In reference to the investigation of the half-monthly inequality, it is comparatively of little consequence which transit of the moon is taken for comparison; it is otherwise in the investigation of the effect of a change in the moon's declination and parallax, as well as for a similar effect due to the sun, which latter, however, cannot become a subject of investigation for the tidal series in hand, on account of its short extent; for the same reason, the variation in the inequality, in height, will have to be passed over. To ascertain the effect due to the moon's declination and parallax, an anterior value, corresponding to a certain age of the tide, is to be taken in the comparison; the preceding investigation gave for the retard 1¼ day, each lunitidal interval, minus its corresponding mean value for the respective hour of the moon's transit, was therefore tabulated in respect to the moon's declination and parallax (separately for each), corresponding to one day anterior to the time of high or low water, thus referring the results to transit E. The present investigation can only furnish an approximation to the true results; the

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[1] For comparison of different values for this ratio, the following have been selected: $\frac{S''}{M''}$ for London, 0.379; for Plymouth, 0.407; from the discussions of the Superintendent of the U. S. Coast Survey, for Key West, 0.325; San Diego, 0.39; and San Francisco, 0.342. (*Annual Reports* of 1853 and '54.) $\frac{S'''}{M'''}$ for Dundee, 0.277; for Brest, 0.346; for Plymouth, 0.294.

observations, while they give reliable value for the half-monthly inequality, cannot be expected to give more than an approximation to its variations. For any one station, and any one inequality or correction to it, special examinations require to be made to ascertain that transit of the moon, best suited for the purpose; this has hardly been done for any standard station, and it suffices to state here that, by referring to an anterior transit, the whole half-monthly inequality is moved backward through nearly twenty-four minutes for every transit preceding. Upon the inequality itself, the effect is but of a differential character. Thus to refer our table to transit E, deduct 24^m from each value.

To concentrate as many values as possible to a mean, the changes of declination and parallax were grouped for three values. The separate parcels for declination are for declination 0 to 13°, 13° to 21°, and 21° to 27°.5, irrespective of sign. The parallax groups are: 54′ to 56′, 56′ to 58′, and 58′ to 61′.4.

The differences of interval for the high and low waters were made out separately, and, in general, agreed tolerably well. I obtained the following results:—

TABLE SHOWING THE CORRECTION (IN MINUTES) TO THE MEAN HOURLY INTERVAL, FOR A CHANGE IN THE MOON'S DECLINATION AND PARALLAX.

Moon's transit.	Correction to interval for moon's declination.			Correction to interval for moon's parallax.		
	0° to 13°.	13° to 21°.	21° to 27°.5.	54′ to 56′.	56′ to 58′.	58′ to 61′.4.
0^h 30^m	-2^m	-7^m	$+5^m$	-12^m	$+14^m$	-7^m
1 30	+15	−5	−18	−17	+17	+5
2 30	+21	−7	−12	−11	+12	−2
3 30	+23	−11	−9	−1	+20	−10
4 30	+9	0	−13	−1	+1	−3
5 30	+14	+4	−15	+16	+19	−36
6 30	−9	+18	−3	+7	−3	−2
7 30	+1	−13	+9	+5	−3	−6
8 30	−2	+9	+15	+26	−10	+8
9 30	−6	+1	+22	+9	−11	−5
10 30	+1	−6	+10	+10	−9	−7
11 30	−3	−2	+3	−4	+4	+4
Mean	$+5^m$	-1^m	-1^m	$+2^m$	$+4^m$	-5^m
No. of observ.	373	262	348	387	244	333

Mean declination 16°.0. Mean parallax 57′.0.

The above table of declination corrections exhibits systematic values for the periodical part of the lunar effect, or for the term $D \sin. 2 (\phi - \gamma)$. Between 0° and 13° of declination, the correction is positive for transits between 1^h and 7^h, for other hours negative; for declinations between 13° and 21° it is positive, between the hours of 4 and 10; for remaining hours it is negative, and for declinations 21° to 27°.5, the correction is positive, for hours 7 to 1, and negative for remaining hours of transit. The quantity D is accordingly about 14 minutes, and γ equals 15°, 60°, and 105° respectively.

The variation in the inequality due to the changes of the moon's declination appears large when compared with its value at other places, but is in conformity with the large value of the half-monthly inequality itself.

The periodical part of the parallax correction is of the same form as given above.

The empirical values for the groups of small and middle values of parallax appear systematic; the values in the last column for large parallax are less regular. The maximum correction on the average is somewhat greater than one-fourth of an hour.

The corrections to the mean establishment for changes of the sun's declination and parallax may be taken as one-third of the corresponding lunar values, and in the present case will probably not exceed five minutes of time.

The means of each column, containing the non-periodical part, are small, and appear rather irregular; they are variable with the transit or the moon's age adopted in the discussion.[1]

Diurnal Inequality.—We now proceed to the examination of a prominent feature in the Rensselaer Harbor tides, namely, the diurnal inequality. This inequality is well marked in the diagrams, Plates I, II, and III. Although the existence of this inequality, in height and times, has long been known to practical men, it was not until about twenty-five years ago that its laws were understood and reduced to computation by Mr. Whewell.[2] The subject has since been taken up by the present superintendent of the U. S. Coast Survey, Prof. Bache;[3] his researches commenced about nine years ago, and resulted in a further extension of the method of discussion as well as in the recognition of the geographical limits of the phenomena on our own coast; further, the discussion of single day tides, produced by this inequality in extreme cases, and here complicated by an extremely small rise and fall of the tides, was now successfully accomplished. According to the equilibrium theory, the diurnal tide ought to be very small in latitude 79°; but viewing the Rensselaer Harbor tide as a wave, produced principally in the Atlantic, and propagated through Davis's and Smith's Straits, the existence of the diurnal inequality in so high a northern latitude cannot surprise us. The following notes were extracted from Captain McClintock's narrative of the voyage of the "Fox,"

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[1] On this point the reader may consult Whewell's 9th series of tidal researches: "Laws of the Tides from a Short Series of Observations," Phil. Trans. 1838; also Airy, "Tides and Waves," articles 552 and following.

[2] Researches on the Tides, sixth series. On the Results of an Extensive System of Tide Observations made on the Coasts of Europe and America in June, 1835. By the Rev. W. Whewell. Phil. Trans. Roy. Soc. 1836.

Researches on the Tides, seventh series. On the Diurnal Inequality of the Height of the Tide, especially at Plymouth and Singapore. By the same author. Phil. Trans. 1837.

Researches on the Tides, eighth series. On the Progress of the Diurnal Inequality Wave along the Coasts of Europe. By the same author. Phil. Trans. Roy. Soc. 1837.

[3] Note on a Discussion of Tidal Observations at Cat Island in the Gulf of Mexico, by Prof. A. D. Bache. Coast Survey Report for 1851, App. No. 7; Additional Notes thereto, Coast Survey Report for 1852, App. No. 22.

On the Tides at Key West and of the Western Coast of the United States. Coast Survey Report for 1853, App. Nos. 27 and 28. By Prof. A. D. Bache.

Comparison of the Diurnal Inequality of the Tides at San Diego, San Francisco, and Astoria, on the Pacific Coast of the United States. Coast Survey Report for 1854, App. No. 26. By Prof. A. D. Bache.

Approximate Co-Tidal Lines of Diurnal and Semi-Diurnal Tides of the Coast of the United States on the Gulf of Mexico. Coast Survey Report for 1856, App. No. 35. By Prof. A. D. Bache.

For the theoretical investigation of the diurnal tide, see also Airy's Tides and Waves, articles 46 and following; and articles 562 and following.

in 1857, '58, '59. Referring to Bellot Strait: "As in Greenland, the night tides are much higher than the day tides." Speaking of the ice motion, and remarking that the tides are the chief cause of it, he says: "Now we know that the night tides in Greenland greatly exceed the day tides." Also, when near Buchan Island, north of Upernavik, and in the vicinity of Cape Shackleton: "We had grounded during the day tide, and were floated off by the night tide, which on this coast occasions a much greater rise and fall." By the labors of Dr. Kane we now know that the diurnal inequality extends as high up as 79° of latitude on the north-western coast of Upper Greenland. In a report of Mr. Sonntag's to Dr. Kane, dated Godhavn, Sept. 12, 1855, he says: The mean height of spring tides is 12.8 feet, and at the time of new and full moon high water is at $12^h\ 0^m$; the highest spring tide is three days after full moon, and the night tide is at this time fully three feet higher than the day tide. At Northumberland Island, Sept. 10, 1854, at (after) the time of full moon high water was at 11^h P. M., and the night tide rose three feet more than the day tide. These statements, crude as they necessarily are, show that the attention of the party was fully directed to the phenomenon.

A cursory examination of the Plates (I, II, and III) shows that the diurnal inequality extends without exception over the whole series of observation, that it is well marked in the difference of the height of high water, but very little or irregularly in the height of low water; that sometimes the day tide, at other times the night tide is the higher of the two occurring in a lunar day; further, that it vanishes a day or two after the moon's crossing the equator, and that it amounts in maximo to about three feet some time after the moon attains her greatest declination. There is but one instance where the inequality approximates to the production of a single day tide. See curve for Nov. 23, 1853.

We may now enter somewhat more fully into the discussion of this inequality, which is produced by the interference of two independent waves, the diurnal and the semi-diurnal, the former depending for its size chiefly on the moon's declination. For a complete study of these compound waves, they require to be examined in their separate parts, and it would therefore be our first object to effect their separation into the diurnal and the semi-diurnal; a process which, when graphically performed, is neither too laborious nor lacking in accuracy; it is nevertheless a process of some nicety, and requires observations of standard excellence. Upon trial, I found the less rigorous method employed by Mr. Whewell in his discussion of the Plymouth and Singapore tides, was better suited to the general mass of the observations at Van Rensselaer, and that the above described process of separation had better be reserved to that portion of our observations which are apparently of the best character.

The observed heights of high and low water were laid down graphically, and a line was drawn by the eye, cutting off the zigzags of the successive high waters, leaving equal portions above and below the intermediate curve. These differences from the mean height were then set off from another axis, and those belonging to the high water next following the moon's superior transit were marked by a curve of dashes; those following the moon's inferior transit were marked by a curve of dots. These curves, without exception, were found to have alternately, as the

moon has north or south declination, positive and negative ordinates, in perfect accordance with the equilibrium theory, according to which the tide (high water) which belongs to a south transit of the moon should be the greater of the two of the same day, the moon's declination being north, or should be the smaller of the two, the moon having south declination; when the moon crosses the equator (or, according to experience, some time after it), the inequality vanishes; the time by which the full effect is produced is, as in other cases of the application of this theory, later than theoretically indicated. On Plate III are given specimens of the diurnal inequality curve, constructed as explained above and on the same scale as the other diagrams on these plates. By means of the diagrams, the epoch when the inequality vanishes has been made out as follows:—

TABLE SHOWING THE OBSERVED TIMES WHEN THE DIURNAL INEQUALITY VANISHES, TOGETHER WITH THE TIME WHEN THE MOON CROSSES THE EQUATOR, AND THE DIFFERENCE OF THESE TIMES, OR THE NUMBER OF DAYS BY WHICH THE CAUSE PRECEDES THE EFFECT. THIS DIFFERENCE IS ALSO CALLED THE EPOCH.

Year.	Inequality disappears.	Moon's declination equal 0.	Difference, or epoch.	Year.	Inequality disappears.	Moon's declination equal 0.	Difference, or epoch.
1853	Oct. not observed	15^d 7^h	- - -	1854	April 28^d 8^h	24^d 11^h	3^d 21^h
"	Oct. 30^d 21^h	29 18	1^d 3^h	"	May 9 24	9 0	1 0
"	Nov. 12 10 / 13 6	11 13	1 7	"	" 23 14	21 17	1 21
"	" 27 22	26 4	1 18	"	June 7 9	5 10	1 23
"	Dec. 9 9	8 19	0 14	"	" 19 9	17 22	1 11
"	" 25 12	23 13	1 23	"	July 5 4	2 17	2 11
1854	Jan. not observed.	5 2	- - -	"	" 31 22	29 22	2 0
"	" " "	19 18	- - -	"	Sept. 9 3	7 22	1 5
"	Feb. 3 4	1 10	1 18		Remaining observations of Series IV not sufficiently reliable.	22 9	- - -
"	" 16 18	15 23	0 19			Mean.	1^d 15^h
"	Mar. 3 12 / 1 12	28 19	1 17				
"	" 16 0	15 5	0 19				
"	Mar. obs'n incompl.	28 4	- - -				

The results for the epoch are very regular, and with the exception of part of the last series, which is of inferior accuracy, no observation has been omitted. The inequality vanishes at the distance of 1.62 days' motion of the moon from her nodes.

The magnitude of the diurnal inequality, and its variation depending on twice the moon's declination, was made out by dividing the inequality curves in six parts between the times of disappearance, and by tabulating the ordinates as well as the corresponding declination of the moon, the following results were obtained from 12 complete cycles, omitting no value, viz:—

AMOUNT OF DIURNAL INEQUALITY IN THE HEIGHT OF HIGH WATER.

Ordinate.	(In feet.)												Mean *dh.*	Mean declination.
0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0°
1	1.1	2.1	0.8	2.7	1.0	0.3	0.2	1.4	2.7	1.5	1.5	1.0	1.4	12
2	0.5	2.9	2.3	4.0	4.2	2.5	1.0	1.5	2.2	2.0	2.1	3.0	2.3	21
3	1.5	2.2	3.0	4.6	4.0	2.8	1.1	1.6	2.2	3.1	2.0	2.0	2.5	25
4	1.6	2.3	3.0	4.6	0.2	3.6	1.5	1.4	1.8	1.9	3.3	2.7	2.3	22
5	0.8	1.1	1.1	3.0	2.4	1.2	0.7	3.5	2.2	1.0	2.0	2.0	1.7	13
6	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0

The mean declination corresponds to an epoch 1.6 days anterior, which remark applies also to the formula $dh = C \sin. 2\,\delta'$, representing the diurnal inequality dh in two successive high or low waters, δ' being the moon's declination. For the value of C we obtain 3.3, which gives us the following comparison:—

DIURNAL INEQUALITY IN HEIGHT.

(Epoch 1.6 days.)

Moon's declination.	Observed dh.	Computed dh.	Difference.
	Feet.	Feet.	Feet.
0°	0.0	0.0	0.0
12	1.4	1.4	0.0
21	2.3	2.2	0.1
25	2.5	2.5	0.0
22	2.3	2.3	0.0
13	1.7	1.5	0.2
0	0.0	0.0	0.0

The diurnal inequality in time I have tried to exhibit by numbers as well as by diagrams; it seems, however, that the incidental irregularities in the observations themselves, coupled with the fact that the observations generally were only made half-hourly and at other times hourly—so far exceed in magnitude the inequality itself as to make the effect of the changes of the moon's declination exceedingly obscure. The lunitidal intervals (for high and low water) between Oct. 17 and Dec. 28, 1853, between Jan. 28 and March 7, 1854, and between June 1 and July 7, 1854, were tabulated in vertical columns; the means of the alternate values were tabulated in the 2d column, and placed in the horizontal line opposite the intermediate value of column one. The numbers in the first column were next subtracted from the corresponding numbers in the second column, if the interval belonged to the inferior transit; if belonging to the superior, the values in the second column were subtracted from those in the first. The moon's declination, for noon each day, was also set down. The 276 values for diurnal inequality in time, thus obtained, were plotted. After attempting to deduce an epoch and arranging the values for different assumptions for epoch, no satisfactory result could be obtained in any way according with the expression

$$d\psi = \frac{g \tan. \delta'}{1 + A \cos.^2 \phi} \text{ (see Lubbock, Phil. Trans. 1837),}$$

and the results of the investigation must be confined to the following general remark. The diurnal inequality in time is in maxima probably not exceeding two hours; it seems to be less in amount for the times of high water than for the times of low water, a result the reverse of that belonging to the inequality in height. A similar conclusion was arrived at in the discussion of the tides at San Francisco, Cal. (Prof. A. D. Bache in Coast Survey Report for 1853, p. *81), when the *smaller* inequality in height of high water (when compared with that for low water) corresponded to the *greater* inequality in time of high water (when compared with the inequality for low water). Whether the inequality of the height for high or low water is the greater or smaller depends only on the epoch of the diurnal wave compared with the epoch of the semi-diurnal wave. There is no regular increase

of the inequality corresponding to an increasing (irrespective of sign) declination of the moon, but the curve appears double-crested about the time of maximum declination, there being a sudden diminution in the inequality, preceded and followed by high values; about the time of the moon's crossing the equator the inequality is very irregular.

On Plate IV, the actual separation of the semi-diurnal and the diurnal wave has been effected graphically, for which purpose a part of the best observations was selected; these observations extend over the period from Oct. 30 to Nov. 22, 1853. The process of decomposition in use in the U. S. Coast Survey was at first an analytical one, by computing sine curves; since 1855, however, a graphical process, equivalent thereto, was substituted; this latter method, as introduced by assistant L. F. Pourtales, may be briefly explained as follows: After the observations are plotted and a tracing is taken, the traced curves are shifted in epoch 12 (lunar) hours forward, when a mean curve is pricked off between the observed and traced curves; this process is repeated after the tracing paper has been shifted 12 hours backward; the average or mean pricked curve thus obtained represents the semi-diurnal wave. On an axis parallel with that on which the time is counted, the differences between the originally observed and the constructed semi-diurnal wave were laid off; this constitutes the diurnal curve. In the case in hand I have simplified the process of separation by blackening the under surface of the tracing paper with a lead pencil, and running in with a free hand; the intermediate curves by the pressure of a style, an average of the two traces thus left on the lower paper, gave the semi-diurnal wave in quite an expeditious manner. On the diagram, the diurnal curve with its epoch of high water nearly coinciding with that of the semi-diurnal wave, appears plainly with its variation in size depending on the moon's declination.

Investigation of the Form of the Tide Wave.—The shape of the tide wave has been ascertained in the manner described in art. (479) Tides and Waves, and depends on the hourly observations of 60 tides, 30 during spring tides and an equal number during neap tides, that is, the observed heights on the day of the syzygies and quadratures and on the first and second day after, were tabulated, forming ten groups of three columns each, from low water to low water. The columns of an equal number of hours (they vary from 16 hours to 11 hours) were united in a mean. In order to combine these it was assumed that the interval from the observed low water to the next following low water corresponds to 360° of phase, and the time of every intermediate observation was converted into phase by that proportion. In order to render the observed heights comparable, the range from high to low water in every half tide (the reading of low water for phase 0 generally not being identical with the reading of the succeeding low water or phase 360°) was supposed to correspond to 2.00, and the elevation above the low water was converted into number by that proportion, thus furnishing a series of ordinates for equidistant abscissæ. The means of all the phases and corresponding converted depressions within every 30th degree of phase were then taken with proper regard to the weights, depending on the number of columns, of equal hours, united at the commencement of the reduction. By observation of the progress of the numbers,

it was easy to alter the latter so as to make them exactly correspond to the phases 30°, 60°, 90°, 120°, etc. In this manner the following numbers have been obtained:—

FOR THE SPRING-TIDE WAVE OCCURRING ONE AND A QUARTER DAY AFTER FULL AND NEW MOON.

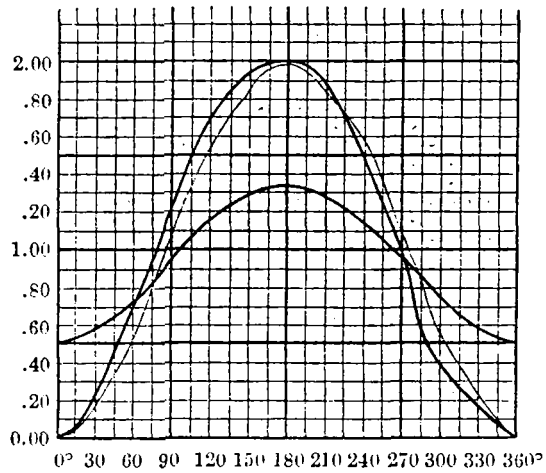
Phase of groups.							Proportional height above low water.						
						Mean.							Mean.
	0°	0°	0°	0°	0°	0°		0.00	0.00	0.00	0.00	0.00	0.00
	26	28	30	33	36	30		0.06	0.23	0.24	0.27	0.10	0.21
	51	55	60	65	72	59		0.32	0.68	0.90	0.70	0.46	0.71
	77	83	90	98	108	89		0.91	1.13	1.36	1.32	1.17	1.24
	103	111	120	131	144	120		1.39	1.68	1.73	1.76	1.52	1.70
	129	138	150	164	180	156		1.84	2.04	1.98	1.93	2.00	1.95
	154	166	180	196	216	180		1.94	1.98	2.00	2.00	1.88	2.00
	180	194	210	229	252	208		2.00	2.00	1.84	1.56	1.23	1.88
	206	222	240	262	288	237		1.84	1.84	1.45	1.15	0.70	1.46
	231	249	270	294	324	270		1.58	1.23	1.00	0.65	0.41	0.97
	257	277	300	327	360	300		1.14	0.79	0.27	0.25	0.00	0.37
	283	305	330	360		330		0.60	0.40	0.17	0.00		0.17
	309	332	360			360		0.15	0.16	0.00			0.00
	334	360						0.02	0.00				
	360							0.00					
Weight	5	4	13	7	1		Weight	5	4	13	7	1	

The columns headed "mean" show the ordinates of the waves for (nearly) equidistant intervals of time.

The following table contains the corresponding numbers for the neap tide wave occurring 1¼ day after the first and last quarter, and as derived from 30 tides observed hourly from low to low water:—

Phase of groups.								Proportional height above low water.						
							Mean.							Mean.
	0°								0.00					
	24	0°							0.07	0.00				
	48	26	0°						0.26	0.17	0.00			
	72	51	28	0°			0°		0.49	0.55	0.24	0.00		0.00
	96	77	55	30	0°		29		0.89	1.11	0.59	0.20	0.00	0.20
	120	103	83	60	33	0°	58		1.19	1.53	0.93	0.50	0.60	0.00	0.52
	144	129	111	90	65	36	89		1.55	1.83	1.35	1.05	1.02	0.00	1.08
	168	154	138	120	98	72	119		0.82	2.00	1.73	1.60	1.44	0.35	1.51
	192	180	166	150	131	108	147		2.00	1.95	2.00	1.85	1.81	1.06	1.82
	216	206	194	180	164	144	180		1.92	1.62	1.96	2.00	2.00	1.88	1.97
	240	231	222	210	196	180	213		1.64	1.43	1.72	2.00	1.72	2.00	1.84
	264	257	249	240	229	216	241		1.25	1.09	1.32	1.84	1.43	1.63	1.58
	288	283	277	270	262	252	271		0.94	0.67	0.80	1.37	0.79	0.99	1.08
	312	309	305	300	294	288	301		0.51	0.24	0.32	0.79	0.15	0.10	0.56
	336	334	332	330	327	324	331		0.23	0.05	0.04	0.42	0.00	0.00	0.22
	260	360	360	360	360	360	360		0.00	0.00	0.00	0.00	0.00	0.00	0.00
Weight	3	4	8	13	1	1		Weight	3	4	8	13	1	1	

The results are represented in the annexed diagram. The result for the neap tide curve has also been multiplied by $\frac{47}{11.1}$, the ratio of neap and spring tide range as found on a preceding page, and was increased by 0.5 to refer it to the same level.



The full curves in the diagram show the form of the spring and neap tide wave (the scales being arbitrary), to which has been added for convenient comparison the dotted curve representing the neap tide wave on the same relative scale as the spring tide wave. It is apparent that the spring tide wave is slightly steeper between low and high water than between high and low water, and that the neap tide wave is very nearly symmetrical in respect to rise and fall.

We have seen that the duration of rise is $6^h\ 04^m.7$, hence the duration of fall will be $6^h\ 19.^m7$; or in making ebb the time is 15 minutes greater than in making flood, a circumstance in conformity with the shape of the curves of rise and fall. This holds good for an average tide; according to art. (510) Tides and Waves, if the place of observation is not far from the sea, or, as in our case, in a bay, the water will occupy a shorter time to rise than to fall, and the inequality will be greater at spring tides than at neap tides; this is fully illustrated in the preceding diagram, the spring tide wave being the steeper of the two.

The form of the tide waves will be found closely represented by the following expressions:—

For the spring tide wave—

$$5.83 + 5.58\ sin.\ (\theta + 278°) + 0.20\ sin.\ (2\,\theta + 281°);$$

For the neap tide wave—

$$2.42 + 2.25\ sin.\ (\theta + 269°) + 0.09\ sin.\ (2\,\theta + 290°);$$

in which expressions the angle θ counts from low water to low water, from 0 to 360°, and the height of the wave is expressed in feet.

The relative numbers, given above, as the ordinates, have been changed in the proportion of 2 to 11.1 for the higher and of 2 to 4.7 for the lower wave. The following table shows the agreement between observation and the numerical expressions, in which the 3d and higher terms are zero:—

FORM OF THE TIDE WAVE AT VAN RENSSELAER HARBOR.

Phase.	Height of Spring tide, in feet.		Height of neap tide, in feet.	
	Observed.	Computed.	Observed.	Computed.
0	0.0	0.1	0.0	0.1
30	1.2	1.4	0.5	0.4
60	3.9	3.9	1.3	1.3
90	6.9	6.8	2.5	2.5
120	9.4	9.3	3.5	3.5
150	10.7	10.9	4.3	4.3
180	11.1	11.1	4.6	4.6
210	10.4	10.2	4.3	4.4
240	7.9	8.0	3.7	3.7
270	5.4	5.3	2.5	2.5
300	2.1	2.4	1.3	1.3
330	0.9	0.5	0.5	0.4
360	0.0	0.1	0.0	0.1

Respecting the effect of the wind and ice on the tides, it may be remarked that the former can only be slight, since the sea is protected from the direct action of the wind by its icy cover for the greater part of the year. When the sea is partially open, the effect becomes sensible, as may be seen by the following note extracted from the log-book:—

"August 17, 1853. The above records show a heavy gale from the southward gradually hauling to the eastward; the effect of this gale on the tides was very marked; our flood rose two feet above any previous register, overflowing the ground ice, and our last ebb or outgoing tide was hardly perceptible." The ice crust cannot sensibly affect (by friction on its lower surface) the progress of the tide wave, and will certainly not sensibly interfere (by friction on the ice foot and breakage of the ice fields) with the rise and fall of the tide.

Progress of the Tide Wave.—The tide at Van Rensselaer Harbor may be taken as a derived tide, and transmitted to it from the Atlantic Ocean, and in part modified by the small tide originating in the waters of Baffin's Bay; which latter tide, however, must necessarily be small, particularly on account of the general direction of the bay, which is very unfavorable for the production of a tide wave. That the tide wave is travelling up along the western coast of Greenland, or, in other words, reaches Van Rensselaer Harbor from the southward, may be seen from the following observed establishments:—

Holsteinborg Harbor, latitude 66° 56′, longitude 53° 42′. High water at F. & C. 6^h 30^m. Spring tides rise 10 feet.—Capt. Inglefield, 1853.

Whalefish Islands (near Disco), latitude 68° 59′, longitude 53° 13′. Time of high water F. & C. 8^h 15^m. Highest tide 7½ feet.—Parry's 3d Voyage of Discovery.

Godhavn (Disco), latitude 69° 12′, longitude 53° 28′. Tidal hour 9^h. Rise and fall 7½ feet.—See Map in Narrative of Kane's First Voyage.

Upernavik, latitude 72° 47′, longitude 56° 03′. High water at F. & C. 11^h. Rise 8 feet.—Capt. Inglefield, 1854.

Wolstenholm Sound, latitude 76° 33′, longitude 68° 56′. High water at F. & C. 11^h 8^m. Rise, both at spring and neaps, 7 to 7½ feet.—(See Admiralty Chart of Baffin's Bay, sheet 1, 1853, corrected to 1859.) The observations themselves, taken by Captain Saunders of H. M. S. North Star, in 1849 and 1850, were kindly fur-

nished to Prof. Bache by the Hydrographer to the Admiralty, Captain J. Washington, R. N., and are given in the appendix to this paper. And finally,

Van Rensselaer Harbor, latitude 78° 37′, longitude 70° 53′. High water at F. & C. $11^h\ 50^m$, as derived from the preceding analytical expression. Rise and fall at spring tide 11.1 feet, at neap tide 4.7 feet, average range 7.9 feet.

By means of the difference in the establishments of Holsteinborg and Van Rensselaer, we can obtain an approximation to the depth of Baffin's Bay and Smith's Straits, viz:—

	Tidal hour.	Longitude.	Sum	Difference.	
Holsteinborg	$6^h\ 30^m$	$3^h\ 35^m$	$10^h\ 05^m$	$6^h\ 28^m$	Difference corrected for the
Van Rensselaer	11 50	4 43	16 33		moon's motion $6^h\ 26^m$.

Assuming the distance along the channel to be 770 nautical miles, we have a velocity of the tide wave of about 202 feet in a second, which, according to Airy's table (174), Tides and Waves, would correspond to a depth of nearly 1300 feet, or about 220 fathoms—a result probably smaller than the true value, since the other observations indicate a greater depth, it may be taken as an inferior limit; in the same manner we find from the co tidal hours of Upernavik and Van Rensselaer a depth of near 800 fathoms, and a similar result from the Wolstenholm observations; this last result may perhaps be taken as an upper limit.

Soundings.—The following soundings have been copied from the log-book:—

June 19, 1853. Lat. 51° 12′, long. 52° 8′ (government sounding twine and 32-pound shot).

Chronometer time.	Mark.
$8^h\ 47^m\ 0^s$	Red, started.
49 10	White.
52 10	Bottom, with 178 fathoms; shot brought up with gray mud and fine sand. The line was afterwards measured.

June 26, 1853. Lat. 59° 48′, long. 50° 3′ (government sounding twine and 32-pound shot).

Chronometer time.	Mark.	Chronometer time.	Mark.
$3^h\ 56^m\ 35^s$	Started 75 fathoms from the next mark.	$4^h\ 21^m\ 25^s$	White.
57 25	Red.	25 10	Red.
58 50	White.	29 15	White.
4 00 37	Red.	33 25	Red.
2 48	Black.	37 30	Black.
5 16	White.	42 0	White.
8 0	Red.	46 30	Red.
11 0	White.	51 15	White.
14 5	Red.	56 0	Red.
- - - - -	Missed the mark.	58 0	Bottom with 1817 fathoms, line cut.

August 1, 1838. Melville Bay, lat. 75° 40′, long. 62° 12′ (government sounding twine and 32-pound shot).

Chronometer time.	Mark.
$5^h\ 47^m\ 6^s$	Started.
48 8	Red.
49 40	White.
51 40	Red.
54 0	Black.
54 45	Bottom with 429 fathoms; shot brought up with dark green sand (specimen preserved).

APPENDIX.

TIDAL OBSERVATIONS MADE ON BOARD H. M. S. NORTH STAR, COMMANDER SAUNDERS, AT THE WINTER QUARTERS IN WOLSTENHOLM SOUND. (FROM THE SHIP'S LOG.)

DATE.	High water.		Low water.	
1849.	Time.	Height.	Time.	Height.
		Ft. In.		Ft. In.
Nov. 16, A. M.	12h 0m	78 0	4h 0m	69 4
" 17, A. M.			5 30	70 11
" 17, P. M.	0 30	78 6		
" 29, A. M.	11 0	76 5	5 0	71 4
" 30, A. M.	10 0	79 1	4 30	70 0
Dec. 14, P. M.	11 0	69 6	6 0	65 2
" 22, P. M.	4 0	70 9	10 30	65 4
" 29, A. M.	11 0	73 10	3 30	64 0
1850.				
Jan. 13, A. M.	12 0	71 6	5 30	64 2
" 21, P. M.	4 0	70 4	10 30	65 1
" 27, A. M.	11 0	72 4	5 30	64 2
Feb. 3, P. M.	3 30	70 0	9 0	63 10
" 19, P. M.	4 0	70 3	9 30	66 8
March 5, P. M.	4 30	70 0	10 0	66 10
" 13, A. M.	11 30	76 0		

DATE.	High water.		Low water.	
1850.	Time.	Height.	Time.	Height.
		Ft. In.		Ft. In.
Mar. 13, P. M.			6h 0m	69 0
" 19, A. M.	3h 0m	75 6		
" 19, P. M.			11 0	70 10
" 27, P. M.	11 0	76 2	5 30	67 9
April 4, A. M.			12 0	69 9
" 4, P. M.	4 0	72 2		
" 12, A. M.	11 30	70 1	5 0	69 2
" 26, A. M.	11 0	70 3	5 0	69 2
May 4, P. M.	5 0	75 0		
" 19, A. M.	5 30	77 2		
" 19, P. M.			11 30	72 6
" 26, A. M.	1 0	75 10	6 0	69 0
June 2, P. M.	1 0	68 11		
" 23, P. M.	11 0	74 4		
July 9, P. M.	11 0	74 10	3 0	66 1

From the rough manner with which the above observations appear to have been made, an approximate establishment and rise of tide only can be deduced from them.

H. W. F. and C. appears to take place between $XI^h\ 0^m$ and $XI^h\ 15^m$, say $XI^h\ 8^m$, and the rise both at springs and neaps from 7 to $7\frac{1}{2}$ feet.

(Signed) JNO. BURWOOD, MASTER R. N.,
(*Tide Computer*).

ADMIRALTY, 3*d July*, 1860.

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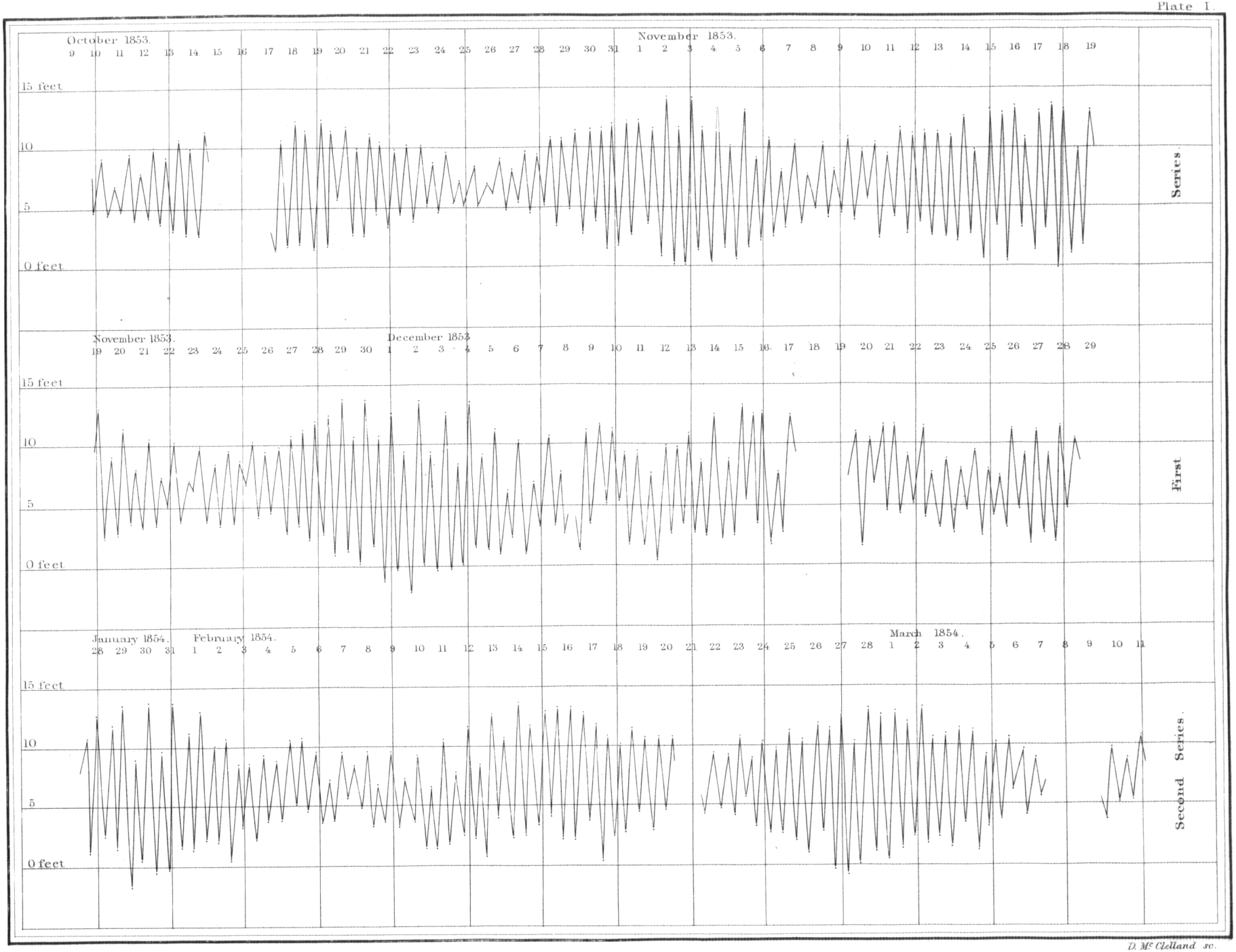
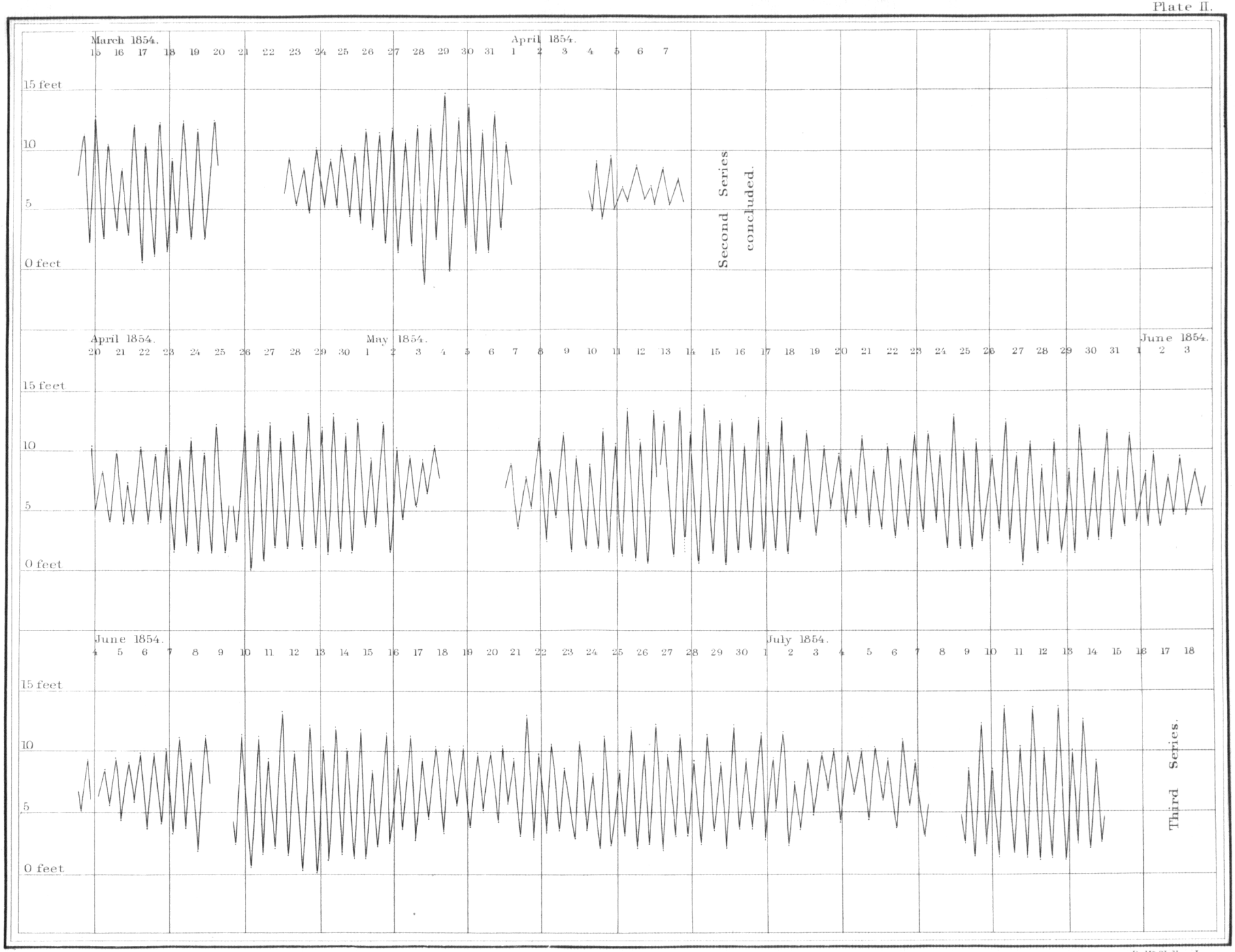


D. McClelland sc.



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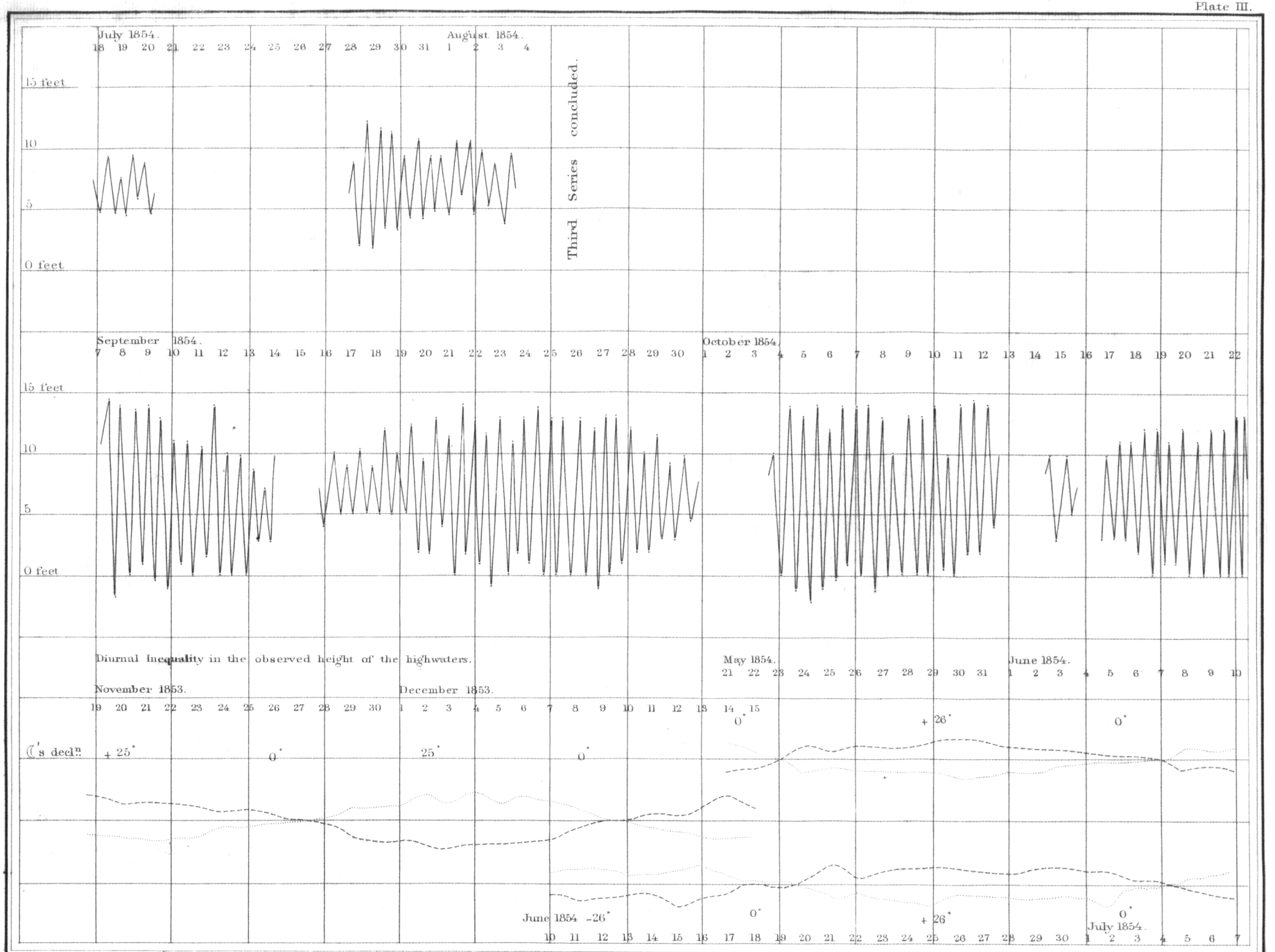

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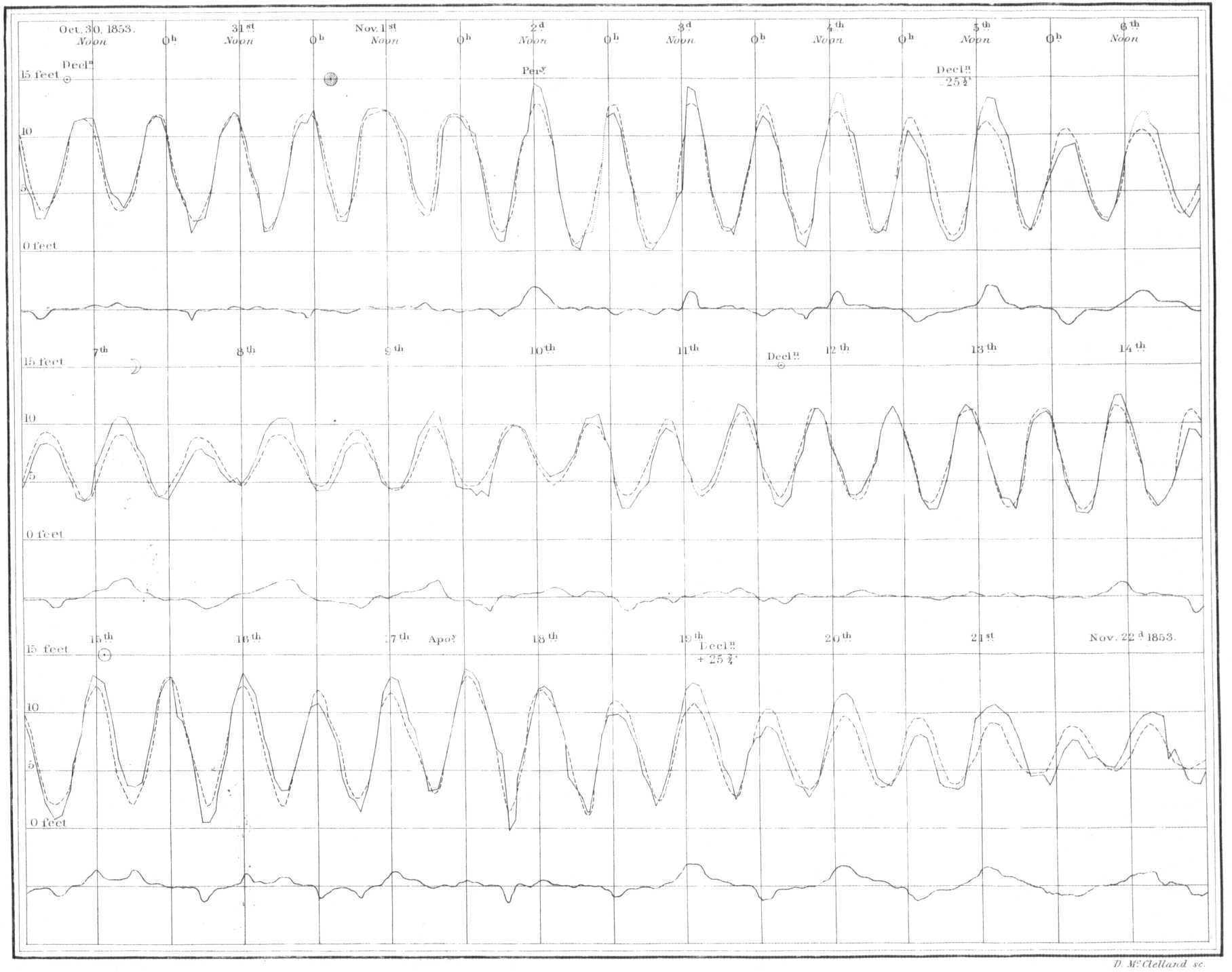

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