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INTRODUCTION.

This REVIEW for November, 1893, is based on reports from 2,997 stations occupied by regular and voluntary observers. These reports are classified as follows: 154 reports from Weather Bureau stations; 39 reports from United States Army post surgeons; 2,121 monthly reports from state weather service and voluntary observers; 29 reports from Canadian stations; 219 reports through the Southern Pacific Railway Company; 455 marine reports through the co-operation of the Hydrographic Office, Navy Department, and "New York Herald Weather Service;" 153 weekly reports from 39 U. S. Life-Saving stations; 29 reports from navigators on the Great Lakes; monthly reports from local services established in all states and territories; and international simultaneous observations. Trustworthy newspaper extracts and special reports have also been used.

The WEATHER REVIEW for this month has been prepared under the general editorial supervision of Prof. Cleveland Abbe.

CHARACTERISTICS OF THE WEATHER FOR NOVEMBER, 1893.

LOW AREAS.

The principal areas of low pressure have been those attending the storms that passed over the Lake region on the 22d and 23d, the coast of the states of Washington and Oregon on the 6th and 7th, the middle Atlantic coast on the 8th; but, in general, the area of the United States was dominated by high pressures and fair weather. On the other hand, the storms of the Atlantic and Pacific oceans have been more severe than usual; the storm that prevailed over Great Britain and the neighboring portion of Europe on the 16th and 18th seems to have been one of the most severe on record.

TEMPERATURE.

The average temperature was decidedly below the normal throughout the United States; the deficit being from 2° to 5° throughout the region from the Rocky Mountains eastward to the Appalachian range.

PRECIPITATION.

The precipitation was generally decidedly above the normal on the coast of Oregon, Washington, and northern California, but below the normal in New England.

The amount of snowfall seems to have been fully up to the normal and the quantity lying on the ground at the end of the month, especially in the northern portion of the Lake region, amounted in many places to 20, 40, and even 60 inches.

INLAND NAVIGATION.

The rivers have generally remained below the danger line. Owing to ice and snow, navigation on the Lakes had generally closed at the end of the month, and for the same reason navigation on the Missouri above Kansas City, the Mississippi above Keokuk, and the Ohio above Parkersburg had closed.

ATMOSPHERIC ELECTRICITY.

The auroral display of the evening of November 1 and early morning of the 2d was observed in nearly every state from our northern boundary southward to Virginia and Missouri.

ATMOSPHERIC PRESSURE (expressed in inches and hundredths).

The distribution of mean atmospheric pressure reduced to sea-level for November, 1893, as determined from observations taken daily at 8 a. m. and 8 p. m. (75th meridian time), is shown by isobars on Chart II, which also gives the so-called prevailing winds, or those most frequently observed at each station.

The normal distribution for November of atmospheric pressure and the direction of the normal wind resultant for each station is shown on Chart V. This chart has been prepared by Prof. H. A. Hazen, who has also prepared all the others of this series preliminary to the publication by the Weather Bureau of specially prepared data and charts showing the meteorological and climatic features and conditions of the United States. The pressures for both Canada and the United States are reduced to sea-level but not to standard gravity by Prof. Hazen's methods and formulæ. The wind resultants are as given by him at page 124 of his "Meteorological Tables," and are computed by Lambert's formula, giving equal weight to each observed wind without regard to its velocity.

As compared with the preceding month of October the mean pressure for November, 1893, was lower in New England and the Canadian Maritime Provinces, the maximum change being 0.08 at the mouth of the Saint Lawrence; pressure had also fallen in the extreme western part of the state of Washington, the maximum change being .04 at Fort Canby. In all sections of the country the mean for November was higher than for October, the maximum rise being 0.14 at Jupiter, Fla.; 0.11 at Omaha, Nebr., Des Moines, Iowa, and Columbia, Kans.; 0.14 at Winnemucca, Nev.; 0.15 at Battleford, Saskatchewan; and 0.16 at Medicine Hat, Assiniboia.

As compared with the normal for this month the pressures for November, 1893, have been slightly below the normal in

the valley of the Saint Lawrence, the Northwest, and the Lake region, the maximum depression being 0.09 at Port Arthur, Ont. Pressures have been slightly above the normal in California and New England.

HIGH AREAS.

I.—This area was central on the morning of the 1st in eastern Virginia, and is the continuation of high No. XIII of the month of October. On the 2d the ridge of highest pressure was in about the same locality, after which it merged into the tropical high of the Atlantic Ocean.

II.—On the 1st, in the morning, pressure was high off the coast of Oregon; the center moved rather rapidly southeastward over the Rocky Mountain plateau as a long ridge which steadily increased in length, so that on the morning of the 3d we have two high centers in Idaho and Illinois, respectively, and on the morning of the 4th three high centers are located in Utah, Texas, and Vermont, while, of course, in the whole intervening region pressure was above the normal. The morning of the 5th shows approximately the same distribution of pressure, but on the morning of the 6th the barometer had risen sufficiently to unite the areas of high pressure into one irregular shape, whose center was in West Virginia. During the next twenty-four hours pressure rose to the northward, and on the morning of the 7th the high center was in New Hampshire, after which it moved slowly southeast and disappeared on the 8th east of New England. The continuance of this high in the east Atlantic states during the 4th to the 7th may have given rise to low No. V, which seems to have been east of Florida on the 6th.

III.—On the 7th, in the morning, the pressure which had been rising on the 6th on the California coast had also risen over the Rocky Mountain plateau, and the central high was in Nevada. This central high disappears on the 9th in New Mexico.

IV.—On the 9th the pressure rose rapidly on the north Pacific slope in the rear of low No. VI, and was highest on the morning of the 10th at Portland, Oregon. Pressure continued to rise, and on the morning of the 11th the highest centers were in Washington and Wyoming, while high barometer prevailed over the Rocky Mountain plateau. An extensive cold wave prevailed on the eastern front of this high area, with rain or snow from Manitoba to Texas. On the morning of the 12th the highest pressure was in Nevada and Utah, and the front of the cold wave extended from southern Texas to Arkansas, Missouri, Illinois, Wisconsin, and Lake Superior. On the morning of the 13th pressure had risen on the northwestern side but had fallen on the southeastern side of the high area and the center was in Alberta, affording a remarkable illustration of the fact that when a layer of air is descending obliquely to the earth's surface, forming an area of high pressure, the central high will vary, from time to time, both as to location and pressure, depending on the characteristics of that layer. The movement of the central high is not a measure of the movement of the mass of air, as a whole, so long as the descent continues. On the morning of the 14th a high pressure covered the Rocky Mountain plateau and nearly all of the eastern and western slopes; highest pressures were central in Washington and in northwestern Texas during the day; high northeast and northwest winds prevailed on the Texas and Louisiana coasts, with light rain, and the conditions seemed favorable to the formation of whirlwinds on the Gulf, but the flow of cold, dry air seems to have annulled these, if any existed. On the morning of the 15th highest pressures were in southern Texas and Utah; it is difficult to understand the formation of the ridge that prevailed this morning from Oregon to Texas, unless we assume that the pressure of low area VII had fallen decidedly near the Mexican coast and Lower California. Frosts were reported this morning from nearly all over Texas, Georgia, Alabama, Arkansas, Mississippi, and Louisiana. After this rise on the western Gulf pressure fell steadily; the highest was in Alabama and Georgia on the morning of the 16th, and in North Carolina on the morning of the 17th. Frosts prevailed in South Carolina, Georgia, Alabama, and northern Florida on the morning of the 16th, and were reported in North and South Carolina and Georgia on the morning of the 17th. In general the frosts that occurred in this area of high pressure occurred after the central highest pressure had reached Texas in its southward movement, and while it was moving eastward, on the 16th and 17th.

V.—After a slight fall, pressure began to rise again on the 16th on the coast of Oregon, and by the morning of the 17th the region of high pressure included two centers in British Columbia and eastern Manitoba, respectively. On the morning of the 18th the region of high pressure extended from British Columbia to Kansas, being highest in Wyoming and British Columbia. On the 19th, a. m., pressure was highest in Wyoming, having fallen somewhat on the Pacific coast. Frost was reported on the morning of the 17th in northern California, with cold, dry, destructive, northerly winds, as also on the 18th and 19th in the same region. The high pressure now moved more nearly southward, and on the morning of the 20th was central in Arizona, with light frost at San Diego, Cal. During the 19th the southeastern end of the original ridge developed into a separate high center which was on the 20th, a. m., in North Carolina, after which it disappeared off the middle Atlantic coast on the 21st. The direct southern movement of the western portions of this high area and the presence of the central high in Arizona on the morning of the 20th is to be correlated with the presence of a depression west of the Mexican coast, a remnant of which appears in Texas on the morning of the 22d.

VI.—While low No. X was central in the Lake region on the 22d, pressure rose decidedly over the Canadian Maritime Provinces, and a branch of the high pressure over the Atlantic pushed westward over Newfoundland, being apparently central in the Gulf of Saint Lawrence on the morning of the 22d, after which it disappeared.

VII.—On the 21st, a. m., pressure began to rise in British Columbia, Alberta, and Washington. On the 22d, a. m., the highest pressure may be located in Alberta, and on the 23d, a. m., a large area of high pressure extended from Athabasca to Kansas, separating the two well-marked lows (XII) on the Oregon coast and (X) on Lake Huron. On the 24th, a. m., the high pressure extended from the center of the Gulf of Mexico to the north of Manitoba, with three centers in Manitoba, Iowa, and Missouri. On the 25th, a. m., the highest pressure was in West Virginia, and heavy frost was reported at Cape Hatteras, N. C. 26th, a. m., the central highest pressure had risen appreciably and was in central Virginia, with a subsidiary center north of Lake Ontario. On the 27th, a. m., the highest pressure was central in Rhode Island, and on the 28th, a. m., near Cape Breton.

VIII.—On the 28th, a. m., pressure was rising in Assiniboia, while the depression No. XII *b* was central in Wyoming. On the 29th, a. m., the low area extended as a trough from Washington to Wyoming, while the high area extended as a ridge from Alberta to North Dakota and a system of steep gradients of pressure and temperature lay between these; this condition continued during the 29th, and an analogous system of steep gradients is seen on the map of the 30th, a. m., while the central highest pressure in Assiniboia had considerably increased. The subsequent history of this high pressure belongs to December.

LOW AREAS.

I.—This is a continuation of No. XIX of October, which on the 31st was moving southeastward over Manitoba. On

the morning of the 1st a general depression extended from Lake Superior to Kansas and Wyoming. A trough of low pressure, with opposing winds, extended from central Kansas to the eastern part of South Dakota, but the lowest pressure was apparently north of Lake Superior. The latter apparently filled up while the former moved northeastward over the Lake region, and on the 3d disappeared at the mouth of the Saint Lawrence.

II. On the 1st, in the afternoon, a depression was approaching Athabasca on the north side of high No. II, and on the 3d, in the afternoon, its center was located in the northern portion of Alberta and the pressure was rising in British Columbia. Its path was nearly eastward at the northern border of the Canadian stations, and at 6 a. m. it was apparently north of the Gulf of Saint Lawrence.

III.—On the 4th, in the afternoon, a depression was approaching the coast of British Columbia, and on the 5th, in the afternoon, it was apparently central on the border between that province and Alberta. On the morning of the 6th an extensive area of low pressure covered Alberta and Saskatchewan and on the afternoon of the 6th two low centers existed, one in British Columbia the other in North Dakota; the latter may be considered as an offshoot from the principal area from the north, and which was developing a remarkable tendency to stretch rapidly southward. The map of the 7th, a. m., shows the persistence of this tendency by the formation of the trough with subsidiary centres in western Kansas and southern Minnesota, while the principal low was central in Athabasca. On the 7th, p. m., the former depression had almost entirely filled up, there being only a slight deficit of pressure from Lake Superior to southern Texas.

IV.—As above stated, this is located in British Columbia on the 6th, and in Saskatchewan on the 7th, p. m. During the 8th this depression filled up and disappeared, but the barometer again fell decidedly on the coast of British Columbia, as described in low No. VI.

V.—In connection with high No. II, which was central on the 4th, a. m., in New England, an area of low pressure existed in the Gulf of Mexico during the 4th; probably this was a portion of a much larger depression extending over the Caribbean Sea and the West Indies. On the 5th and 6th a central low was apparently moving westward towards Florida, whose location can be approximately given on the afternoon of the 7th at N. 32°, W. 75°. By the morning of the 8th a well-defined disturbance was central near Cape Hatteras, and on the evening of the 9th the center was southeast of Cape Cod, after which it moved northeastward too far from the coast stations to be recognized.

VI.—A depression approached the coast of British Columbia on the 8th, the barometer was lowest at Spences Bridge, B. C., on the morning of the 9th, and on the evening of that day the pressure was low throughout Alberta, probably representing the southern end of a trough extending farther northward. This depression moved southeast, and was central on the morning of the 10th in South Dakota. During the 10th and 11th this trough stretched southward to Texas and filled up at its northern end, and although indefinite partial depressions continued until the 12th, yet no well-defined central low resulted—in fact, we may plausibly consider that the southern end of this depression was really the northern end of the area No. VII peculiar to the Mexican coast, as described in previous MONTHLY REVIEWS, and which during the current November has sometimes stretched northeastward, though not so frequently and decidedly as during September and October.

VII.—This number is given to the low pressure that extends from Arizona and northern Mexico to the south or southwest, and that has sometimes during November stretched as a trough north or northeastward into the United States. Such extensions occurred as follows: On the 3d, p. m., a short arm reached into southern Texas; on the 9th, p. m., and 10th, a. m., this low extended northeastward so as to join low No. VI, and in fact constituted a trough or slight depression between the two high areas Nos. III and II that were over the Rocky Mountain plateau and the Atlantic coast, respectively; it maintained this position during the 11th, on which date, however, it became divided into separate low areas, respectively, on the Texas coast and north of Lake Huron. On the 16th and 17th pressure fell steadily from southern California to Texas, while the great high area, No. V, moved southeastward over the Rocky Mountain plateau, and, so far as observations are available, the daily maps render it plausible that a well-defined area of low pressure rather than a trough had advanced northeastward over Lower California toward Arizona. The map of the 17th, 8 p. m., would indicate that the area No. VII was at that time also an area of revolving winds central at the head of the Gulf of California, but if so this cyclonic system was broken up on the 18th and pressure rapidly recovered. On the 24th low No. XII, which was then central in Washington, extended southward to a temporary junction with No. VII, but this was broken up on the 25th. On the whole, therefore, this low area off the Pacific coast of Mexico has been far less prominent than during the preceding months, and the areas of high pressure that have moved eastward over the Pacific coast have frequently obliterated it entirely.

It is proper to consider the depression that we have called area No. VII as an extension, or branch northward, of the so-called equatorial depression which, as is well known, is not uniform in its position or character, owing to the irregularities of the earth's surface. Similarly, many of the depressions that appear on the northern borders of the United States as indentations in our isobars must be considered as extensions, or branches southward, of the general area of low pressure that occupies the Arctic regions. When such depressions make a temporary connection through northern Mexico and the central portions of the United States it is simply equivalent to the temporary disturbance of the atmospheric effort to establish a uniform and so-called tropical belt of high pressure from east to west along the parallels between N. 30° and N. 40°. This tropical belt of high pressure is almost permanently broken into eastern and western portions over the Atlantic and Pacific oceans, respectively, during the months of July and August. It is less frequently interrupted in May and June or September and October, and is sensibly continuous from ocean to ocean during November, December, January, February, March, and April.

VIII.—On the 11th, in the morning, a low area appears in Athabasca, while high No. IV prevailed over the Rocky Mountain plateau region. This depression extended rapidly southward, but its central lowest pressure was not within the limits of our stations until the 16th, and the track given on Chart I, therefore, generally represents only the position of the axis of a southern extension or branch from the larger depression to the northward. We are, therefore, not to consider the locations there given from the 12th to the 16th as the centers of cyclonic whirls, but as the axes of troughs of low pressure having northwesterly winds on the west and southeasterly winds on the eastern side; this trough extended farthest south on the 12th, when its southern end was almost isolated as a whirl over Lakes Michigan and Huron, but the complete development of such a cyclonic area was not consummated. The tendency to the formation of a special whirl over the lower lake region was renewed on the 15th, when, by reason of the fall of temperature with cold northwest winds, there was formed an area of snow over Lakes Huron, Erie, and Ontario, but by the morning of the 16th this had disappeared

and the principal low center was in the southern part of the Gulf of Saint Lawrence.

Illustrations of similar movements will frequently be found in the charts of the "Bulletin of International Meteorology," the study of which shows that well-defined cyclonic areas, after passing over a large portion of the north Pacific, merge into the general depression of the Arctic region and pass over Alaska and British America as troughs or V-shaped depressions having steep gradients on the southern side but low gradients on the northern side. These are perfectly analogous to the similar depressions that move eastward over the north Atlantic into Europe. Sometimes the southern apex of the V-shaped depression extends to N. 50°, or even N. 40°, in North America, while in Europe it generally reaches only to N. 70° or N. 60°, and sometimes to N. 50°. The Arctic isobar of 29.6 frequently has, on any given date, several southward extensions, as, for instance, November 7, 1883, when one reached into Manitoba, N. 50°, while another reached southward into central Germany, N. 50°, and still a third touched northern Corea at N. 60°. Within this area of 3,000 square degrees pressure was everywhere lower than 29.6; outside of this area the steepest gradients were in Siberia and the northwest Pacific and northeastern Europe, but the gentlest gradients were over the north Atlantic and North America. The upper air, which on all sides flows from the tropical highs into this Polar depression, being deflected into a spiral path around the North Pole, flows in a direction and with a speed that is feebly indicated by the surface winds, and carries with it numerous minor and incomplete whirls, and even belts of opposing winds, which also revolve intact around the Polar basin until they are broken up and are replaced by others. The international maps of November, 1883, afford numerous illustrations of this process, and the large region within the isobar 29.6 is there seen to be carried sometimes far southward into the north Atlantic, and occasionally also southward into the north Pacific, or at least into Bering Sea. The progress of one of these minor whirls, or extensions from the Polar depression, is undoubtedly far slower than that of the air which circulates within them. They describe their path at a rate of about 30 miles per hour, or 10° of a great circle per day, and would, therefore, if they maintained their integrity, pass entirely around the zone of N. 55° to N. 65° in about eighteen days. This rate of rotation about the meteorological pole is an important fundamental datum in the mechanics of the atmosphere.

IX.—From the 10th to the 15th high pressure area No. IV prevailed over the United States while an extensive low prevailed throughout the British Possessions to the northward. On the 14th, p. m., the barometer was falling at Athabasca, and apparently an area of low pressure having passed from the Pacific Ocean eastward over Alaska and the Rocky Mountains was now descending southeastward on the eastern side of that range. It was central in Minnesota on the afternoon of the 16th, after which its path turned from east-southeast to east-northeast, and on the morning of the 18th its center was apparently in Labrador north of our stations but with a tendency to move southward.

X.—A general depression followed close in the rear of No. IX, apparently located in Athabasca on the 19th, in the morning, and was central in Alberta on the 20th, a. m.; after passing southeast into Kansas and Iowa it turned to the east-northeast on the 21st. On the 22d the central low stretched eastward into a long oval, and the winds indicate a subsidiary whirl central over Maine on the afternoon of that date; the path of the latter northeastward into the Gulf of Saint Lawrence is shown by the winds but not by any special barometric depression.

XI.—Apparently the northwest winds in the rear of low No. X developed into a whirl off the New England coast after the 23d, 8 p. m.; a special barometric depression was central on the 24th, a. m., near Halifax; this developed into a severe storm on the Atlantic which passed eastward just south of Newfoundland, on the 25th, a. m.

XII.—On the 21st and 22d the pressure rose steadily in Athabasca, Alberta, Saskatchewan, and southward over the the Rocky Mountain plateau, forming a large area of high pressure with a rather low temperature and a slight preponderance of northerly winds, but by no means such as to suggest a special flow of cold air from the north. On the 22d pressure began to fall from northern California to British Columbia, and in such a way as to show that a well-developed revolving storm was moving northeastward towards Oregon and Washington. As the Rocky Mountain plateau prevented the flow of air at or near sea level from British America into this depression on the coast, and the consequent formation of a symmetrical whirl, therefore while the pressure was diminishing on the Pacific coast, with steady southwest wind and rain, the air over the interior of North America moved south and east along the eastern slope of the Rocky Mountains, forming high No. VII.

Thus the original low area No. XII was to a great extent broken up, and finally on the 25th, in the morning, was represented by an irregular depression having two centers, No. XII*b* in Washington and No. XII*a* in Montana, respectively, while the barometer continued high to the north of this depression. No. XII*a* was central on the morning of the 25th in Montana but had expanded into an oval depression, with a third center, No. XII*c*, to the southward in Colorado, and on the 26th, in the morning, the map showed a long trough with centers (No. XII*a*) in Manitoba and (No. XII*c*) in Texas, respectively. The former (No. XII*a*) moved northward and disappeared probably by filling up; the latter (No. XII*c*) became an important storm-center, as in fact is usually the case with the southern end of such a trough, or the southernmost of two depressions; it moved rapidly north-northeastward, was central in Michigan on the 27th, p. m., and disappeared in Labrador on the 29th.

The western part of the original depression, which we have called No. XII*b*, withdrew westward to the coast of British Columbia during the 25th, but on the afternoon of the 26th its center was again in Washington, forming the western branch of an irregular depression that included Nos. XII*a* and XII*c*. The depression now stretched southeastward as an ill-defined oval, whose center on the morning of the 28th was in Wyoming, when it constituted the western nucleus of the depression that stretched from the Pacific coast to New England and included No. XII*c* in its eastern portion. The southeastward movement continued until the 8 p. m. observation of the 28th, when it was central in eastern Kansas; it then moved northeastward over the Lake region and disappeared on the 30th at the mouth of the Saint Lawrence.

On the 28th while No. XII*b* was moving southeastward a trough still connected it with the depression on the coast of Oregon, and the barometer still continued high in Alberta and Assiniboia. Out of this condition a new central depression (No. XII*d*) developed, which was apparently in Wyoming on the 29th, 8 a. m. This moved southeastward and disappeared in northern Texas on the 30th in the afternoon.

The depression that was almost permanently present during the summer months south of Arizona, and which we have called No. VII, has not been conspicuous during November, its principal appearance being on November 17th, as above narrated, and on November 24th, when it temporarily united with the depression on the coast of Oregon. On the other hand, the depressions that have appeared at the northwestern corner of our map must be considered as the southeastward extensions of the depression that prevails on the

north Pacific in the winter-time, and that has during the latter half of the current month been a prominent feature. The general circulation of the atmosphere has now gone through the autumnal change and has taken on most of the features that characterize its condition in the winter months.

Movements of centers of areas of high and low pressures.

Number.	First observed.			Last observed.			Path.		Average velocities.	
	Date.	Lat. N.	Long. W.	Date.	Lat. N.	Long. W.	Length.	Duration.	Daily.	Hourly.
High areas.		°	°		°	°	*Miles.*	*Days.*	*Miles.*	*Miles.*
I	1, a. m.	38	77	2, a. m.	36	78	.....	.....	.....	.....
II	1, a. m.	48	124	8, a. m.	42	69	4,000	7.0	571	24
III	6, a. m.	37	123	9, a. m.	34	104	1,300	3.0	433	18
IV	10, a. m.	47	126	17, a. m.	36	27	5,100	7.0	727	30
V	16, a. m.	42	125	21, a. m.	38	73	3,900	5.0	780	32
VI	22, a. m.	47	63	.....	.....	.....	.....	.....	.....	.....
VII	22, a. m.	54	114	28, a. m.	46	60	3,500	6.0	583	24
VIII	28, a. m.	53	115	30, p. m.	49	104	600	2.5	240	10
Sums	.....	.....	.....	.....	.....	.....	18,400	30.5	3,334	.....
Mean of 6 paths	.....	.....	.....	.....	.....	.....	.....	.....	556	23.2
Mean of 30.5 days	.....	.....	.....	.....	.....	.....	.....	.....	603	25.1

Movements of centers of areas of high and low pressures—Continued.

Number.	First observed.			Last observed.			Path.		Average velocities.	
	Date.	Lat. N.	Long. W.	Date.	Lat. N.	Long. W.	Length.	Duration.	Daily.	Hourly.
Low areas.		°	°		°	°	*Miles.*	*Days.*	*Miles.*	*Miles.*
I	31, p. m.	52	92	3, a. m.	29	70	2,500	2.5	1,000	42
II	3, p. m.	54	112	6, a. m.	51	64	2,100	2.5	840	35
III	4, p. m.	49	130	7, a. m.	41	99	1,900	2.5	760	32
IV	6, p. m.	53	124	7, p. m.	54	108	750	1.0	750	31
V	6, p. m.	23	73	12, a. m.	40	40	2,550	5.5	465	19
VI	8, p. m.	52	129	10, a. m.	39	101	1,500	1.5	1,000	42
VII	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
VIII	11, a. m.	57	114	17, a. m.	49	52	3,000	6.0	500	21
IX	14, p. m.	55	110	18, p. m.	29	60	2,600	4.0	650	27
X	20, a. m.	51	112	23, p. m.	50	73	2,500	3.5	715	30
X *a*	22, p. m.	46	69	23, a. m.	48	63	800	0.5	.....	.....
XI	23, p. m.	41	67	25, a. m.	46	53	1,000	1.5	667	28
XII	22, a. m.	41	128	24, p. m.	42	122	700	2.5	280	12
XII *a*	24, p. m.	49	122	26, p. m.	50	94	1,600	2.0	800	33
XII *b*	26, p. m.	49	124	30, a. m.	49	66	3,400	3.5	971	45
XII *c*	25, a. m.	46	107	29, a. m.	52	63	3,700	4.0	925	39
XII *d*	29, a. m.	43	108	30, p. m.	33	.97	900	1.5	600	25
Sums	.....	.....	.....	.....	.....	.....	31,500	44.5	10,923	.....
Mean of 15 paths	.....	.....	.....	.....	.....	.....	.....	.....	728	30.3
Mean of 44.5 days	.....	.....	.....	.....	.....	.....	.....	.....	711	29.6

NORTH ATLANTIC STORMS FOR NOVEMBER, 1893.

[*Pressure in inches and millimeters; wind-force by Beaufort scale.*]

The paths of storms that passed over the western portion of the north Atlantic Ocean are shown on Chart I, so far as can be traced from information received up to the 25th of December, through the co-operation of the Hydrographic Office, U. S. Navy, and the "New York Herald Weather Service."

The normal pressure for November, as shown by the international simultaneous observations, is about 30.00 (762) throughout the north Atlantic Ocean between the 10th and 15th parallels of north latitude; north of this a zone of 30.10 (764), or more, extends from Algeria westward over the United States into the Pacific; north of this latter zone pressure diminishes steadily, and the areas of lowest pressure are a narrow oval including Iceland and North Cape and a second oval extending from Alaska westward to Corea; in both these areas pressure is 29.60 (752), or less.

As compared with the annual normal pressure for the Northern Hemisphere the monthly normals for November show a deficiency of .05 in the central portion of the north Atlantic Ocean, as also over Great Britain and Scandinavia, but an excess of .05, or more, over the United States and of .10 over Alaska.

The tracks of storms for November may be classified as principally those that move southeastward from Alaska to the Lake region, thence eastward to Newfoundland, and thence northeast to northern Europe.

The region of greatest frequency of storm-centers extends from Lake Superior eastward over the Gulf of Saint Lawrence, where an average of 5 tracks per month cross over each space of 5° in latitude and longitude during November. Comparatively few storm-centers pass from the West Indies north or northwest to the American coast.

The average velocity of movement of storm-centers for November in statute miles per hour is 31 when moving eastward along the northern border of the United States and 21 for the Atlantic Ocean between Nova Scotia and Great Britain. The simultaneous charts of the Northern Hemisphere for 1878 to 1887 show that during these ten years only one storm in the month of November was traced across both the North American continent and the north Atlantic Ocean, and again only one storm was traced across both the north Atlantic and Europe.

During November, 1893, the following storms have been traced over portions of the north Atlantic Ocean; the centers are located for Greenwich noon by international simultaneous observations as follows:

A. This appeared off the Straits of Belle Isle November 1, and after moving southeast to N. 50°, where it was nearly stationary on the 3d and 4th, was broken up on the 5th in W. 35°.

B. This developed southeast of Nova Scotia on the 4th in connection with the low pressure that was then in Labrador; it moved northeastward to about N. 50°, W. 40° on the 6th, and then turned more decidedly northward and disappeared on the 7th at N. 55°, W. 39°, possibly for the want of marine records in this region, while an area of high pressure was central east of this region, extending to Great Britain and Norway.

C. This storm appears from the latest records to have been central on the 7th at N. 42°, W. 50°, and on the 8th at about N. 45°, W. 40°. By this time this was a large and well-marked whirl of wind; the centers of the surrounding high pressures were respectively over New England and the region between Ireland and Iceland. The center moved nearly due north and on the 9th was at N. 51°, W. 41°, after which the depression had moved northward beyond our stations and, apparently, partly filled up by the 10th.

D. This is depression No. V in the list of American low areas and may be located on the 6th north of Cuba; after this date it steadily developed both as a whirl and as a low pressure with increasing winds; its path lay northeastward a short distance from the United States coast, while areas of high pressure were central northwest of it over the continent, Lake region, middle, and the east Atlantic states, and southeast of it on the Atlantic Ocean. On the 10th it was in N. 39°, W. 55°, and on the 11th in N. 41°, W. 46°; at this date an area of high pressure was central in northern Ireland and Scotland and another in New England, while the pressure between N. 20° and N. 40° throughout the middle portion