

also there is often a long delay in the beginning of a storm or High, so that great care is needed in measuring the velocity.

The following table gives the approximate velocity of storms during the past 18 years. There has been no opportunity to make a projection of the tracks or measurement of these velocities except such as a close scrutiny of records would give:

Year.	Number.	Velocity per hour.	Year.	Number.	Velocity per hour.
		Miles.			Miles.
1873	6	28.0	1883	6	25.0
1874	7	24.0	1884	5	32.0
1875	4	17.0	1885	6	23.0
1876	6	21.0	1886	6	32.0
1877	5	22.0	1887	5	27.0
1878	4	25.0	1888	6	23.0
1879	6	22.0	1889	6	24.0
1880	4	32.0	1890	10	24.0
1881	4	28.0			
1882	5	23.0	Mean	5.6	25.3

Little significance can be placed upon the marked diminution in 1875 nor on the increase in '80, '84, and '86. It is probable that the mean velocity of storms during July in this country is about 24 miles per hour, and in August perhaps a very little greater. During the earlier years it was very difficult to trace storms to the west of the Mississippi and, as it is probable that the velocity is a very little less in that region than to the east, we may consider these values as slightly in excess, if anything.

As already noted under High III, there is a uniform oscillation in air pressure from morning till night. In order to find whether this extended to the Low as well, the following table was prepared showing the area in square miles within the isobar 30.20 and also within the isobar 29.60. A serious difficulty exists in such measurements owing to the lack of ob-

servations to the north. The observations at high stations in British N. W. T. cannot be used since the observed temperature is used for reducing barometer readings to sea level, while in the United States this difficulty is overcome by using the mean 24-hour temperature for making the reduction, thus eliminating the diurnal range of temperature from 8 a. m. to 8 p. m.:

Table showing mean area (in square miles) of isobars 30.20 and 29.60.

Date.	30.20.		29.60.		Date.	30.20.		29.60.	
	A. M.	P. M.	A. M.	P. M.		A. M.	P. M.	A. M.	P. M.
1	0	0	30,000	240,000	17	1,100,000	500,000	0	0
2	30,000	0	20,000	20,000	18	900,000	250,000	0	0
3	40,000	0	0	0	19	700,000	150,000	0	0
4	0	0	0	20,000	20	5,000	0	0	0
5	0	0	0	20,000	21	100,000	50,000	0	20,000
6	0	0	0	80,000	22	800,000	400,000	1,000	20,000
7	300,000	0	0	20,000	23	650,000	400,000	0	40,000
8	120,000	2,000	0	0	24	600,000	10,000	10,000	40,000
9	20,000	0	0	0	25	10,000	0	5,000	0
10	60,000	0	0	0	26	0	0	0	0
11	200,000	0	0	40,000	27	0	0	0	0
12	300,000	10,000	0	0	28	0	0	50,000	200,000
13	400,000	0	0	0	29	0	0	100,000	100,000
14	150,000	0	0	0	30	0	0	0	80,000
15	90,000	0	0	80,000	31	0	0	0	150,000
16	150,000	50,000	0	0		200,000	100,000	100,000	0
	800,000	200,000	0	0					

This table shows that there is a marked oscillation in the centre of a High, the pressure being very much higher in the a. m. than p. m. In the centre of Low there is also an oscillation in the opposite direction, but the isobar of 29.60 is a little too low to show this well in August. With a few exceptions the pressure is lower in a Low in the p. m. than in the morning. This would seem to have an important bearing upon the question of the diurnal range of the barometer, and, when properly studied, may possibly assist in developing the theory of storms.

Tabulated statement showing principal characteristics of areas of high and low pressure.

Barometer.	First observed.		Last observed.		Duration.	Velocity per hour.	Maximum pressure change and maximum abnormal temperature change in twelve hours and maximum wind velocity.										
	Date.	Lat. N.	Long. W.	Lat. N.			Long. W.	Station.	Rise.	Date.	Station.	Fall.	Date.	Station.	Direction.	Miles per hour.	Date
High areas.	0	0	0	0	Days.	Miles.											
I.	1	44	88	43	68	3.5	37	Father Point, Quebec	Inch.	1	Philadelphia, Pa.	14	1	Sandusky, Ohio	ne.	16	1
II.	2	47	125	47	60	5.5	29	Bismarck, N. Dak.	.33	2	Fort Sully, S. Dak.	19	2	Helona, Mont.	nw.	20	2
III.	6	47	128	47	62	7.0	32	Anticosti Island, G. St. L.	.35	12	Bismarck, N. Dak.	21	7	Chicago, Ill.	ne.	40	11
IV.	11	46	124	41	72	4.5	25	Baugen, Ont.	.35	15	Swift Current, N. W. T.	21	11	Block Island, R. I.	ne.	14	16
V.	15	53	126	46	59	4.4	25	Huron, S. Dak.	.44	16	Fort Assiniboine, Mont.	27	15	do	e.	24	19
VI.	17	48	126	45	57	4.5	21	Chatham, N. B.	.35	20	Dodge City, Kans.	21	19	do	ne.	18	21
VII.	17	51	105	42	79	4.5	18	Father Point, Quebec	.34	22	Bismarck, N. Dak.	25	21	Grand Haven, Mich.	nw.	30	22
VIII.	23	48	125	38	73	4.5	19	Eastport, Me.	.33	28	Concordia, Kans.	15	25	Fort Assiniboine, Mont.	sw.	14	26
IX.	23	54	115	42	82	4.0	17	Rockliffe, Ont.	.26	30	Huron, S. Dak.	16	29	Chicago, Ill.	e.	12	30
Mean					4.7	26			.32							21	
Low areas.																	
I.	1	46	104	49	90	2.0	23	Huron, S. Dak.	Fall.	1	Valentine, Nebr.	18	1	Marquette, Mich.	sw.	48	2
II.	5	51	110	50	62	5.5	20	Halifax, N. S.	.34	10	Rapid City, S. Dak.	24	6	Fort Sully, S. Dak.	nw.	58	7
III.	9	52	115	51	63	5.5	21	Fort Sully, S. Dak.	.24	11	Fort Sully, S. Dak.	15	9	Rapid City, S. Dak.	sw.	55	11
IV.	13	51	116	47	62	4.5	23	Fort Buford, N. Dak.	.36	14	Northfield, Vt.	19	17	Fort Sully, S. Dak.	nw.	44	15
V.	15	45	98	34	94	2.0	26	Fort Smith, Ark.	.14	16	Cairo, Ill.	10	16	Kansas City, Mo.	nw.	26	16
VI.	18	36	102	48	63	2.0	45	Chatham, N. B.	.34	20	Sydney, C. B. I.	10	20	Eastport, Me.	se.	28	20
VII.	19	52	105	51	66	5.5	25	Montreal, Quebec	.48	21	Fort Buford, N. Dak.	21	19	Montreal, Quebec	n.	44	22
VIII.	21	53	116	47	60	7.0	18	Eastport, Me.	.62	27	Fort Custer, Mont.	20	21	Valentine, Nebr.	n.	68	24
IX.	23	36	102	35	73	5.0	19	Wilmington, N. C.	.18	29	Mobile, Ala.	10	27	Port Eads, La.	sw.	48	27
X.	26	51	104	46	62	4.5	18	Milwaukee, Wis.	.24	28	Cheyenne, Wyo.	26	26	Buffalo, N. Y.	sw.	32	29
Mean					4.4	24			.32							45	

NORTH ATLANTIC STORMS FOR AUGUST, 1890 (pressure in inches and millimetres; wind-force by Beaufort scale).

The paths of the storms that appeared over the north Atlantic Ocean during August, 1890, are shown on chart I. These paths have been determined from international observations by captains of ocean steamships and sailing vessels received through the co-operation of the Hydrographic Office, Navy Department, and the "New York Herald Weather Service."

Eight storms have been traced for August, 1890, the average number for the corresponding month of the last 7 years being

9. Of the storms traced for the current month 4 were continuations of storms which first appeared over the North American continent; one was central on the 1st north of Newfoundland; one moved eastward between the Grand Banks and Greenland, thence southeastward to about the 20th meridian, and thence northward to the British Isles; one apparently developed off the middle Atlantic coast; and one is given an approximate north of west path north of the West Indies to a

point about midway between the Bahamas and Bermuda, where it recurved northward and moved northeastward about midway between Bermuda and Nova Scotia. No storms traversed the ocean from coast to coast. With the exception of the West India cyclone referred to, no violent storms were reported for the month, and the weather was generally fine along the steamship tracks.

Hurricanes. In August of preceding years well-defined storms of destructive violence, averaging about 2 per month, have moved westward over or near the West Indies, and thence recurved over the Gulf of Mexico or off the Atlantic coast states. Storms of great strength have also appeared over the west Gulf. Among notable West India and Gulf storms charted and described in the REVIEW for August of preceding years were: 1879, 17th to 19th, storm moved from the Bahamas along the Atlantic coast, attended by gales of hurricane force and unusually high tides. 1880, 12-13th, storm in west Gulf devastated the Texas coast at the mouth of the Rio Grande; 18th, storm at the Island of Jamaica caused loss of life and immense damage to shipping and property; 26th to 31st, storm moved north of the Bahamas and crossed north Florida 29-30th, strewing the Florida coast with wrecks and doing great damage to property and crops. 1881, 27th, storm moved north of west to the coast near Savannah, Ga., causing extensive destruction of property and loss of life. 1885, 23d to 25th, storm moved along east Florida and south Atlantic coasts, causing great destruction on the south Atlantic coast, where the damage was estimated at \$1,500,000. 1886, two severe storms moved north of west over the Caribbean Sea, one recurving northward over Cuba and the Bahamas, and the other passing into the Gulf; 19-20th, a very destructive storm in the west Gulf; at Indianola, Tex., not a building was left standing, and the barometer fell to about 28.00 (711). 1887, two energetic and destructive storms moved from the vicinity of the Windward Islands, north of the West Indies, to the Bahamas, where they recurved north and northeast. 1888, 16th to 19th, storm moved from the Bahamas to the west Gulf coast, with violent squalls and heavy rain.

August, 1890, opened with low pressure north of Newfoundland and fresh gales over the Grand Banks; high pressure prevailed over mid-ocean south of the 50th parallel; while over the eastern part of the ocean moderate to fresh gales attended a depression central north of the British Isles. On the 4th a storm was central far to the north of Newfoundland, whence it moved southeastward to about N. 46°, W. 17° by the 9th, with pressure 29.40 (747) to 29.60 (752) and fresh gales, and thence passed northeastward to southern Ireland by the 10th. From this date until the 17th the pressure continued low over the British Isles, and on the 15th a barometer reading of 29.01 (737) was reported at Leith, Scotland. On the 6th a storm of moderate energy was central in the lower Saint Lawrence valley, whence it moved to north of the Grand Banks by the 7th, after which it apparently advanced south of east and united with the depression central over mid-ocean. On the 10th a storm was central in the Saint Lawrence Valley, whence it moved to north of Newfoundland by the 11th, without evidence of marked energy. On the 11th a dispatch from Havana, Cuba, stated that there were some indications of a far cyclone east by south from Cuba. On the 12th a dispatch from Havana, Cuba, stated that a cyclone moving nw. to south Atlantic coast was far to the ne. of that place. On this date a storm of moderate energy was central in about N. 39°, W. 67°, to which position it had apparently advanced from the sw. On the 13th a slight depression was central south of Nova Scotia, after which it disappeared. On the 15th and 16th a storm of moderate strength moved eastward north of the Gulf of Saint Lawrence over Labrador, after which it disappeared north of the region of observation. On the 17th a storm moved eastward to the Gulf of Saint Lawrence and on the 18th and 19th probably moved northeast beyond the region of observation. The evening of the 23d a dispatch from Havana, Cuba, stated that there was a moderate cyclonic disturbance, with heavy rain, southeast of that place. From the 23d to 27th low pres-

sure prevailed over and near the British Isles, and on the 26th the barometer reading at Leith, Scotland, was 29.19 (741), and fresh to strong gales prevailed over the east part of the ocean.

On the 24th a dispatch from Havana, Cuba, stated that a disturbance was sw. from that place, increasing in energy. A dispatch dated Havana, Cuba, 25th, 7.35 p. m., stated that the disturbance was west, probably moving wnw., and on the 26th a dispatch from Havana stated that there was a disturbance far w. by n., resembling a moderately large diameter cyclone, which would probably recurve near Texas. On the morning of the 27th the storm referred to in dispatches from Havana was well-defined over the northwest Gulf, and during that date it advanced over the lower Mississippi valley. On the 28th a storm was central over the Gulf of Saint Lawrence, with pressure below 29.30 (744) and fresh gales, whence it moved ene. over Newfoundland by the 29th, after which it disappeared north of the region of observation.

The most important storm of the month was the West India cyclone of the 27th-31st, the path of which is approximately plotted on chart I. This storm was first reported to the eastward of the Windward Islands on the 26th. On this date the s. s. "Haytian," at noon, in N. 24° 52', W. 54° 45', had moderate ese. breeze, with cloudy, squally, dirty weather, and wind increasing in the afternoon. On the 27th, at noon, this vessel was in N. 22° 18', W. 58° 35', and reported squally e. winds, dull weather, falling barometer, heavy rain and high sea. In the afternoon and evening hard gale and high sea, terrific squalls, wind and rain, blinding lightning from w. and southward. Stopped engines and hove ship to on starboard tack, heading nne. at 11 p. m. At midnight heavy gale with terrific squalls and high confused seas. On the 28th at noon, in N. 22° 55', W. 59° 34', wind e. strong, and heavy easterly swell. Mr. Joseph Ridgway, jr., the observer at Saint Thomas, W. I., reports that on the 26th and 27th there were indications of a cyclone in the neighborhood of Saint Thomas. The barometer (aneroid) fell to 29.89 (759) to 29.90 (759) (113 feet), the usual reading being 30.00 (762) to 30.02 (762). The wind shifted from ne. to nw. and w., with strong puffs from the ne. The tide was higher than usual and there was a southerly swell. The barometer did not rise to its usual position until midnight of the 27th. Mr. Ridgway stated further that the s. s. "Alliance," from Newport News, arrived 11 p. m., 28th, and reported having encountered heavy seas from e. and se.; lowest barometer 29.90 (759), and that the s. s. "Portuense" was sunk in a hurricane on the 28th about 250 miles ne. from Anegada Island, and captain and 9 of crew lost; the balance of the crew reached Tortola Island in the ship's life boat. The "Portuense" foundered in about N. 21°, W. 63°, shortly after 6.30 a. m., 28th; between 2 and 3 a. m. a fearful ne. hurricane raged and the barometer was reported 28.50 (724); shortly after ship foundered the wind went to sse. The bkn. "Onalaska," at 8 a. m., 28th, in N. 24°, W. 62° 20', had hard gale from ese., with terrific sea running from se. and s.; the barometer which had been standing at 30.30 (770) fell to 29.70 (754). Hove to with head to s., and so remained 10 hours, the hurricane evidently passed to the sw. On the 30th the brig "Abbie Olifford" was wrecked, with loss of life, in about N. 30°, W. 67°. At 2 a. m., 31st, the s. s. "Orinoco" was struck by a hurricane about 100 miles nw. from Bermuda. The wind came from about sse., and terrific seas swept over the vessel, carrying all movable objects overboard, smashing the steering gear and a life boat, and flooding the saloon. The barometer stood at 29.20 (742) until 4 a. m., when it began to rise, and at 10 a. m. the wind was sw. Terrific storms of hurricane force were encountered during the 31st along the trans-Atlantic steamship routes south of Nova Scotia. Reports at hand will not admit of more definitely describing this storm or of more accurately locating its path.

FOG IN AUGUST.

The limits of fog-belts west of the 40th meridian, as determined from reports of shipmasters, are shown on chart I by

Atlantic
Oc.
W.I.

dotted shading. In the vicinity of the Banks of Newfoundland fog was reported on 21 dates; between the 55th and 65th meridians on 11 dates; and west of the 65th meridian on 9 dates. Compared with the corresponding month of the last two years the dates of occurrence of fog near the Grand Banks numbered one less than the average; between the 55th and 65th meridians 2 more than the average; and west of the 65th meridian the same as the average. On the dates for which fog was reported near the Grand Banks general storms were approaching from the west, except on the 8th when variable winds and unsettled weather prevailed, and on the 26th with southerly winds and falling barometer. On the dates fog was reported between the 55th and 65th meridians it occurred with the approach or passage to the northward of general storms, save on the 2d when se. winds and unsettled weather prevailed. On the dates fog was reported west of the 65th meridian it occurred with the approach or passage to the northward of general storms, save on the 2d, 3d, and 13th when variable or southerly winds and unsettled weather prevailed in that region. On the 2d to 6th, 10th, 11th, 14th, and 26th dense fog was reported at points along the New England and New York coasts by observers of the Signal Service, its occurrence in each instance attending the presence in the Saint Lawrence Valley or the Lake region of general storms whose influence extended off the coast.

OCEAN ICE IN AUGUST.

The table below shows that for August, 1890, ice was reported nearly 3° south and about 5½° east of the average southern and eastern limits of ice for the month, as determined from reports of the last 8 years. The southernmost ice reported for the current month, 3 small icebergs on the 19th in the position

given, was less than 1° farther north than the southernmost ice reported for August, a large iceberg in N. 42° 21', W. 49° 51', in 1887, and the easternmost ice reported for the current month, a flat iceberg on the 6th in the position given, was nearly 1° east of the easternmost ice reported for August, noted in 1887 and 1889. Comparing the current with the preceding month there was a decrease in the aggregate quantity of ice reported over and near the Banks of Newfoundland and along the east coast of Newfoundland. Numerous icebergs were reported in the Straits of Belle Isle and thence eastward to the 49th meridian throughout the month. Compared with the corresponding month of the last 8 years the ice reported for August, 1890, about equalled the average in quantity. The limits of the region within which Arctic ice was reported for August, 1890, are shown on chart I by ruled shading.

The following table shows the southern and eastern limits of the region within which icebergs or field ice were reported for August, during the last nine years:

Southern limit.			Eastern limit.		
Month.	Lat. N.	Long. W.	Month.	Lat. N.	Long. W.
August, 1882	46 50	46 00	August, 1882	46 50	46 00
August, 1883	43 26	51 41	August, 1883	48 00	44 00
August, 1884	43 24	48 44	August, 1884	47 50	43 50
August, 1885	43 48	52 04	August, 1885	48 03	42 45
August, 1886	48 35	48 45	August, 1886	50 00	48 00
August, 1887	42 21	49 51	August, 1887	48 06	40 00
August, 1888	42 21	49 51	August, 1888	51 53	55 00
August, 1889	43 34	48 38	August, 1889	53 00	45 00
August, 1890	42 30	50 21	August, 1890	50 13	39 10
Average	45 06	50 14	Average	49 19	44 42

* Straits of Belle Isle.

† Isolated field ice in N. 58°, W. 40°.

TEMPERATURE OF THE AIR (expressed in degrees, Fahrenheit).

Many of the voluntary stations do not have standard thermometers or shelters.

The distribution of mean temperature over the United States and Canada for August, 1890, is exhibited on chart II by dotted isotherms. In the table of Signal Service data the monthly mean temperature and the departure from the normal are given for regular stations of the Signal Service. The figures opposite the names of the geographical districts in the columns for mean temperature and departure from the normal show, respectively, the averages for the several districts. The normal for any district may be found by adding the departure to the current mean when the departure is below the normal and subtracting when above. The monthly mean temperature for regular stations of the Signal Service represents the mean of the maximum and minimum temperatures.

The mean temperature was highest from south Nev. southward over extreme southeast Cal. and west Ariz., where it was above 85, and at stations in that region the mean value was above 90. The mean temperature was also above 85 at stations in the lower Rio Grande valley. North of a line traced from the Atlantic coast in latitude about N. 30° westward along the east Gulf coast, thence northwestward to south Kans., and thence southwestward to the middle Rio Grande valley, and in the Gila, lower Colorado, San Joaquin, and Sacramento valleys the mean temperature was above 80. The mean temperature was lowest at elevated stations in west-central Colo., and in the lower Saint Lawrence valley and north Ontario, where it was below 55, and north of a line traced from north New Brunswick westward to northern Wis., thence northwestward to Manitoba, and thence westward to the Pacific coast the mean temperature was below 60. The mean temperature was also below 60 along the Pacific coast north of San Francisco, Cal.

The mean temperature was below the normal, except in eastern Me. and the Canadian Maritime Provinces, at stations on the south New England and New York coasts, over the southeast slope of the Rocky Mountains and thence southward to the

lower Rio Grande valley, over the northern plateau region, and along the immediate Pacific coast between the 33d and 45th parallels. The greatest departures below the normal temperature were noted in the upper Mississippi valley and thence northward to the British Possessions, where they exceeded 3, and the greatest departures above the normal temperature were noted at Sydney, C. B. I., and San Francisco, Cal., where they exceeded 3 and 2, respectively.

At stations in the west part of the upper lake region and the northern part of the upper Mississippi valley, and at Lenoir, N. C., the mean temperature was the lowest, and at stations on the N. C. and middle Cal. coasts, and in the lower Rio Grande valley, the mean temperature was the highest reported for August.

DEVIATIONS FROM NORMAL TEMPERATURE.

The following table shows for certain stations, as reported by voluntary observers, (1) the normal temperature for August for a series of years; (2) the length of record during which the observations have been taken, and from which the normal has been computed; (3) the mean temperature for August, 1890; (4) the departure of the current month from the normal; (5) the extreme monthly mean for August, during the period of observation and the years of occurrence:

State and station.	County.	(1) Normal for the month of Aug.	(2) Length of record.	(3) Mean for Aug., 1890.	(4) Departure from normal.	(5) Extreme monthly mean for Aug.			
						Highest	Year.	Lowest	Year.
Arkansas. Lead Hill	Boone	77.8	8	78.3	+ 0.5	81.0	1886	75.5	1882
California. Sacramento	Sacramento	71.5	37	66.8	- 4.7	76.0	1866	66.2	1887