

# MONTHLY WEATHER REVIEW,

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(General Weather Service of the United States.)

WAR DEPARTMENT,

Office of the Chief Signal Officer,

DIVISION OF

TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

## INTRODUCTION.

In compiling the present REVIEW the following data, received up to April 14th, have been made use of, viz: the regular tri-daily weather charts, containing the data of simultaneous observations taken at 122 Signal Service stations and 12 Canadian stations, as telegraphed to this office; monthly journals and means, 142 and 141 respectively, from the former, and monthly means from 13 of the latter; reports from 27 special Sunset stations; 205 monthly registers from Voluntary Observers; 55 monthly registers from United States Army Post Surgeons; Marine Records; International Simultaneous Observations; monthly reports from Voluntary Observers in, and the local Weather Services of, the States of Iowa and Missouri; reliable newspaper extracts; special reports.

## BAROMETRIC PRESSURE.

Upon chart No. II is illustrated the general distribution of the atmospheric pressure, as reduced to sea-level, for the month by the isobaric lines. Compared with the means for March of previous years, the average pressure for the present month is lower 0.08 inch for Portland, Or., and from 0.01 to 0.02 for Minnesota and Red River of the North Valley. For all the other districts it averages above; California, 0.03 to 0.05; Rocky Mountains stations, from 0.05 in Montana to 0.12 in New Mexico; plains of Kansas, Nebraska and Indian Territory, 0.10 to 0.12; Missouri valley, 0.03 to 0.06; Mississippi valley, (except Minnesota,) 0.02 at La Crosse to 0.09 at Cairo; Gulf States, 0.05 to 0.08; Ohio valley and Tennessee, 0.07 to 0.09; Upper Lake region, 0.00 to 0.08; Lower Lake region, 0.06 to 0.12; South Atlantic States, 0.04 at Charleston to 0.15 at Cape Hatteras; Middle Atlantic States, 0.06 to 0.12; New England, 0.11 to 0.16 inch.

*The Local Barometric Ranges* for the month are as follows: California, least, from 0.42 inch at San Diego to 0.67 at Red Bluff; Western Plateau, 0.60 at Pioche to 0.90 at Boise City; Rocky Mountains, 0.55 at Fort Craig to 0.87 at Virginia City; Portland, Or., 1.19; Gulf States, 0.50 at Key West to 0.90 at St. Marks, 0.68 at New Orleans and 1.19 at Fort Stockton; Tennessee and the Ohio valley, 0.83 at Cairo to 1.01 at Knoxville; plains of Nebraska, Kansas and Indian Territory, 1.16 at Fort Gibson to 1.46 at North Platte; Northwest, 0.89 at St. Louis to 1.27 at St. Paul, 1.45 at Yankton and 1.00 at Bismarck; Red River of the North Valley, 1.15 at Pembina to 1.39 at Breckenridge; Upper Lake region, 0.96 at Chicago to 1.26 at Marquette; Lower Lake region, 0.97 at Cleveland to 1.21 at Oswego; Middle Atlantic States, 1.26 at Fort Whipple to 1.46 at New York city; South Atlantic States, 1.03 at Jacksonville to 1.61 at Cape Hatteras; New England, 1.29 on Mt. Washington to 1.38 at Burlington, 1.86 at Wood's Holl and 1.94 at Eastport.

*Areas of High Barometer.*—Of these eleven were sufficiently well marked to merit a description. In the Atlantic States and Florida, generally, the minimum temperatures of the month were produced by No. I on the 1st and 2nd; in Dakota, Montana, Idaho, Nevada and Utah, by No. II on the 1st; in California, by No. III on the 3rd; over the northern portions of New York and New England, by No. IV on the 6th; in the Upper Mississippi and Lower Missouri valleys and Kansas on the 14th, in the Upper Lake region, from the 15th to the 17th, and over Lake Erie, the Ohio valley, West Virginia, Tennessee and the Gulf States west of Georgia, from the 17th to the 19th, by No. VI.

No. I,—described as No. VIII for *February*, was central over the Gulf of St. Lawrence on the morning of the 1st; minimum temperature below zero from northern New England north and northeastward, and  $-17^{\circ}$  at Chatham; reduced barometer at Chatham 30.84 inches, and at Sydney 0.91 above normal. During the day it disappeared in advance of low pressure No. I. Along the North Carolina coast northeast gales prevailed:—Cape Lookout, 44, and Kittyhawk, 32 miles per hour.

No. II.—This high pressure area is a continuation of No. IX, described in *February Review*. 1st, it was central in Dakota; barometer 0.52 above the normal at Yankton; a. m. minimum temperature,  $-28^{\circ}$  at Fort Garry,  $-27^{\circ}$  at Fort Buford,  $-1$  at Yankton, and below freezing from thence to Washington Ty., Oregon, Nevada, northern portions of Arizona, New Mexico, Texas and Missouri, and to the Lake region. 2nd, by morning it had moved to the Lake region; barometer reduced to sea-level at Parry Sound 30.74, or 0.68 above the normal. 3rd, central north of Lake Ontario, barometer averaging 0.63 above normal. During the day it rapidly passed to the New England coast; p. m. barometer at Boston 30.67, or 0.74 above normal. 4th, by morning the pressure had considerably diminished in advance of low pressure No. II, and was highest from northern Georgia to the Middle Atlantic coast and southern Nova Scotia. During the day it lost its identity over the Southern States as the following approached from the westward. Cautionary Off-Shore Signals were displayed at Indianola and Galveston in anticipation of a "norther," but not justified.

No. III.—3rd, in the morning the pressure was high over California, with cool, clear weather; during the day it rapidly extended eastward over the mountains, as shown by the departures from the normal of the barometric readings. 4th, morning, it was central over Nebraska and Kansas; during the day it probably united with a second area which advanced southeastward over Manitoba, and at midnight reached from Lake Superior to western Kentucky. 5th, central northeast of Lake Huron; at Ottawa, a. m. barometer 30.74, and minimum temperature  $-11^{\circ}$ . 6th, by morning it had advanced eastward to western Nova Scotia; barometer 30.70, or 0.81 above normal, at Halifax. The temperature fell to  $-12^{\circ}$  at Chatham and Father Point. In advance of low pressure No. IV it disappeared eastward.

No. IV.—probably developed over the Lake region, night of the 6th and 7th, and then moved south and eastward, with cold, partly cloudy weather and, along the New Jersey and New England coasts, northwest gales, where Off-shore Signals would have been justified. 8th, in the morning the barometric ridge extended from the Middle Atlantic States to the St. Lawrence valley; highest over western New England.

No. V.—There was a decided increase in pressure over California on the 9th, which rapidly extended northeastward on the 10th, so that by midnight it was central in western Nebraska and southern Dakota, and where it probably united with a second high area which advanced southeastward from British Columbia. 11th, highest in Manitoba during the p. m., with the barometric ridge covering the Mississippi valley. 12th, a. m., central over the Ohio valley, after which it passed to the eastward over the Middle Atlantic coast, with diminishing central pressure.

No. VI.—While the pressure was considerably above the average in California and Nevada on the 11th, it rapidly rose above the normal in Washington Territory and Oregon, and extended its influence southeastward. 12th, it was central near western Oregon; a. m. barometer at Roseburg 30.53, and 0.53 above the normal at Olympia, W. T. During the day it continued advancing east and southward across the mountains, with cold and clear weather. 13th, by night the central highest pressure reached Dakota and Nebraska, producing low temperatures and northwesterly gales throughout the Northwest and Kansas; midnight barometer at Yankton 30.67, or 0.50 above normal. 14th, a. m. minimum temperature below zero from northern Nebraska to Montana, Dakota and Minnesota, and  $-18^{\circ}$  at Fort Garry. As it progressed southeastward to the central Mississippi valley the central pressure diminished. 15th, in the morning a second high area appeared in the Northwest. The two combined by night and were central over northern Missouri; a. m. minimum temperature  $-22^{\circ}$  at Pembina. 16th, it withdrew northward to the Red River of the North, with temperature  $-26^{\circ}$  at Pembina, as low pressure No. X advanced northeastward from Texas; after which it again moved southward over the Lower Missouri valley on the 17th, where it remained nearly stationary on the 18th, with low temperatures from the Northwest to the Lake region. 19th, as low-pressure No. XI advanced southeastward over Kansas, this high area rapidly withdrew to the South Atlantic coast, and thence on the 20th and 21st along the coast beyond Nova Scotia. At midnight of the 13th a "norther" was anticipated on the Texas coast, and Off-Shore Signals hoisted, but not justified.

No. VII.—During the night of the 20th it reached Minnesota from the northward. 21st, it extended over the Lake region. 22nd, crossed New England; at midnight the barometer at Sydney stood 0.53 above the normal, after which it disappeared to the eastward in advance of low pressure No. XII.

No. VIII.—21st, the pressure increased considerably in California and extended its influence eastward across the Rocky Mountains. 22nd, it continued increasing, and by night it was central in Indian Ty. 23rd, it advanced northeastward over the Ohio valley to the Middle States, and disappeared on the 24th.

No. IX.—The barometers reached their highest points in Washington Ty. and Oregon during the night of the 22nd; 0.26 above the normal at Olympia. 23rd, it rapidly advanced southeastward, and at midnight was central in Colorado. 24th, a. m. barometer 0.36 above normal at Dodge City. By midnight it was central in southern Illinois, with barometric ridges running from thence to Lake Superior and from southern Missouri to central California. 25th, it continued its eastward course. 26th, in the morning it

covered the St. Lawrence valley and eastern half of the Middle States. 27th, by midnight it was central over the Gulf of St. Lawrence, with increased pressure; barometer at Sydney 30.51, or 0.61 above normal. 28th, disappeared as low-pressure No. XV progressed eastward.

No. X.—It was first felt during the night of the 26th in northern California and western Oregon. 27th, the pressure increased from the Pacific States to Montana, Wyoming and Colorado, with colder, clearing weather; a. m. and p. m. barometer at Roseburg 0.30 above the normal, and 0.29 at Boise City. 28th, it covered the entire region from the Pacific coast to the Missouri valley and the Southwest, and advanced toward the last section; central in Utah; p. m. and midnight barometer at Salt Lake City 0.42 above the normal. 29th, it continued nearly stationary, but with diminishing pressure; at midnight the barometric ridge reached from Montana to New Mexico. 30th, the pressure having been below the normal over the entire country from the Mississippi valley eastward and diminished on the Pacific coast this high area was dissipated in the Rocky Mountain region.

No. XI—made its appearance in Montana during the night of the 30th. On the 31st it advanced southeastward toward the Northwest and Colorado. By midnight it was apparently central in Wyoming; barometer at Cheyenne, 0.25 above normal.

*Areas of Low Barometer.*—Upon chart No. I are shown the tracks of the centres of eighteen. An examination of the chart will show that a majority of the storms passed eastward over Washington Territory and Oregon. In some cases the tracks are indicated by broken lines, as it is impossible to definitely locate them, on account of the small number of stations in that region, from some of which reports have not yet been received. In fact it is believed that the centres of some have crossed farther to the northward. Generally, in the high country between the Pacific coast range and the Rocky Mountains the barometric range and precipitation have been comparatively small, also the winds less strong, during the progress of these disturbances. During the advance of Nos. V, VI and VII the maximum temperatures of the month were generally produced in the Lake region and Upper Ohio valley from the 8th to the 10th, and over the Middle States, New England and North Carolina from the 10th to the 12th; of No. XV, throughout the Northwest, from the 26th to the 28th, and from the Lower Ohio valley to the South Atlantic and Gulf States, except North Carolina and Texas, on the 28th and 29th; of No. XVII, from the Pacific coast eastward to New Mexico, Colorado, Wyoming, Montana and western Dakota, from the 29th to the 31st; of No. XVIII, in Texas, on the 30th and 31st.

Nos. I and III.—The former is a continuation of No. IX, described in the *February Review*. 1st, it moved from Wisconsin northeastward into Canada. Light snow and sleet occasionally fell from the Northwest to the Lakes, St. Lawrence valley, Maine and New Brunswick. High pressure No. I quickly followed it, producing steep barometric gradients, and resulting high northwesterly winds in the Northwest and Upper Lake region. The Cautionary Signals displayed at Milwaukee, Grand Haven and Ludington were justified. A barometric trough extended towards Texas, in which No. III gradually developed. Light rains were frequent from Texas to the Ohio valley. 2nd, the central depression, although considerably above the normal, advanced to West Virginia. Light rains prevailed from Missouri, Arkansas and Tennessee northeastward, turning to snow from Iowa to Lake Erie, and from latter to Maryland and northern Virginia. Along Lake Erie northeasterly gales occurred. The disturbance was dissipated during the night. Maximum hourly wind velocities of NE. 27 miles at Toledo and NE. 40 at Cleveland were recorded, while snow was falling, but the display of Cautionary Signals had not been resumed on account of the suspension of navigation. Warning was sent to Toronto for the Canadian stations along the Lakes and in the St. Lawrence valley.

No. II.—By midnight of the 1st the pressure had reached its minimum along the coast of Washington Territory and Oregon; 0.43 below the normal at Portland; gales prevailed along the coast, with rain; Pacific Mail Steamship "Dakota" encountered a very severe gale at night off Washington Territory, barometer 29.18 in.; at Roseburg, W. 32 miles; in Shasta Valley, Cal., southerly gale. 2nd, it advanced into Montana, with numerous light rains in the northern half of California, Oregon, Washington Territory, Idaho, and turning to snow in western Montana. At Mare Island Navy Yard, Cal., the wind velocity averaged W. 54.7 miles. 3rd, passed over northern Dakota into Canada; p. m. barometer 0.37 below normal at Pembina. The rain and snow-area reached the Upper Mississippi valley. High winds occurred at Mare Island, Cal., averaging 38 miles per hour from the W.; at Winnemucca, W. 32; Salt Lake City, W. 37, with light snow; Cheyenne, NW. 36; and Dodge City, SW. 36 miles. 4th, its progress northeastward, and north of the St. Lawrence valley, was very rapid. Light rains were frequent from the Lakes and Ohio valley eastward, partly changing to snow over the northern sections, with occasionally high winds: Pembina, NW. 29; Milwaukee and Alpena, SW. 27; Port Huron, SW. 32; Saugeen, S. 30; Father Point, SW. 45 miles.

No. IV.—3rd, the pressure having regained its normal again began diminishing in Washington Territory and Oregon, reaching its minimum during the night, with rainy weather. 4th, the central depression probably advanced into Montana, with heavy rains and southerly gales thence to the northern half of California; an average of S. 56.4 miles at Mare Island, Cal.; highest velocity, SE. 36 at Roseburg; SE. 40 at Red Bluff; SW. 35 at Winnemucca; and SE. 28 at Boise City; hurricane at some distance off the mouth of the Columbia river. 5th, by morning it was central in northern Dakota, and later moved into Canada. Frequent light rains accompanied it from Indian Territory to the Upper Lakes, partly as snow in latter. 6th, its path was north of the Lakes, but at night changed its course southeast towards New England. From the Ohio valley northward and eastward rainy weather or snow prevailed, with high winds or gales at

places: at Alpena, NW. 36; Cleveland, S. 35. 7th, it crossed New England and passed off the coast of Nova Scotia. From its track northward snow fell, accompanying northeast backing to northwest gales: at Boston, NW. 33; Eastport, NE. 45 miles. Cautionary Signals displayed on the 5th along Lake Michigan and the North Carolina and New Jersey coasts were partly justified; the Off-shore Signal for Eastport was ordered late.

Nos. V and VI.—After the previous storm had passed eastward from the Pacific coast, before the pressure could regain the normal it again began diminishing on the 5th from California to Montana. At midnight the storm-centre was off the coast of Oregon. Rainy weather prevailed from Washington Territory to the northern portions of Nevada and California, with frequent southerly gales; at Red Bluff, SE. 39; Mare Island, SSW. an average of 62.5 miles per hour. 6th, the central depression apparently passed up the Columbia river and into northern Montana, accompanied by heavy rains along the coast and light rains or snow over the interior, with strong southerly winds veering to westerly; at Pioche, S. 36 miles. At Portland, a. m. barometer 29.39, or about 0.63 below normal. In northern California the heavy rains produced floods. 7th, by morning it was central in western Dakota, as shown by the wind directions at the various stations; a. m. barometer at Bismarck, 0.52 below normal. During the day it developed into two distinct depressions, one passing northeast into Manitoba, the other southeast into western Iowa. From Montana to northern Utah snow and rain accompanied it; at Deadwood, S. 28 miles. While still below the normal the pressure again fell from Washington Territory to the northern half of California, with rainy weather and increasing southerly winds, and storm No. VI made its appearance; it rapidly extended its influence southeastward to Montana, Wyoming and Colorado; high winds occurred at Red Bluff, SE. 28, and Winnemucca, SW. 28 miles. 8th, by midnight No. VI was central in western Dakota. The peculiar course taken by the southern branch of No. V was no doubt due to the low pressure left over the elevated region to the westward, while it was high to the eastward, and to the quick succession of No. VI. From Utah to Montana and Dakota light rains were frequent, turning to snow over the northern portion, with gales at places; NW. 32 at Cheyenne. From Kansas to the Lakes and in the Middle States light rains and high winds occasionally prevailed; S. 32 at Fort Sill; SW. 32 at Dodge City; SW. 33 at Grand Haven. In northern Pennsylvania, western New York and central and northern Ontario heavy thunder-storms are reported to have occurred, with hail in latter. 9th, the two probably united in Minnesota, and passed over Lake Superior into Canada; a. m. barometer at Breckenridge 29.41, or 0.58 below normal. Frequent rains were reported from the Northwest to the Lakes, with southerly gales over latter; SW. 36 at Milwaukee and Grand Haven; SW. 40 at Saugeen; SW. 34 at Sandusky; S. 34 at Cleveland. During the 10th the central depression passed eastward, at some distance north of the St. Lawrence valley, producing light rains from the Middle States northeastward. Cautionary Signals were displayed from the 7th to the 9th along Lake Michigan, and justified; 8th, on Texas coast, partly.

No. VII.—Before rising to the normal, after the passage of No. VI, the barometer commenced falling night of the 7th in Washington Territory and Oregon. 8th, p. m. barometer at Portland 29.40, or 0.64 below normal; at Virginia City 0.43 below by midnight. Rainy weather prevailed from northern California to Washington and Idaho Territories, and continued the following day, partly turning to snow towards latter, with southerly gales at many points; SE. 39 at Red Bluff and SW. 44 at Winnemucca. 9th, as the centre moved into Manitoba, light snow fell from Montana to northern Dakota, with southerly gales at places to the southward. 10th, while the central depression was north of the Lakes, in the barometric trough to the southward light rains fell from Missouri and the Ohio valley to southern Michigan and the Lower Lake region, except that heavy rains accompanied thunder-storms over the southern portion of this area. Southerly veering to northwest gales were produced over the Upper Lake region; W. 30 at Duluth; SW. 30 at Alpena; NW. 31 at Milwaukee; and SW. 40 at Grand Haven. 11th, by morning the centre was near Quebec; barometer 0.50 below normal. During the day it moved eastward to the Gulf of St. Lawrence. Light rains were frequent from the central Gulf States northeastward to the Lower Lakes, St. Lawrence valley, New Brunswick and Nova Scotia. After the winds shifted to west or northwest they increased in force; W. 33 at Parry Sound; W. 45 at Father Point; W. 30 at Boston; and NW. 28 at Philadelphia and Cape May. The Off-shore Signals ordered on the 11th for the North Carolina and New Jersey coasts were succeeded by northwesterly gales.

No. VIII.—Strong southerly winds and frequent light rains continued from northern California to Washington Ty. on the 9th, with increasing pressure. 10th, the barometer fell, and reached its minimum of 0.23 below the normal by midnight at Olympia. Cloudy and rainy weather continued in Washington Ty. and Oregon, with southerly winds; light rain and snow in Idaho; and snow along Fraser river, British Columbia, with northeast winds. During the night the centre moved northeastward into British Columbia, and on the 11th southeastward into eastern Montana, producing light snow or rain in that section. 12th, as it progressed towards the Upper Lakes it was accompanied by brisk to high winds, and in its northern half by snow and rain: NE. 40 miles at Duluth; SW. 35 at Milwaukee, and NW. 38 at Grand Haven. 13th, it advanced to northern New England, where it was dissipated. On Long Island Sound very rough weather was experienced. High winds occurred at Sandusky, N. 28; at Kittyhawk, SW. 31; at Cape May, S. 38; at Philadelphia, SW. 30 miles. In the barometric trough, which formed to the southward, a slight depression developed on the Gulf coast, and produced rainy weather in that section. Cautionary Signals were displayed the 13th on the North Carolina and New Jersey coasts, and followed by southerly gales at places.

No. IX.—formed during the night of the 13th over the Upper Lake region; where the pressure had remained below the average after the previous disturbance passed eastward, and while high pressure area No. V was advancing southeastward over the Northwest. The barometric gradient became very steep, with resulting northerly gales and frequent snow from Dakota, Minnesota and Wisconsin to Kansas and Missouri: NW. 32 at Bismarck; NW. 35 at Breckenridge; N. 36 at Cheyenne; NE. 44 at Dodge City; NW. 30 at Omaha, and NW. 28 miles at St. Paul. 14th, the centre took an eastward course to New England. Rainy weather accompanied it in the Eastern Gulf and Atlantic States, and very generally snow with winds shifting to high westerly or gales in the Lake region: NW. 36 at Milwaukee and Grand Haven; W. 32 at Parry Sound; W. 34 at Sandusky, and W. 26 at Toronto and Rochester. On Mt. Washington the maximum hourly velocity of the month, 114 miles, occurred this date. During the 15th it disappeared over the Gulf of St. Lawrence, followed by colder, clearing weather from the Lakes to the Atlantic coast, and at many points by westerly gales: Detroit, W. 27; Sandusky, W. 36; Buffalo, SW. 36; Father Point, W. 30; Cape May, NW. 30; Boston, NW. 26 miles. Cautionary Signals displayed the 13th and 14th for Lake Michigan were fully justified; the Off-Shore Signals for the New Jersey and North Carolina coast, only partly.

No. X.—This disturbance can be traced to the Pacific coast. On the 14th the barometer fell somewhat below the normal in California, with a tendency to extend northeastward toward Montana; at Los Angeles, Cal., there was a slight fall of rain. 15th, the depression, after having advanced toward Wyoming and Colorado, took a southeasterly course toward Texas, where occasional rains fell at night. From Montana to southwestern Dakota light snow was reported. At Winnemucca high west winds—35 miles—prevailed during the afternoon. 16th, after reaching Texas the central pressure began diminishing. As it progressed northeastward frequent rains, accompanying thunderstorms at places, prevailed from the Western Gulf States to Arkansas, Kentucky and the Virginias, with warm southerly winds, and snow from thence to Wyoming, Nebraska, Iowa and the Lower Lake region, with northerly winds. 17th, rainy weather prevailed from the Eastern Gulf States to southern New England, and snow from thence northward. In the northern portions of the Middle and Eastern States the snow-storm was severe. As high pressure No. V quickly followed it the barometric gradient became steep, and high winds and gales were frequent: Indianola, NE. 46; Punta Rassa, SE. 30; Wilmington, SW. 32; Cape Hatteras, S. 35; Cape Lookout and Cape Henry, N. 44; Atlantic City and Boston, NW. 36; Portland, NE. 33; Eastport, NE. 34 miles; Halifax, S. 30 miles. Off-Shore Signals were hoisted for a “norther” on the Texas coast night of the 16th, and fully justified; the Cautionary Signals of the 16th and 17th, from North Carolina to New England, were followed by gales; Toronto was also notified for the stations in Nova Scotia, New Brunswick and Newfoundland.

No. XI.—This storm crossed Oregon on the 18th; p. m. barometer at Portland, Or., 0.25 below the normal. Threatening and rainy weather prevailed from thence to California and Nevada; at Winnemucca, wind S. 36 miles. 19th, by midnight it was central in western Kansas; barometer at Dodge City 0.34 below normal. In its northern quadrant light snow fell: in southern, light rains, with high southerly wind at Dodge City. 20th, from Nebraska eastward to the Lower Lake region northeasterly winds and snow, at places heavy, accompanied its progress; from southern Missouri and Tennessee to the Middle Atlantic States, southerly winds and generally light rains. The central depression decreased during the day, the barometric gradient became less steep, and the winds were only fresh to very brisk. 21st, it rapidly moved northeastward off the coast of Nova Scotia. Light snows were frequent on its northern and light rains on its southern side. High winds occasionally occurred along the Texas, North Carolina and New Jersey coasts: S. 36 at Indianola, SW. 30 at Wilmington, SW. 32 at Cape Lookout, SW. 28 at Kittyhawk, and SE. 31 at Sandy Hook. Signals were ordered the 19th for Lake Michigan; 20th for Texas coast, Lake Erie, North Carolina and New Jersey coasts, and partly verified.

No. XII.—After the previous storm had left the Pacific coast, the pressure rose very slightly before it again diminished. 19th, threatening and rainy weather and southerly winds prevailed from California to Washington Ter. At midnight the storm-centre reached the coast from the westward; barometer at Portland, 0.33 below the normal; SE. 28 miles at Red Bluff. 20th, light rains were frequent as far south as Nevada and Utah and turning to snow in Montana, while the central depression moved into Montana; p. m. barometer 0.19 below normal at Virginia City. 21st, high pressure No. VI, which was advancing southeastward over the Lake region, forced it to change its direction towards Texas. Light snows were frequent throughout the Northwest, and rain-areas thence to the Gulf States, with thunderstorms in Arkansas and Alabama. Northwest gales succeeded the depression in Wyoming, Colorado and Nebraska; NW. 36 miles at Cheyenne, Denver and North Platte. At midnight it curved to the northeastward, and rapidly moved on the 22nd to Lake Ontario; a. m. barometer at Cincinnati 0.31 below normal. The area of precipitation became very extensive, and included the entire country from the Mississippi valley eastward; from the Lake region to New England principally as snow; south and east of the Ohio valley frequent thunderstorms. The barometric gradient grew more steep upon its northern and eastern sides, producing gales; Sandusky, E. 32; Boston and New London, E. 28; Wood's Holl, SE. 40; Sandy Hook, SE. 35; Cape May, SE. 32; Norfolk, S. 28; Wilmington, SW. 33; Augusta, S. 30; Atlanta, S. 32. At Milledgeville, Ga., a tornado is reported to have formed, which destroyed houses, trees, &c., and carried the bridge spanning the Oconee river from its piers. 23rd, it crossed Nova Scotia with northeasterly gales, and was followed in the Atlantic States by high pressure No. VI, clearing weather, and along the Middle Atlantic coast by northerly

gales; at Eastport, NE. 30; Cape May, NW. 35; Cape Hatteras, NE. 33; Kittyhawk, NE. 32; Cape Lookout, NE. 31 miles. The signals ordered up the 22nd along Lakes Erie and Ontario, and from North Carolina to Maine, were very generally succeeded by gales. Warnings were telegraphed for all the Canadian stations.

No. XIII.—Light rains, southerly winds and diminishing pressure from northern California to Puget Sound on the 21st indicated its approach, with the centre at some distance to the northward. 22nd, threatening and rainy weather continued as on the previous day and extended into Montana as light snow, with high westerly winds at Umatilla and Winnemucca. 23rd, as the centre passed over Minnesota the p. m. barometer at St. Paul fell 0.45 below the normal. The rain-area extended to northern Illinois and Lake Michigan, with increasing southerly winds, changing to snow along the northern side of the track, with strong easterly winds. The pressure was high to the southeastward, while it was quickly followed by high-pressure No. VIII; northwesterly gales resulted from Montana and Dakota to Kansas and northern Missouri; at Fort Keogh, Montana, NW. 33; Fort Stevenson and Yankton, Dakota, NW. 40; Cheyenne, NW. 36; North Platte, NW. 60 miles. 24th, it moved into Canada, accompanied by rain or snow. In the Lake region the winds generally veered to westerly gales; W. 39 at Milwaukee; NW. 38 at Grand Haven; W. 29 at Port Huron; SW. 36 at Cleveland, and NW. 30 at Toronto. On the 23rd Signals were ordered for the Upper Lakes and Lake Erie; 27th, for Lake Ontario, and from Norfolk to Portland. Along the Lakes they were fully verified, and along the coast generally not justified.

No. XIV.—Like the preceding storm, rainy weather, southerly winds and falling barometer from northern California to western Washington Ty., on the 23rd, indicated its approach; heavy easterly winds in gusts and heavy rain at New Westminster, B. C.; by midnight the centre had reached the coast of the latter. 24th, its course was northeastward into British Columbia; the barometers at Boise City and Virginia City did not even fall below the normals. 25th, light rains were frequently reported from Idaho to the Upper Mississippi valley, and the centre advanced to northern Minnesota; p. m. barometer at Pembina 0.52 below normal; at North Platte the wind velocity reached NW. 48 miles. 26th, light rains were very general from the interior of the Southern States and the Middle States to the Lakes—partly as snow in two last sections. Along the Middle Atlantic coast the wind increased to gales at night: SE. 34 at Cape Hatteras; SE. 36 at Atlantic City; SE. 45 at Barnegat; SE. 48 at Sandy Hook, and SE. 35 at New York city. At Melissa, Tex., a destructive thunder and hail-storm occurred in the evening. 27th, it passed over New Jersey into the Atlantic. Easterly gales prevailed from Long Island to Massachusetts, with heavy rains; E. 35 at New London; SE. 32 at Wood's Holl, and SE. 38 at Boston. On the 28th and 29th it was felt at Bermuda by strong southerly winds, with rain, veering to northwesterly, and barometer at 9 a. m. of latter date 29.77 in. Signals were ordered the 25th for Lakes Superior and Michigan; 26th, Lakes Huron and Erie, New Jersey and North Carolina coasts; 27th, along New England coast. Along the lakes they were partly, and along the coast fully, justified. Warnings were also sent for the Canadian stations along the lakes on the 26th.

No. XV.—During the 25th this storm advanced from the Pacific Ocean to the coast of Washington Territory. The U. S. Steamship "Alaska" reports having experienced a terrific hurricane from the southeast during the afternoon and for eighteen hours off that coast. Rainy weather prevailed in Washington Territory and Oregon all day, with south and east winds. During the night the centre evidently passed over Puget Sound; the barometer at Olympia fell but 0.24 below the normal. 26th, an extensive barometric trough formed to the southward in which southerly gales prevailed; at Winnemucca, SW. 56 and Salt Lake City, SE. 34 miles. Falling barometer, winds shifting to warmer southerly and increasing cloudiness over the Northwest indicated its approach. 27th, light rains fell as far southward as Utah, New Mexico and western Texas, with thunderstorms in southern Dakota. By midnight it was central in Minnesota, with a narrow barometric trough running to Texas; p. m. barometer at Breckenridge about 0.60 below normal. Throughout the Northwest it was preceded by brisk to high southerly winds, which shifted to northwest gales in Dakota and Nebraska; SE. 36 at Breckenridge; SE. 31 at St. Paul; NW. 32 at Yankton; and NW. 58 at North Platte. 28th, as it progressed eastward threatening and rainy weather prevailed from the Lakes to Texas and the Ohio valley, with frequent thunderstorms and brisk to high winds. 29th, during the day a second depression developed to the southward, which was central over southeastern Virginia at 4:35 p. m.; p. m. barometer at Norfolk 0.53, and midnight at Montreal 0.55, below the normals. From Lake Huron, the Lower Lakes and the St. Lawrence valley to the northern portion of the Gulf States rain was frequent. High winds and gales occurred from the North Carolina to the New Jersey coast; SW. 40 at Wilmington; SW. 35 at Kittyhawk, and SE. 28 at Sandy Hook. 30th, as shown on the chart, the two united over Maine, and there lost the distinctive features owing to the advance of storm No. XVI. On the 28th Off-shore signals were ordered for the Texas coast, and Cautionary Signals for Lake Erie and the New Jersey coast; 29th, warnings were dispatched for the Canadian stations in the St. Lawrence valley, New Brunswick and Nova Scotia, and Cautionary Signals ordered to be displayed along the coast from North Carolina to Maine. The last were very generally succeeded by southerly gales; the others, only partly justified.

No. XVI.—After the previous disturbance had passed northeastward the pressure continued considerably below the normal, and on the morning of the 30th a decided depression had developed in North Carolina; barometer at Wilmington 29.45, or 0.66 below the normal, southeast wind and threatening weather. By 4:35 p. m. the Cape Lookout barometer had fallen to 29.10, or 0.92 below the normal; the

winds along the North Carolina coast had shifted to north and east and increased to gales, with very heavy rains. In about lat.  $30^{\circ}$  N., long.  $79^{\circ} 30'$  W., several vessels encountered heavy SSW. gales, which veered to NNW. and increased to hurricane force;  $30^{\circ}$  N.,  $70^{\circ}$  W., very heavy westerly gales on this and following days, heavy seas stove deck-houses, sails blown away, &c.;  $32^{\circ} 30'$  N.,  $77^{\circ} 15'$  W., heavy SW. gale veered to NW., heavy sea;  $34^{\circ}$  N.,  $75^{\circ} 40'$  W., hurricane from NNE. veered to NW. for fifteen hours; off Cape Hatteras severe NE. gale for thirty hours;  $36^{\circ} 10'$  N.,  $72^{\circ} 10'$  W., strong SE. gale for twelve hours, suddenly changed to NNE., blew with hurricane violence, continued for thirty hours, and backed to NW., barometer 28.30, bad cross-seas, decks swept, struck by lightning; off Hatteras, SE. gale, veered to S. and SW., suddenly shifted to WNW. and increased to a hurricane, with heavy cross-sea;  $33^{\circ} 45'$  N.,  $77^{\circ} 10'$  W., most violent gale ever experienced; at Bermuda squally weather commenced in the evening. Maximum velocities: SW. 36 at Punta Rassa; NW. 32 at St. Marks and Atlanta; NW. 39 at Savannah; NW. 36 at Wilmington; N. 52 at Cape Lookout, and NE. 61 at Kittyhawk. 31st, its path was evidently farther to the eastward than as traced on the chart; at Bermuda, by noon, barometer fell to about 29.30, with heavy wind, thunder-storm and hail;  $36^{\circ} 30'$  N.,  $73^{\circ}$  W., heavy E. gale, veered to NW., increased to hurricane; 200 miles east by south from Sandy Hook, heavy S. gale, veered to NE. for two days with heavy cross-sea, barometer 28.37 in.; along the coast from North Carolina to Maine terrific NE. gales prevailed and gradually backed to NW., with snow, partly turning into rain, on the New England coast; shipping suffered very heavily, numerous vessels having been damaged, while reports have been received of the total loss of a number. Maximum velocities: N. 65 miles at Kittyhawk; N. 78 at Cape Henry; NW. 60 at Cape May; NW. 48 at Philadelphia; NW. 56 at Sandy Hook; NW. 30 at New London; NW. 48 at Wood's Holl; NW. 33 at Boston; N. 36 at Portland, and NE. 36 at Eastport. In the afternoon isobar 29.30 included an immense area—the greater portions of Nova Scotia and New England, the New Jersey coast, and thence to Bermuda. By midnight the barometer at Portland had fallen to 28.92, or 1.02 below normal; at Eastport, to 28.83, or 1.07 below normal, with heavy thunder-storm; at Halifax, to 28.95, with heavy rain and southeast wind. During the following day the centre passed over Nova Scotia to the Gulf of St. Lawrence; the p. m. barometer at Halifax fell extraordinarily low, 28.50, or 1.33 below the normal. For several days later incoming vessels report having experienced gales and high sea to the eastward of Nova Scotia. This was the most severe and destructive storm of the month. Cautionary Signals were kept up the 30th along the New England coast and ordered for the North Carolina coast; also, Off-Shore Signals for the New Jersey coast. On the 31st all Signals were changed to Off-Shore. Warnings were continued for the Canadian stations in Nova Scotia and New Brunswick. All were well justified by the subsequent gales.

No. XVII.—During the night of the 29th the pressure fell below the normal in California and Oregon. 30th, it continued diminishing, with increasing cloudiness, and extending eastward toward the Rocky Mountains. 31st, a. m. barometer at San Francisco 0.32 below normal; the central depression moved northward toward Oregon; frequent light rains fell in California.

No. XVIII—probably passed southeastward over the Northwest on the 30th as a slight barometric depression. 31st, it developed into a storm-area over the Southwest, with frequent light rains thence to Tennessee, the Ohio valley, Upper Lake region, Northwest, Wyoming, Colorado and New Mexico. Brisk to high southerly winds prevailed in the Southwest; and high northerly winds or gales in the Northwest, where the barometric gradient became quite steep through the rapid advance of high pressure No. X. The wind velocity reached S. 32 miles at Indianola; NE. 48 at Dodge City; NE. 32 at North Platte; N. 31 at Yankton; NW. 35 at Breckenridge, and NW. 42 at Pembina. The midnight barometer at Shreveport fell to 0.42 below the normal.

## INTERNATIONAL METEOROLOGY.

On chart No. IV are shown the probable tracks of storm-centres over the oceans, deduced from data received at this office up to April 5th; and in the upper right hand corner will be found an index to the same. In the upper left hand corner is a small table giving the approximate wind direction and probable maximum velocities (in miles per hour and metres per second) attending the depressions on the dates named. The following is a brief notice of the same, and also of some storms over the Southern Hemisphere.

*Atlantic Ocean.*—No. I is a continuation of area No. III of the February REVIEW; it passed rapidly eastward, south of Newfoundland, on the 10th of February. On the 11th it was encountered by the steamships "Ohio" and "Hibernian," and on this day and the 12th it prevailed as a violent storm between the meridians  $50^{\circ}$  and  $25^{\circ}$  W. On the 13th and 14th it moved southeast off the Irish coast, and high pressures, with fresh to strong westerly gales, prevailed over mid-ocean; on the latter day, and until the 18th, it was accompanied by severe gales and hurricane-winds from the Bay of Biscay to the Baltic. No. II is a continuation of area No. IV of the same REVIEW. It passed northeastward to the north of Newfoundland on February 13th. From the time of the passage eastward of the preceding area to the 19th, the pressure remained quite low over the British Isles, with the centre of depression apparently to the west-northwest, and it is possible that the present area moved somewhat as shown on chart; on the 20th it was over the British Isles, and on the 22nd approached the Baltic. No. III is a continuation of No. VI of the same REVIEW. During February 21st and 22nd it moved slowly as a very severe storm, as shown on the chart; on the 22nd it passed northward over Newfoundland, and severe southerly gales were experienced as far east as  $37^{\circ}$  W. From the 24th to the 26th it probably moved eastward, and passed to the north of Scotland on the 27th. No. IV developed in the southwest quadrant of area No. II on the 23rd. No. V developed