

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.
<b>High areas.</b>							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	77	5,100	7.0	727	30
V.....	16, a. m.	42	125	21, a. m.	38	73	3,900	5.0	780	34
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
<b>Sums.....</b>							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.
<b>Low areas.</b>							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.	73	12	12, a. m.	40	40	2,550	5.5	455	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
XI.....	23, p. m.	46	69	23, a. m.	48	53	800	0.5		
XII.....	23, p. m.	41	67	25, a. m.	46	53	1,000	1.5	667	28
XIII.....	22, a. m.	41	128	24, p. m.	42	122	700	2.5	280	12
XIIIa.....	24, p. m.	49	122	26, p. m.	50	94	1,600	2.0	800	33
XIIIb.....	26, p. m.	49	124	30, a. m.	49	66	3,400	3.5	971	45
XIIIc.....	25, a. m.	46	107	29, a. m.	52	63	3,700	4.0	925	39
XIIId.....	29, a. m.	43	108	30, p. m.	33	97	900	1.5	600	25
<b>Sums.....</b>							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

of the north Atlantic was decidedly below the average; easterly gales prevailed from the English Channel and Irish Sea eastward to W. 30° and southeasterly gales between W. 30° and 40°; northerly gales prevailed from Newfoundland southward to N. 30°, the whole constituting a very extensive whirl around the storm-center as above located for this date; there are also evidences of the beginning of an independent whirl south of the principal one.

On the 12th the lowest pressure apparently extended as a long oval northwest and southeastward, with its center at N. 40° and W. 40°. At noon of the 13th the map shows a large area of pressure 29.5 or less, the center being as before, N. 40°, W. 40°, but the barometer had now fallen decidedly over England, the highest pressure had been rapidly transferred to southern Germany, and pressure had also fallen over the Atlantic States and Canadian Provinces. At noon of the 14th the center of lowest pressure and revolving winds was at N. 43°, W. 36°, and at noon of the 15th the low pressure extended as a trough northeast and southwest between N. 40° and N. 50°, the center being at N. 45° and W. 30°, but subsidiary and minor depressions were at this time also central in northern Scotland, France, and northern Russia. On the 16th pressure had recovered over northern and central Europe, but low pressures with attending whirlwinds were central west of Ireland at N. 52°, W. 18°, and on the western portion of the Atlantic in connection with the low center over the Gulf of Saint Lawrence.

From this date, during the 17th, 18th, and 19th, a continuous gale, sometimes of hurricane force, prevailed on the European coast; in the English Channel southeast winds prevailed on the 16th, west winds on the 17th, and northwest on the 18th and 19th, which, by the 20th, had veered to northeast with clearing weather and high pressure; the lowest pressure was central on the 17th at N. 56°, W. 4°; on the 18th at N. 54°, E. 3°, and also at N. 44°, E. 8°; on the 19th at N. 53°, E. 9°, and also at N. 45°, E. 11°; on the 20th at N. 49°, E. 11°, and also N. 43°, E. 12°. On the 21st these latter low pressures had filled up and others had developed in northern and central Russia, respectively.

While this extensive storm area was thus, on the 16th to the 20th, moving slowly eastward through western Europe and while an extensive depression was moving down the Saint Lawrence Valley the pressure rose steadily over the Atlantic Ocean between N. 10° and N. 60°, W. 10° and W. 50°; although a belt of high pressure was thus made to prevail from the south Atlantic states to Algeria yet it may be an open question whether the barometric rise north of this zone should be considered as due to a bodily movement of the zone northward; although southerly winds prevailed for a time in the eastern portion of the Atlantic yet by noon of the 20th the pressure was higher between N. 45° and 60° than it was to the southward, and on the 21st the central highest pressure (30.6 to 30.7) extended from Ireland westward to W. 35°, so

that the growth, the location, and the movements of this area of high pressure which, in fact, continued nearly stationary until the 24th, must be attributed to a general descending current over this portion of the Atlantic precisely similar to the descending high pressure areas of the North American continent.

E. From the 16th to the 23d several low areas passed over Labrador to the Atlantic Ocean north of our marine reports and evidently pursued a northeasterly course toward Greenland and Iceland, keeping on the northern side of the general area of high pressure just described; on the 24th the low area No. XI of the American series was off the New England coast, and on the 25th it was central in the Gulf of Saint Lawrence; this also moved northeastward over Labrador beyond our stations and kept to the north of the above-mentioned high area. On the 28th the American area of low pressure No. XIIc passed down the Saint Lawrence Valley and on the 29th passed northeastward over Labrador and remained beyond the limit of our reports. While these several low areas were thus pursuing extreme northerly paths and while high pressure prevailed from Great Britain southwest and west the pressure remained permanently low in the northern part of Norway and this low area undoubtedly extended westward to southern Greenland.

#### OCEAN ICE IN NOVEMBER.

The limits of the regions within which field ice or icebergs were reported for November, 1893, are shown on Chart I by crosses.

The southernmost ice, reported on the 13th, was in N. 50° 40', W. 54° 13', and the easternmost ice, reported on the 2d, in N. 52° 51', W. 52° 20'. The ice of the current month was noted on two dates in the Straits of Belle Isle, and six high bergs were reported eastward from the Straits.

No Arctic ice was reported for November, 1892. In November, 1891, an iceberg was observed in N. 51° 58', W. 55° 35', on the 8th. In November, 1890, a small piece of ice was noted in N. 46° 35', W. 47° 51'. In November, 1882, 1883, 1887, and 1888, no ice was reported near Newfoundland and the Grand Banks. In November, 1884 and 1889, several icebergs were seen over the eastern part of the Banks of Newfoundland. On one date in November, 1885, and one date in November, 1886, ice was observed south of the 50th parallel.

#### OCEAN FOG IN NOVEMBER.

The limits of fog belts west of the 40th meridian, as determined by reports of shipmasters, are shown on Chart I by dotted shading. Near the Grand Banks of Newfoundland fog was reported on 8 dates; between the 55th and 65th meridians on 3 dates; and west of the 65th meridian no fog was reported. Compared with the corresponding month of the last 6 years the dates of occurrence of fog near the Grand Banks numbered 2 less than the average; between the 55th and 65th meridians the same as the average.

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

The distribution of the monthly mean temperature of the air over the United States and Canada is shown by the dotted isotherms on Chart II; the lines are, however, not drawn for the higher irregular surface of the Rocky Mountain plateau; the temperatures have not been reduced to sea level, and the isotherms, therefore, relate to the average surface of the country over which they are drawn; in mountainous regions such isotherms would be controlled largely by the topography, and it is, therefore, not practicable to present the temperature data in this manner unless a contour map on a large scale is published as a base chart.

In the table of meteorological data from voluntary observers the actual mean temperature is given for each station, and in the tables of climatological data for the regular stations of the Weather Bureau both the mean temperatures and the departures from the normal are given. In the latter table the stations are grouped by geographical districts, for each of which is given the average temperature and departure from the normal. The normal for any district or station may be found by adding the departures to the current average when the latter is below the normal and by subtracting when it is above.