

920
3927

MONTHLY WEATHER REVIEW.

WASHINGTON, D. C., JANUARY, 1883.

INTRODUCTION.

This REVIEW presents a general summary of the meteorological conditions which have prevailed over the United States and adjoining territories during the month of January, 1883, and a brief description of the storms occurring in the north Atlantic ocean.

The following may be mentioned as the special features of the month:—

1st.—The very low mean temperature, which is generally below the normal for all parts of the country, the departures being most marked for the upper lake region, the extreme northwest and the upper Mississippi and Missouri valleys for which the monthly means are from 7° 9 to 11° 5 below the January normal. The month has been generally cold throughout, but the weather was especially severe from the 18th to 25th over the districts for which the departures from the normal are the greatest, causing much suffering to the inhabitants, and considerable loss by freezing stock.

2d.—The excessive rainfall over the south Atlantic and east Gulf states, and the marked deficiency in the rainfall in California.

3d.—The heavy snow-storms in the western sections of the country obstructing railroads and interrupting communication of all kinds.

4th.—The very brilliant meteor which was observed on the evening of the 3d, at many stations in Ohio, Indiana, Illinois, Iowa, Michigan, and Wisconsin.

In the preparation of this REVIEW, the following data received up to February 20th, have been used; viz.: the regular tri-daily weather charts, containing data of simultaneous observations taken at one hundred and thirty-six Signal Service stations and fourteen Canadian stations, as telegraphed to this office; one hundred and seventy-eight monthly journals, and one hundred and seventy-one monthly means from the former, and fourteen monthly means from the latter; two hundred and twenty-four monthly registers from voluntary observers; fifty-six monthly registers from United States Army Post Surgeons; Marine Records; International Simultaneous Observations; Marine Reports, through the co-operation of the "New York Herald Weather Service;" abstracts of Ships' Logs, furnished by the publishers of "The New York Maritime Register;" monthly weather reports from the local weather services of Indiana, Kansas, Nebraska, and Missouri, and of the Central Pacific railway company; trustworthy newspaper extracts; and special reports.

NOTE.

The subject of INTERNATIONAL METEOROLOGY, with accompanying charts, heretofore included in the MONTHLY WEATHER REVIEW, will, hereafter, be found with the SUMMARY OF INTERNATIONAL METEOROLOGICAL OBSERVATIONS, and the title of that publication will be: MONTHLY SUMMARY AND REVIEW OF INTERNATIONAL METEOROLOGICAL OBSERVATIONS.

Beginning with this number the charts accompanying the REVIEW will be as follows: chart i., tracks of low-barometer areas; chart ii., ocean storm-tracks; chart iii., isobars, isotherms, and winds; chart iv., precipitation. The tables heretofore printed on the charts, will, hereafter, be published in the body of the REVIEW, under their respective headings.

BAROMETRIC PRESSURE.

[Expressed in inches and hundredths.]

The mean barometric pressure for the month of January, 1883, over the United States and Canada, is shown by the isobarometric lines (in black) on chart iii.

The chart shows a region of high barometer covering parts of northern California and Nevada, and southern Oregon and Idaho, to be inclosed by the isobar of 30.3. The isobar of 30.25 includes a region extending from the Pacific coast between the parallels of 35° N. and 47° N., eastward to Wyoming and Utah. A narrow ridge of high barometer also covers a part of the extreme northwest and the Missouri valley; in the former district, a maximum mean pressure of 30.31 is reported from Fort Buford, Dakota, while to the southward the pressure decreases to 30.18 at Fort Bennett, Dakota, and then increases over the lower Missouri valley to 30.24 at Yankton, Dakota, and Leavenworth, Kansas, and 30.25 at Huron, Dakota, and Omaha, Nebraska. Between these regions of high barometer, a small area, including parts of Wyoming, Colorado, Nebraska, and Kansas, is inclosed by an isobar of 30.15. The isobar of 30.2 incloses nearly the whole of the country lying west of the ninety-fifth meridian, and also includes a narrow strip of country extending from the lower Missouri valley southeastward to the south Atlantic coast. A second isobar of 30.2 embraces a small area near the middle Atlantic coast. The regions of least mean pressure are the Canadian Maritime Provinces and the upper lake region. In the latter district, the lowest monthly means reported are: Marquette, 30.05, and Mackinac City, 30.06. In the Canadian Maritime Provinces, the lowest means are: Sydney, Nova Scotia, 30.03; Chatham, New Brunswick, 30.06; Father Point, Province of Quebec, 30.06.

Compared with the means of the previous month (December, 1882,) the mean pressure is from 0.06 to 0.13 higher on the Pacific coast. In the northern and middle slopes, reports from a few of the most northerly stations show a slight increase, but the pressure is generally lower, and at Cheyenne, Wyoming, and on the summit of Pike's Peak, Colorado, the decrease amounts to 0.12. In all other districts a general increase has taken place, being very slight over the interior and southern sections of the country. In the lower lake region and middle Atlantic states the pressure is from 0.01 to 0.09 higher. The most marked increase of the month occurs over New England and the Canadian Maritime Provinces, where the increase ranges from 0.10 to 0.16.

DEPARTURES FROM THE NORMAL VALUES FOR THE MONTH.

Compared with the January means of previous years, the mean barometric pressure is, with the exception of a slight decrease at a few stations, generally above the normal over the entire country. The most marked departures occur on the Pacific coast north of parallel 35° N., where they range from 0.11 to 0.15 above the normal. In the other districts west of the Mississippi river, the departures vary from 0.02 below to

0.09 above the normal. East of the Mississippi the departures are very slight, except in New England, where the pressure is from 0.05 to 0.10 above the normal. The following are the only stations reporting means below the normal: Fort Bennett, Dakota, 0.02; Cheyenne, Wyoming; Grand Haven, Michigan, Pittsburg, Pennsylvania; Knoxville, Tennessee; Lynchburg, Virginia; and Charlotte, North Carolina, 0.01.

BAROMETRIC RANGES.

The monthly barometric ranges were greatest in the upper lake region, extreme northwest, upper Mississippi and Missouri valleys, north Pacific coast region, and on the middle and south Atlantic coasts. They were least in the southern sections of the country. The greatest monthly ranges reported are as follows: Mackinac City, Michigan, 1.35; Escanaba, Michigan, 1.34; Marquette, Michigan, 1.30. The smallest are: Fort Davis, Texas, 0.48; Key West, Florida, 0.50; Tucson, Arizona, 0.59; Fort McKavett, Texas, 0.59; Silver City, New Mexico, 0.64; Punta Rassa, Florida, 0.66. In the several districts the monthly ranges have varied as follows:—

New England.—From 0.95 on the summit of Mount Washington, New Hampshire, to 1.19 at Eastport, Maine.

Middle Atlantic states.—From 0.94 at Williamsport, Pennsylvania, and 0.79 at Lynchburg, Virginia, to 1.20 at Cape Henry, Virginia.

South Atlantic states.—From 0.92 at Atlanta, Georgia, and Charlotte, North Carolina, to 1.32 at Hatteras, North Carolina.

Florida Peninsula.—From 0.50 at Key West to 0.96 at Cedar Keys.

Eastern Gulf.—From 0.80 at New Orleans, Louisiana, to 0.92 at Starkville, Mississippi.

Western Gulf.—From 0.67 at Fredericksburg, Texas, to 0.97 at Fort Smith, Arkansas.

Rio Grande valley.—From 0.71 at Eagle Pass, to 0.76 at Brownsville, Texas.

Ohio valley and Tennessee.—From 0.90 at Chattanooga, Tennessee, to 1.17 at Louisville, Kentucky.

Lower lakes.—From 0.93 at Buffalo, New York, to 1.07 at Detroit, Michigan, and Rochester New York.

Upper lakes.—From 1.09 at Grand Haven, Michigan, to 1.35 at Mackinac City, Michigan.

Extreme northwest.—From 1.21 at Fort Stevenson, Dakota and Moorhead, Minnesota, to 1.26 at Saint Vincent, Minnesota.

Upper Mississippi valley.—From 1.09 at Saint Louis, Missouri, and Keokuk, Iowa, to 1.23 at La Crosse, Wisconsin.

Missouri valley.—From 0.96 at Springfield, Missouri, to 1.22 at Huron, Dakota.

Northern slope.—From 0.78 at Helena, Montana, to 1.19 at Fort Keogh, Montana.

Middle slope.—From 0.91 at West Las Animas, Colorado, to 0.94 at Fort Elliott, Texas.

Southern slope.—From 0.48 at Fort Davis, Texas, to 0.97 at Fort Sill, Indian Territory.

Southern plateau.—From 0.59 at Tucson, Arizona, to 0.77 at Camp Thomas, Arizona.

Middle plateau.—From 0.84 at Pioche, Nevada, to 0.95 at Salt Lake City, Utah.

Northern plateau.—From 0.87 at Eagle Rock, Idaho, and Fort Missoula, Montana, to 1.22 at Umatilla, Oregon.

North Pacific.—From 0.90 at Roseburg, Oregon, to 1.20 at Olympia, Washington Territory.

Middle Pacific.—From 0.73 at Sacramento, California, to 0.82 at San Francisco, California.

South Pacific.—From 0.67 at Los Angeles, California, to 0.77 at Visalia, California.

AREAS OF HIGH PRESSURE.

There are described twelve areas of high barometer; six first made their appearance from the north of Dakota; one from the north of Montana; two in Washington Territory; two in California.

Three passed eastward over the lake region, affecting only the northern portion of the United States east of Montana.

Two of those from Dakota and Montana, after moving south and east over the Ohio valley, passed off the middle Atlantic coast. From the Pacific coast, two crossed the entire country, one disappearing off the North Carolina coast and the other beyond New England. Four produced northers along the western Gulf coast; two of the latter extended east beyond Florida.

I.—On the morning of the 1st, the pressure was high in Idaho, in western Dakota, and from Kansas to northern Texas, being from 0.3 to 0.4 above the normal. The temperature was below zero in those regions, excepting that it was below freezing over the interior of Texas and slightly above freezing along the Texas coast. A norther prevailed on the coast of Texas and Louisiana, for which off-shore signals were displayed. Maximum hourly wind velocities reported were: Indianola, n. 38; Galveston, n. 37; Port Eads, ne. 24 miles. During the 1st and 2d, the area of high pressure moved eastward, and by midnight of the latter date was central off the middle Atlantic coast.

II.—During the 2d, this high-pressure area advanced south-eastward over Montana and Dakota, in rear of low pressure ii. By morning of the 3d, its centre was still north of Dakota; at Fort Buford the barometer was 0.51 above the normal; the temperature was 30° and more below zero in the northern portions of Dakota and Minnesota; at Fort Garry, —40°. Its progress was south and eastward during the day; at Duluth the barometer was 0.58 above the normal at the 11 p. m. observation. On the 4th, it passed eastward over the lake region, but with the highest pressure to the northward; at Ottawa, the reading of the barometer reduced to sea-level was 30.71, or 0.58 above the normal. On the 5th, it crossed the Saint Lawrence valley, but with diminishing pressure, and over the mouth of the Saint Lawrence northwest gales prevailed. It was apparently dissipated on the 6th and 7th, over Maine, New Brunswick, and Nova Scotia, with low pressure ii. in its advance and iii. in its rear.

III., IV., V.—The pressure increased in California on the 4th and 5th, while low pressure iii. was passing eastward north of Washington Territory and Montana. At Red Bluff, California, it reached its maximum on the morning of the 6th,—30.50, or 0.34 above the normal. High area iii. apparently moved north-eastward, and on the 7th, was central over Washington Territory and Oregon. At Umatilla, the afternoon reduced barometer reading was 30.67, or 0.52 above the normal. At the same time a second high area (iv.) advanced southeastward over Dakota on the 6th and 7th. By morning of the 8th, the entire region from the Pacific coast to Texas, and the upper Mississippi valley, was covered by high pressure, cold, and very generally clear weather. During the night of the 7th, a severe norther began in Texas, which gradually extended east along the Gulf and reached eastern and southern Florida by afternoon of the 9th. Maximum hourly wind velocities: Indianola, n., 59; Galveston, n., 48; Port Eads, nw., 32; Punta Rassa, nw., 44; Key West, nw., 34 miles. At Salt Lake City, the reduced barometer was 30.72, or 0.5 above the normal. During the day, the center continued nearly stationary over Nevada and Utah, with high pressure and generally clear weather over the plateau regions from the Sierra Nevadas to the Rocky mountain slope. These conditions continued on the 9th and 10th. During the afternoon of the 10th, a third high-pressure area of small extent (v.) advanced southeast over Dakota. The two combined, and during the 11th, progressed southeast in advance of low pressure vii. toward the Atlantic coast. By midnight of the 12th, it was central on the North Carolina coast; barometer, 30.64, or 0.46 above the normal. Freezing temperatures were reported in the morning from the northern half of Florida. During the 13th, it passed to the eastward off the coast.

VI.—This appeared on the north Pacific coast during the night of the 11th, and extended eastward to Montana on the 12th. During the 13th, it moved southeastward across the plateau and Rocky mountain regions. At 7.00 a.m. of the 14th, it covered the country from the Missouri and upper Mississippi valleys to northeastern Texas, being central between Saint

Louis and Cairo. During the 14th, 15th, 16th, and 17th, it slowly withdrew northeastward over the Ohio valley, middle Atlantic states, and New England, in advance of low pressure viii. In connection with a slight depression in the Gulf of Mexico it produced a severe norther along the west Gulf coast on the 13th. Maximum hourly velocities reported are: Indianola, n. 41; Galveston, n. 45; Port Eads, n. 32 miles.

VII., VIII., IX.—On the 16th, high area vii. advanced southeastward over the country north of Montana. During the 17th and 18th, the pressure continued increasing from the north Pacific coast to the upper Mississippi valley with very cold weather, and extended its influence on the 18th to the Saint Lawrence valley. During the 19th and 20th, the latter passed eastward over the Gulf of Saint Lawrence as a separate area, (viii.) On the morning of the 19th, the reduced barometer at Umatilla, Oregon, was 30.91, or 0.75 above normal. From eastern Washington Territory east and southeast to western Minnesota, Nebraska, western Kansas, and Colorado, the temperature fell to more than 20° below zero, and in the northern portion of that region to more than 30° below. During the day it developed into two distinct areas, one (vii.) over the Missouri valley and the other (ix.) over the north Pacific coast region. On the 20th, the former moved south to Texas, while the latter remained nearly stationary. In the morning, zero temperatures occurred as far south as northern Texas and the northern half of Arizona. A severe norther was produced in Texas on the 19th and 20th, with sleet and snow. During the evening of the 20th, the norther reached Port Eads, and by night of the 22d, it was felt at Key West. Maximum velocities: Indianola, n. 40; Galveston, n. 35; Port Eads, n. 35; Key West, ne. 33 miles. During the 20th and 21st a slight depression, which had apparently formed over Arizona and New Mexico the preceding day accompanied by light snows and rains, passed northeastward toward the upper lake region and lost its identity in the extensive low-pressure area (xi.) then crossing the lake region. On the morning of the 22d, the whole of the United States, excepting northern New England, was covered by high pressure—highest, vii., being central near Cairo, 30.75, or 0.54 above the normal, and ix., near Umatilla, Oregon, 30.68, or 0.53 above the normal. Excepting the south Atlantic, east Gulf, and California coasts, the temperature was below freezing; from the lake region to Kansas and northern Nevada it was below zero, while in the northern portions of Minnesota and Dakota it was more than 30° below zero. The above conditions generally continued on the 22d and 23d, excepting that the temperature rose in the northern portions of the country during the progress of low pressure xii. High northwesterly winds and gales prevailed the night of the 21st and to the 23d from the New Jersey coast to Cape Hatteras. On the 24th, viii. passed eastward off the middle Atlantic coast, while ix. moved southeastward over the plateau regions toward New Mexico, and was apparently dissipated there in advance of low pressure xiii.

X.—The observations in Manitoba and Dakota on the morning of the 24th, indicated the approach of a cold wave. By midnight, the reduced barometer reading at Moorhead, Minnesota, was 30.70, or 0.51 above the normal. The a. m. minimum temperatures of the 25th, in the Red River of the North valley, were from 30° to 40° below zero. During the day, the centre moved eastward across the upper lake region toward the Saint Lawrence valley. High northerly winds were produced at night on the coast from Rhode Island to North Carolina. The 26th it disappeared eastward over New England with diminished central pressure and cold clear weather.

XI.—The 26th and 27th, the pressure gradually increased over northern California, and extended its influence eastward over the plateau regions. By the afternoon of the latter date, it was central over Nevada, with reduced barometer readings above 30.40. On the 28th, it continued to cover the country from California to Utah and New Mexico. During the progress southeastward of low pressure xv. on the 29th, this high area withdrew toward California. The p. m. barometer at Red

Bluff was 30.53, or 0.37 above the normal. The 30th, it continued central over northern California, and was dissipated on the 31st.

XII.—This high pressure was observed approaching Montana and Dakota from the northward on the 30th. Its influence extended southeastward over the Missouri and upper Mississippi valleys during the 31st. At the midnight observation, the barometer at Fort Buford was 30.61, or 0.44 above the normal, with the central highest pressure to the north of it.

AREAS OF LOW PRESSURE.

Below are described sixteen areas of low pressure, but two (iii. and iv.) have not been charted on account of the depressions having been slight, and the uncertainty as to the location of their centres on the tri-daily weather maps. The small circles on the tracks, as shown on chart i., give the locations of the centres; the figures above them are dates of the month; the figures below them, 1, 2, and 3, represent respectively 7 a. m., 3 p. m., and 11 p. m., Washington time.

The following table shows the latitude and longitude in which each depression, excepting iii. and iv., were first and last observed, and the hourly velocity of each depression while within the limits of the stations of observation:—

Areas of low barometer.	FIRST OBSERVED.		LAST OBSERVED.		Average velocity in miles per hour.
	Lat. N.	Long. W.	Lat. N.	Long. W.	
No. I.	0 /	0 /	0 /	0 /	17.2
II.	37 45	123 30	32 30	143 00	40.1
V.	46 15	101 30	47 30	61 00	46.4
VI.	49 15	121 30	49 30	78 00	61.5
VII.	29 00	87 00	33 00	59 15	37.1
VIII.	49 00	98 15	38 00	73 45	32.3
IX.	50 00	121 00	50 00	60 00	35.5
X.	34 30	113 30	48 30	59 30	44.4
XI.	47 15	117 15	50 15	62 00	37.9
XII.	35 15	113 30	35 30	106 30	16.7
XIII.	47 00	97 45	44 45	64 30	53.1
XIV.	45 30	126 00	46 00	82 00	41.9
XV.	30 00	96 15	44 30	61 00	57.5
XVI.	55 15	123 30	47 00	87 00	36.2
Mean hourly velocity.....					39.8

To show the number of areas of low pressure which have occurred during the month of January, since 1874, the following table has been prepared:—

Month.	Year.	Number.	Month.	Year.	Number.
January.....	1874	8	January.....	1879	15
Do.....	1875	12	Do.....	1880	18
Do.....	1876	12	Do.....	1881	9
Do.....	1877	14	Do.....	1882	14
Do.....	1878	12	Do.....	1883	16

I.—During the afternoon of December 31, 1882, rapidly falling barometer, with easterly winds and light snow at San Francisco, indicated the approach of a disturbance from the Pacific ocean. Later the temperature rose and the snow changed to rain. The latter extended to the interior. By morning of January 1, 1883, the centre was off San Francisco. As the storm moved southward along the coast, light rains prevailed nearly to the southern portion of California on the 1st. On the 2d, they were heavier in the southern portion of that state, and extended into Arizona on the night of the 2d and the 3d. The pressure diminished between the Pacific coast and the Rocky mountains during the night of the 1st and on the 2d, and probably resulted in the development of the succeeding disturbance.

II.—This was a minor depression, that apparently developed in Wyoming and southern Dakota, and rapidly passed over the upper lake region and Saint Lawrence valley to the Gulf of Saint Lawrence. It was occasionally accompanied by light snow and high winds, especially in its western half. Cautionary signals were ordered for lake Michigan on the 2d. Maximum hourly wind velocities: Grand Haven, sw., 34; Buffalo, sw., 42 miles; mouth of the Saint Lawrence, nw., gale; Mount

Washington, violent hurricane, nw., 152 miles, during evening of the 3d, when the anemometer was broken off at the dial.

III.—This slight depression has not been charted. It appeared on the Texas coast on the 3d, with rains, thence to Kentucky, southern Missouri, and Kansas. On the 4th, the depression reached from the Ohio valley south to the Gulf. Rain, generally light, fell throughout the southern states; snow or sleet, from the middle Atlantic coast to the lakes and Missouri valley, and from the last district to Indian Territory. During the 5th, cloudy weather, with light rains, continued from the Gulf to the Ohio valley, but with snow in the lake region, middle states, and New England. The charts giving the deviations from the normal pressures show that this low pressure, also iv., apparently resulted and developed from a general low, covering the plateau regions for several days previous; iii. lost its identity over the upper Ohio valley on the 5th.

IV.—This depression has not been charted. It appeared on the Texas coast on the 5th. Cloudy and rainy weather prevailed on the 6th, in the southern states; snow, changing to sleet and rain in the middle Atlantic states, and snow in New England. The depression passed northeastward to the middle Atlantic coast and disappeared in the general low, the centre of which (v.) was then crossing the lake region.

V.—On the 4th, falling barometer, threatening and rainy weather prevailed over the north Pacific coast region, with snow at night in the interior. The central depression rapidly passed eastward, but at some distance north of the limit of the stations on the 5th. Light rains, and at places brisk to high winds, accompanied it from the north Pacific coast and northern Nevada to Dakota, the precipitation being in the form of snow in the latter. The 6th, it crossed the upper lake region accompanied by occasional light snows and high winds. During the 7th, it moved very quickly to the Gulf of Saint Lawrence, with light snows, from Michigan eastward. From Lake Michigan to the lower lakes, high southwest veering to north-west winds occurred.

VI.—After the movement east of the preceding storm, rainy weather continued during the night of the 5th and on the 6th along the north Pacific coast, with snow during the latter date, thence east over Montana; at Portland, Oregon, 6.87 inches of rain fell within twenty-four hours. By night of the latter date, the centre had progressed southeastward to western Montana. During the 7th, its movement southeastward to the west Gulf states was exceedingly rapid, probably due to the conditions then prevailing, the pressure being below the normal over the entire country from the Mississippi valley to the Gulf and Atlantic coasts, and above the normal along the Pacific coast, with high-pressure area iv. over Montana and Dakota. Light snows accompanied it from Montana and Dakota to Utah, New Mexico, Kansas, Missouri, and Illinois. During the 8th and 9th, its progress to the south Atlantic coast and thence northeastward was unimportant. Generally cloudy weather accompanied it, with occasionally light rains in the southern states, but with sleet changing to light snows, thence northeastward to the lower lakes, New England, and Nova Scotia.

VII.—After the preceding depression had passed northeastward, the pressure continued below the normal along the eastern Gulf coast, with a severe norther along the west Gulf states. By the morning of the 9th, low pressure vii. had fully developed and was central in northern Florida. As it moved northeast along the coast with high pressure v. in front of it, the barometric gradient became very steep, resulting in severe northeast gales from Hatteras to Cape Cod on the 9th. Heavy rains fell from Florida to eastern North Carolina, and snow from northern Alabama to New Jersey and Long Island. During the 10th, the snow and northeast gales preceded it along the coast to Nova Scotia, and clearing weather followed it in the south Atlantic states. In the morning, cautionary signals were ordered to be hoisted on the North Carolina coast; in the afternoon, as far north as the coast of Massachusetts, and at night, for the Maine coast. They were fully justi-

fied by the following maximum hourly wind velocities: Hatteras, ne. 42; Kittyhawk, ne. 44; Cape Henry, ne. 52; Delaware Breakwater, Barnegat, and Block Island, ne. 52; Thatcher's Island, ne. 46; Eastport, ne. 32 miles.

VIII.—The approach of this snow-storm from the region to the northward was indicated on the afternoon of the 8th by rapidly falling barometer in Montana and Dakota. In the northern and central portions of the former, high southwest winds increased to gales—at Fort Assiniboine to 52, and Fort Shaw to 58 miles per hour—owing to steep gradients to the southwestward. During the 9th, the centre moved southeast into Wisconsin, with snow from Minnesota and eastern Dakota to Illinois and Missouri. High northwest winds and gales accompanied it on its western side from Montana, Dakota, and Minnesota, south to Kansas. The p. m. barometer at Saint Vincent read 0.69 below the normal, with steep gradients west and southwest. On the 10th and 11th, it passed over the upper Ohio valley and middle Atlantic coast, with no dangerous winds along the latter. Cloudy weather with generally light snow accompanied it from the lakes as far south as Tennessee.

IX.—On the 10th, the pressure began diminishing over the north Pacific coast region and eastward to Montana. During the 11th, the storm-centre advanced southeast to western Dakota. Scarcely any precipitation was produced, but from Montana to eastern portions of Washington Territory and Oregon high westerly winds, and at places severe and destructive gales, accompanied it—at Fort Maginnis, nw., 80 miles. By morning of the 12th, it appeared as a great barometric trough, reaching from Manitoba south beyond western Texas, and central near Fort Bennett, Dakota, where the reduced barometer was 29.44, or 0.76 below normal. During that day, the barometric gradient became steep. In its eastern half, the southerly winds increased to high and at places to gales, with rainy weather at night from eastern Texas northward, and changing over the upper lake region to snow. In its western half, high northwesterly winds and gales prevailed, with snow north of Kansas. On the 13th, it changed its course northeastward. The rain-area extended east over the Gulf states and northeast to the New England coast; to the northward snow fell. Along the Atlantic coast from New Jersey north, in the Saint Lawrence valley, and over the lake region, high southwesterly winds and gales prevailed, but shifted to northwesterly in the latter section. In connection with high-pressure area vi. quite a severe norther was produced along the west Gulf coast. The 14th, clearing weather followed it, with diminishing westerly winds over the lake region, brisk to high northwest winds along the New England and New Jersey coasts, and high north to northeast winds along the Virginia coast and southward to Hatteras. Cautionary signals were ordered for Lake Michigan and the Texas coast on the morning of the 12th; from Port Eads to Pensacola in the afternoon; from North Carolina to Massachusetts at midnight; for the coast of Maine on the morning of the 13th. All were fully justified, except for the North Carolina coast. Maximum hourly velocities: Milwaukee, se., 47; Duluth, nw., 44; Toledo, w., 38; Buffalo, s., 38; Grand Haven, sw., 44; Indianola, n., 41; Galveston, n., 45; Hatteras, sw., 30; Cape May, s. 34; Block Island, sw., 32; Thatcher's Island, sw., 44; Eastport, s., 32; Mount Washington, sw., 100 miles.

X.—On the 13th and 14th, the pressure decreased slightly below the normal in the plateau districts, being lowest over the southern plateau. Light rains fell along the north Pacific coast, and light snows over the interior toward Montana and northern Utah and in New Mexico. During the 15th, the centre passed eastward from Arizona. Threatening and cold rainy weather prevailed from the western Gulf coast to Tennessee, Arkansas, and southern Indian Territory; thence north to lake Michigan and the upper Mississippi valley, numerous light snows, from New Mexico and Arizona to southern Nevada occasional light snows. On the 16th, the rain-area covered the southern states, changing to snow from the upper lakes south-

west to Nebraska and Kansas. As yet no dangerous winds accompanied it, except that in connection with high area vi., then passing off the New England coast, high northeast winds and heavy sea occurred in the vicinity of Cape Hatteras. On the 17th, the rain extended to the Ohio valley and southern New England, and heavy snow to the north and eastward, with increasing winds from the lakes and New Jersey northeastward. The central pressure reached its minimum at Halifax, Nova Scotia, at 7 a. m., of the 18th, being 29.36, or 0.64 below the normal. On the morning of the 17th, cautionary signals were ordered from Chincoteague, Virginia, to Sandy Hook; at midnight they were changed to off-shore, and off-shore signals ordered for the entire New England coast; all were well justified.

XI., XII.—During the afternoon of the 16th, xi. passed south-eastward over eastern Washington Territory, with light rains along the north Pacific coast, but with snow over the interior to Montana and northern portions of Utah and Nevada. On the 17th, it rapidly moved toward New Mexico, probably due to the pressure having been below the normal in that direction, with high pressure along the California coast, and from Dakota and Montana northward. Cloudy weather, with generally light snows prevailed from the upper Missouri valley to Nevada and Utah. The 3 p. m. barometer at Salt Lake City was 29.80, or 0.42 below the normal. During the 18th, threatening and rainy weather, with thunder-storms at places, continued over the southern states; snow from Kansas to the Missouri valley. The centre crossed Texas, and upon reaching the Gulf evidently received new energy. The 19th, a secondary depression (xii.) developed in the upper Mississippi valley and passed northeastward over the upper Lake region beyond the limits of the stations, accompanied by frequent snows and brisk to high winds. In the southern and middle Atlantic states rainy weather prevailed changing to sleet or snow over the interior of Texas, with thunder-storms in the Gulf states; snow from southern New England to the lower lakes. By the afternoon of the 20th, it appeared on the weather chart as an elongated depression reaching the mouth of the Mississippi beyond Lake Huron, with the centre at Toledo; midnight barometer at Parry sound, 29.24, or 0.8 below the normal. Threatening and rainy weather was general from the Mississippi valley eastward, except that it turned to snow or sleet in northern New England, the lake region, and from southern Minnesota to Texas and northern Louisiana. The severe norther produced on the Gulf coast has been mentioned in describing high pressure vii. During this and the following day, high winds and frequent gales prevailed over the lakes; also at places on the Atlantic coast, from Cape Hatteras north. On the morning of the 19th, cautionary signals were ordered for Cape Henry and Kittyhawk, and continued "up" thence to Sandy Hook; on the afternoon of the 20th, they were ordered hoisted from New York to Maine; on the morning of the 21st, off-shore at Hatteras. The signals were changed to off-shore on the 21st. All were fully justified. Maximum hourly velocities: Galveston, n., 45; Kittyhawk, ne., 39; Cape May, nw., 46; Barnegat, nw., 44; Provincetown, se., 36; Thatcher's Island, w., 40; Eastport, se., 32; Mount Washington, se., 114, and w., 116; Oswego, w. 45; Buffalo, w. 50; Cleveland, nw., 40; Grand Haven, w., 36 miles.

XII.—The preceding storm left the pressure below the normal from Nevada southeast to New Mexico on the 18th. The 19th, xii. developed over Arizona and New Mexico, causing light rains in the southern portion of that section; snow over the northern portion, and eastward to Nebraska, Kansas, and Indian Territory. On the 20th, a slight depression appeared in northern Montana, and the two formed a shallow barometric trough reaching from New Mexico to Dakota, in which light snows occasionally fell, and in its western half, high westerly winds occurred. At night and the following day it passed into the general low pressure, (xi.) then existing over the lake region.

XIII.—This disturbance, in its quick movement eastward,

produced numerous light snows and occasionally high winds from eastern Montana to the lakes, northern New England, and the Canadian Maritime Provinces. Cautionary signals were ordered on the afternoon of the 24th along the New Jersey coast and generally justified. Maximum wind velocities, s. 34 miles at Cape May, and nw. 100 miles on Mount Washington.

XIV., XV.—On the 23d, this storm was first felt at Cape Mendocino, California, where a se. gale began blowing, with rain at night, thence north along the coast. During the 24th, the pressure rapidly decreased along the north Pacific coast, with rainy weather, and as far south as beyond San Francisco. At Cape Mendocino, the wind increased to hurricane velocity, being 76 miles per hour at 11 a. m., when the anemometer cups were blown away. During the night a heavy gale prevailed at Astoria, Oregon. At a. m. of the 25th, the barometer at Olympia read 29.46, or 0.56 below the normal, and during the day the rain-area extended eastward over the interior partly as far as Utah, Idaho, and western Montana, with high westerly winds at places. The movement of the storm-centre was north of the limit of the stations. The 26th, rainy weather continued along the north Pacific coast and extended as occasional light rain, changing to snow, thence eastward over the upper Missouri and upper Mississippi valleys to the upper lake region and Lake Erie, with high southerly winds at places on the eastern side of the low. On the 27th, the centre disappeared northeast into Canada, accompanied by light rain or snow and occasionally by high westerly winds from the lakes eastward beyond New England; southward to the Gulf, threatening and rainy weather prevailed, with a shallow barometric trough extending from the lakes to eastern Texas. It was in the latter that the low, xv., developed. During the 28th, cloudy and rainy weather continued in the southern states, Ohio valley, middle Atlantic states and southern New England. Dangerous winds were reported from a few scattered stations. Cautionary signals were ordered on the morning of the 27th from Chincoteague, Virginia, to Eastport, Maine. Maximum velocities: Provincetown, s. 26; Thatcher's Island, s. 35 miles.

XVI.—On the 28th, this low pressure was accompanied by rain from the north Pacific coast to western Montana; at Cape Medocino, Cal., a southeast gale prevailed in the afternoon. By the afternoon of the 29th, the centre was near Bismarck, Dakota—barometer 29.42, or 0.71 below the normal. In its northeast and northwest quadrants snow accompanied it; in its southwest quadrant, rain. In its western half, the gradient was steep, resulting in high northwest winds or gales. On the 30th, its course was northeastward. North and west of the Ohio valley snow fell, with high northwesterly winds and gales, which conditions continued on the 31st. The midnight barometer at Marquette was 29.30, or 0.76 below the normal. During the 31st, high southerly shifting to westerly winds and gales occurred along the middle Atlantic and New England coasts. At midnight of the 30th, cautionary signals were ordered up from Chincoteague, Virginia, to Boston, and on the morning of the 31st, for stations northeast of Boston, and fully justified. Maximum velocities: Delaware Breakwater, se. 32; Barnegat, se. 35; New York City, e. 36; Block Island, se. 36; Provincetown, se. 48; Portland, se. 46; Eastport, se. 43; Mount Washington, s. 110 miles.

NORTH ATLANTIC STORMS DURING JANUARY, 1883.

[Pressure in inches and millimeters; wind-force by Beaufort scale, 0 to 12.]

Chart ii. exhibits the tracks of the principal storms that have occurred over the north Atlantic ocean during January, 1883. The positions of the various storm-centres have been approximately determined from reports of observations furnished by agents and captains of ocean steamships and sailing vessels in the north Atlantic, and from other miscellaneous data received at this office up to January, 24th.

The observations used are, in general, simultaneous, having been taken each day at 7 h. 0 m. a. m., Washington, or 12 h. 8 m. Greenwich time.