MONTHLY WEATHER REVIEW,

SEPTEMBER, 1876.

WAR DEPARTMENT,

Office of the Chief Signal Officer,

DIVISION OF

TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

The present REVIEW is based on the meteorological data collected in the office of the Chief Signal Officer of the Army. Especially have the regular tri-daily charts been consulted, and the monthly journals and reports from four hundred and eighteen stations, classified as Voluntary Observers, Army Posts and Signal Service stations. The more prominent features in the meteorology of the month have been, first—the general prevalence of low pressures and low temperatures east of the Rocky Mountains; second, the unusual rain-fall of the Atlantic States; third, the destructive hurricane of the 16th and 17th.

BAROMETRIC PRESSURE.

In General.—The general distribution of barometric pressure is shown by the isobars upon chart No. II, from which it will be seen that the average pressure is very uniform over the greater part of the region covered by the observations. In September, 1873, the isobar of 30.00 passed from Kansas to Lakes Erie and Ontario, and thence to the Gulf of St. Lawrence, the pressure being higher on the south and east sides. In September, 1874, the same isobar lay decidedly north of the Lower Lakes and the St. Lawrence, but curved southward through the Mississippi valley to the Gulf of Mexico. In September, 1875, its position lay to the south of the Lower Lakes and the St. Lawrence, and in the present month it is still further south and is almost entirely confined to the Gulf States, while the greater part of our territory shows an average pressure from 0.05 to 0.15 lower than in previous years. Perhaps the most remarkable features in this respect are the high pressure in and north of Minnesota and the low pressure off the Middle Atlantic States, which conditions, if they continue, may herald an early and cold winter. As compared with the isobars of August, 1876, lower pressures are noted in Oregon and throughout the Atlantic States, but decidedly higher pressures in Minnesota and Dakota, showing that the change from the summer to the winter distribution of the atmosphere is already well under way.

Areas of High Barometer.—These areas have, during the past September, been marked at each successive recurrence by a steady increase in the temperature depression, in the area and volume of cool air, and in the distance to which they have penetrated southward before being dissipated by solar heat and increasing moisture. Thus, in the early part of the month, none of these were able to produce severe northerly winds on the Gulf coast, while the last one exhibited a somewhat unexpected power in this respect, as shown by the "northers" of September 29th and 30th.

No. I.—This is recorded as No. VII in the Review for August. The course of the central area of highest pressure is very approximately given by its successive positions at 7:35 a. m., and was as follows: On the 1st, central in Dakota, the minimum temperature reported that morning from this region being 41°; on the 2nd, central in Iowa, with a minimum of 35°; 3rd, in Tennessee, minimum 56°, after which it disappeared over the Eastern Gulf and South Atlantic States.

No. II—Followed in the rear of low pressure No. II, and it was central on the successive mornings as follows: On the 4th, in Manitoba, minimum temperature 37°; 5th, Lakes Superior and Huron, minimum 39°; 6th, Maryland, minimum 43°, after which it flowed southward along the Carolina coasts.

No. III—Followed in the rear of low barometer No. IV. It was, on the morning of the 7th, central in or north of Manitoba, the minimum temperature reported being 44°; on the 8th, east of Manitoba, minimum 35°; 9th, north of Lake Superior, minimum 44°; 10th, north of Lake Superior, and the minimum 49°. By this time, also, a portion of the air had extended southward to the Texas coast, where the maximum wind was N. 14 miles; 11th, central north of Wisconsin, with extensions to Texas and New England, and a minimum of 37°, and highest wind on Texas coast N. 20 miles; 12th, north of Lake Superior, minimum 35°; 13th, north of Lakes Huron and Erie, minimum 38°.

No. IV—Followed in the rear of low pressure No. VI. Central on the morning of the 14th in Manitoba, minimum 35°; 15th, in Missouri, minimum 45°, and maximum wind on the Texas coast NE. 24 miles;

16th, north of Lake Erie, minimum 36°, with an extension to the Texas coast, maximum wind NE. 20 miles; 17th, in Maine, minimum 44°, while a hurricane was central on the North Carolina coast; 18th, in Cape Breton, minimum 38°, while the hurricane was central near Buffalo; 19th and 20th, over the Gulf of St. Lawrence; 21st, over the Gulf of St. Lawrence, minimum 36°; 22nd, central in Maine, minimum 40°.

No. V.—Followed low pressure No. VII, on its southwest side. On the 18th, central in Alabama, minimum 59°; 19th, Alabama, minimum 61°.

No. VI.—Followed low pressure No. IX, and on the 25th, was central in Dakota, minimum 35°; 26th, Dakota, minimum 30°, while the lowest pressure was in the St. Lawrence valley, and the maximum wind on the Texas coast, N. 15 miles. 27th, in Missouri, minimum 43°, the low pressure being central in the St. Lawrence valley and the wind on the Texas coast N. 14 miles. On the 28th, high pressure extended from Arkansas to North Carolina, minimum 41°, the wind on the Texas coast NE 16 miles, with the extensive area of low barometer, No. IX, in the St. Lawrence valley. On the 29th, near the Missouri valley, minimum 33°, while the low pressure over the Middle and Eastern States became central in the St. Lawrence valley, and the winds on the Texas coast were N. 15 miles. On the 30th, central in Dakota, minimum 19°, and wind on the Texas coast N. 32 miles.

Areas of low barometer.—During September eight areas of low barometer have been well developed. Five have passed along the northern limit of the signal stations; two have passed from Texas northeastward; the hurricane of the 12th to 18th passed from the Windward Islands east-northeast to the Bahamas, turning to the northeastward near the Georgia coast, and again northward over North Carolina to Washington, thence north-northwest to Buffalo, thence as a slight disturbance eastward to the Atlantic.

No. I.—The morning map of the 1st shows a depression moving southeastward over Canada: after extending as a trough from Pennsylvania to Vermont, it then passed northeast to the Gulf of St. Lawrence. The central low barometer seems to have rapidly fallen from 29.70 on the 1st, at 4:35 p. m., to 29.20 on the afternoon of the 2nd. Considerable rain fell in the Middle and Eastern States, and the highest winds were on the 2nd, 7:35 a. m., Cape May, N. W. 36; Sandy Hook, N. W. 30; at 4:35 p. m., Cape May, N. W. 40; Sandy Hook, N. W. 36; Kitty Hawk, N. 30.

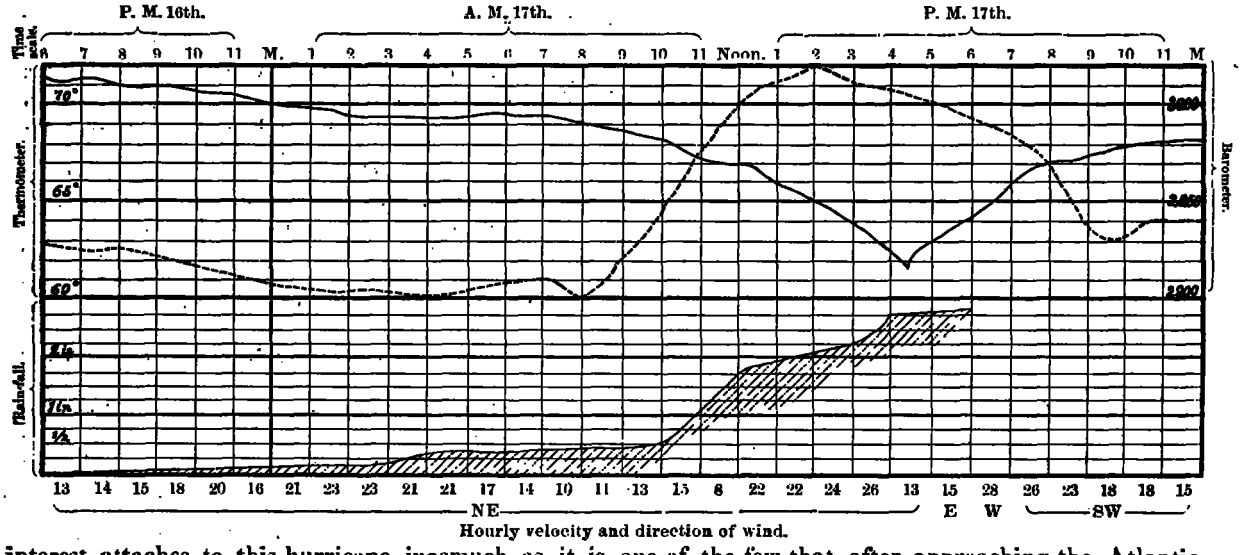
No. II.—The area of high pressure, No. I, having pushed the warmer air of the Mississippi valley west and northward, there were reported on the 2nd, at 4:35 p. m., cloud and rain in Nebraska, Kansas and Colorado, while in Manitoba appeared to be the central region of low pressure, which during the next twenty-four hours moved eastward over Lake Superior, but extended as a trough southwestward to Nebraska. Preserving its long, oval shape, it moved eastward over the Lower Lakes and was, on the 4th, in the afternoon, central near the mouth of the St. Lawrence. High winds were not reported in connection with this depression.

Nos. III, IV and V.—On the southwest side of high barometer No. II, the cold easterly winds produced cloudy weather and numerous light rains, on the afternoon of the 4th, as they ascended toward the crest of the Rocky Mountains; at 11 p. m. warm southerly winds prevailed in Kansas and Nebraska and the cold northwest winds of Colorado were attended with cloud and rain, and the barometric depression appears central near the border of these three States. During the 5th and 6th the barometer fell in all directions from this central region, but the area of greatest depression seems not to have moved any considerable distance, nor can its path be satisfactorily plotted until the afternoon of the 8th, at which time the pressure had began to rise decidedly on the north and west sides of the depression which is now numbered V, and whose subsequent track is given on chart No. I. Its course was approximately eastward, and was traversed quite slowly. The attending area of cloud and rain was quite extensive, covering on the afternoon of the 10th the Northwest, the Lake region, the Mississippi and Ohio valleys and the Atlantic States. Owing to the extensive area of high pressure in British America the winds on the Lakes continued pretty steady N. and NE. from the 7th to the 12th; no steep gradients and but few brisk winds were reported up to the time the depression left the North Carolina coast. The phenomena observed from the 3d to the 8th in Colorado, Kansas and Nebraska were about as follows: Southerly winds extended from the Texas coast northward into Kansas, with maximum temperatures of 95° to 98° during those days, and clear or partly cloudy, dry weather; northerly winds, with maximum temperatures steadily diminishing in Nebraska from 85° on the 5th, to 58° on the 8th; Cloudy and rainy weather prevailed from Nebraska northward to the British Possessions. Central and northern Kansas appears to have been the region of neutral ground between these conditions, and the observer at Great Bend states, that on each afternoon from the 5th to the 8th, the wind gradually veered from the south to the northwest or north, and (probably on the latter date) to the northeast; on each day also, a long line of cloud, extending from south of west to east, gathered to the south of the station, from which thunder-showers and slight whirlwinds or tornadoes started out, moving to the eastward at the rate of about 45 miles per hour. After the 4:35 p. m. report of the 8th, the weather charts show that the cold air accumulating to the northward flowed in a steady current over western Kansas, while the area of low pressure moved eastward. The opposition of northerly and southerly winds in the Missouri valley, was but one feature in the advance southeastward of a great area of cold air in British America. The region from Kansas northward to Lake Huron into Canada, constituted on the afternoon of the 7th a barometric trough, the northern end of which became separated the morning of the 8th from the southern end, by the intrusion of northwest winds over the Lake region, and which subsequently moved eastward as an oval area of low barometer, whose track is given as No. IV upon chart No. I. Its movement

was far more rapid than that of No. V, and no high winds were reported in connection with it at the stations, but the maps from 11 p. m. of the 9th to 11 p. m. of the 10th, seem to indicate the passage of a storm-centre northeastward past Cape Breton, which may possibly have been the subsequent course of No. IV. The observer at Harbor Grace, Newfoundland, reports a severe gale on the 10th. The first indications of its approach was noted by him on the 9th at 4:35 p. m., at which time storm No. IV must have been central in longitude 60°, latitude 43°. Rain began at Harbor Grace on the 9th at 7 p. m., with increasing NE. winds, which continued during the night without veering, and during Sunday, the 10th, with occasional heavy squalls; the aneroid barometer had fallen 0.7 in. Hurricanes were experienced on the 10th, in this neighborhood, by ocean steamers. During Monday, the 11th, the wind backed to strong NW. breezes.

No. VI.—Warm southerly winds prevailed for a short time on the 12th, from Texas to Missouri, while cold northerly winds, cloud and rain extended northward, with rising barometer, into British America. The lowest pressure on the 12th, at 11 p. m., was about 29.95 in Indian Territory, with high, cold northerly winds to the westward. This area of relatively low pressure moving northeastward, rapidly developed, on the 13th and 14th, into a well-marked storm-centre, within which the lowest pressure was 29.70. This depression passed over the Lakes and St. Lawrence valley on the 15th, accompanied by extensive light rains and no high winds; the isobars during the 14th and 15th included a narrow oval pointing nearly N. E.

No. VII.—This hurricane struck the coast of North Carolina, near Wilmington, early on the morning of Sunday, the 17th, but its presence had been perceptible so early as 4:35 p. m. of the 15th, when the Synopsis announced "indications of a severe disturbance to the east of Florida," after which date its movements were regularly predicted in the Probabilities, and the approach of severe winds forewarned by signals. As its centre passed directly over Washington between 4 and 6 o'clock of the afternoon of the 17th, the accompanying copy of the records of self-registering instruments will be interesting. A peculiar



Hourly velocity and direction of wind.

interest attaches to this hurricane, inasmuch as it is one of the few that, after approaching the Atlantic coast, has been deflected to the northwest instead of to the northeast; a deflection which was partially anticipated, and is apparently accounted for by the presence of the area of decidedly high pressure north of the Alleghanies on the 17th, and the consequent heavy rains over the Middle States and Lower Lakes, with northeast winds. After remaining nearly stationary in western Pennsylvania and New York from 11 p. m. of the 17th to 7:35 a. m. of the 18th, the centre moved slowly eastward, and appears, so far as the land stations are concerned, to have degenerated into an area of less intense wind, rain and barometric depression, nor have any reports come to hand indicating its progress eastward over the North Atlantic beyond the course given on chart No. I. Its earlier history, so far as at present known, is as follows: Earlier than the 12th, there is little or no information, but that the hurricane must have existed sometime previous to that date is evident, not only from general considerations, but also from the following note: the British brig, Mary M. Williams, Captain Hanna, from New York for Bahia, was spoken on the 12th, latitude, 25° N., longitude, 43° W., after having been damaged in a hurricane. On the 12th the hurricane-centre approached the Windward Islands, from the southeast or east-southeast, being first felt at Antigua; the lowest barometer, 29.35, occurred at St. Kitt's, on the 12th, at 8:30 p. m., and at St. Thomas, 29.45, on the 13th, 4:30 a. m., up to which time the wind had remained steady from the NE., with increasing force. At Porto Rico, (San Juan? the lowest pressure was 29.49, on 13th, at 8:30 a. m., the wind veering from NNE., on the morning of the 12th, to NE. and subsequently, at 9 a. m. of the 13th, to E. The destruction of crops and buildings is reported to have been very great at these islands. On the 14th, a light hurricane is reported

from Santiago de Cuba, and on the 15th, on the Bahama Banks; it therefore evidently passed somewhat more slowly in this portion of its course than is indicated by the first rough sketch of its track as given in chart No. I, and if the newspaper accounts that have been received are reliable, according to which the hurricane wind, both at Santiago de Cuba and the Bahamas, veered from NE. to SE., it must be considered that the track of the centre lay further westward than that here given. In its passage along the South Atlantic coast, and especially on the 16th, 17th and 18th, very heavy easterly gales prevailed from Cape Hatteras to Cape Cod. The schooner, "Addie Fuller," Captain James Jorgenson, from Brunswick, Ga., to Boston, encountered the storm while north of Cape Hatteras, and, as her barometer has been well compared and reliable, it is worth noting that the lowest pressure recorded was 29.40 about 2 p. m. of the 17th, with a southerly gale of force 8, on a scale of 10. The position of the schooner was probably 100 miles east of the track of the centre of the hurricane. The SW. and NW. winds that succeeded the hurricane, were less violent and of shorter duration at stations in Virginia than in North Carolina. The anemometers at Wilmington and Cape Lookout were disabled at the height of the storm, after recording respectively N. 60 and SW. 73 miles. Other records of high velocities are as follows: The observer at Hampton. Va., reports lowest barometer (29.10 reduced to Signal Service standard) occurred at 1:20 p. m. of the 17th, the wind veering from NE. to SE., and by 4 p. m. to S.; at Washington, D. C., the records of the central office show that the lowest barometer was 29.15 about 4:35 p. m., during a period of calm which lasted from 4:50 to 5:50 p. m.. after which the wind. which had been steady from the E., shifted to the W; the maximum wind velocity was W. 36 miles. The lowest pressures were: Smithville, 29.24; Wilmington, 29.32; Cape Lookout, 29.46.

No. VIII.—While No. VII was passing northward over the Middle States on the 17th, an area of high pressure was apparently advancing southward, reaching Oregon on the 18th, and the barometer was low at the Rocky Mountain stations and from Texas to Manitoba. The oval area of lowest pressure was, on the afternoon of the 19th, on the eastern border of Dakota, whence it extended slowly southeastward to southern Illinois on the 20th at 11 p. m.; while remaining nearly stationary there and in Tennessee and Kentucky during the 21st and 22nd, it extended westward, but eventually on the 23rd was divided into two ill-defined portions, of which the western one vanished, while the eastern one moved slowly eastward and disappeared off the middle Atlantic coast on the 24th. NE. winds, cloud and rain prevailed over the Lower Lakes, Middle Atlantic States and Upper Ohio valley, during the greater part of the time from the 20th to the 24th. Wind velocities exceeding 25 miles were rarely reported, and were essentially local in their severity.

Nos. IX and X.—Low pressure No. IX was preceded by a decided fall in the barometer in Manitoba and Dakota, where its origin may apparently be placed. At 4:35 p. m. of the 24th, it was central in Iowa, and at 11 p. m. extended as a trough from Indian Territory to Lake Superior. After this date, the northern extremity of the trough moved eastward over the St Lawrence valley, and by 7:35 a. m. of the 16th, the central depression had fallen to 29.50, with a larger area of cloud and rain, which increased still more during the day, and was especially persistent over the Lower Lake region, where rain continued until the 27th, while the central lowest pressure remained almost stationary in the St. Lawrence valley. Brisk and high SW. and NW. winds were reported on the 26th and 27th from the middle Atlantic coast and the Lower Lakes. At 7:35 a. m. of the 27th, the progress of depression No. X begins to be apparent in Manitoba, whence it moved east-southeastward over Lake Superior, and was, on the afternoon of the 28th, north of Lake Huron, while No. IX was probably over the Gulf of St. Lawrence. The very slow progress of No. X at this point, was accompanied by continued rain and brisk or high SW. winds until noon of the 29th over the Lower Lakes. The map of the 29th, 4:35 p. m., shows that at that time a very large area of low pressure must have existed in British America on the south and east of James' Bay, the southern end of which extended southward until on the morning of the 30th, the barometer was below 30.00 everywhere east of Lake Superior, Indiana and Georgia. This extended depression was accompanied by the formation of a large area of high barometer between the Mississippi and the Rocky Mountains.

TEMPERATURE OF THE AIR.

The general distribution of the temperature of the air is shown by the isotherms on chart No. II, from which it will appear that normal temperatures have been reported from the Middle and South Atlantic States, but that everywhere else the average is low, and especially so from New England and the St. Lawrence valley westward to the Missouri valley. These low temperatures may be especially attributed to the prevalence of cloudy and rainy weather, except in Minnesota, where northerly winds and higher pressures have prevailed somewhat more than usual.

Maximum and Minimum Temperatures have been as follows: *at northern stations*—Eastport, 69°, 44°; Portland, Me., 84°, 45°; Burlington, 84°, 39°; Malone, 82°, 43°; Albany, 90°, 44°; Oswego, 78°, 44°; Rochester, 78°, 40°; Buffalo, 75°, 43°; Erie, 77°, 45°; Cleveland, 78°, 40°; Toledo, 76°, 41°; Detroit, 77°, 39°; Port Huron, 75°, 38°; Alpena, 70°, 36°; Grand Haven, 76°, 42°; Chicago, 78°, 37°; Milwaukee, 77°, 32°; Escanaba, 74°, 36°; Marquette, 76°, 36°; Duluth, 75°, 34°; St. Paul, 76°, 36°; Yankton, 82°, 26°; Fort Sully, 86°, 25°; Breckenridge, 76°, 24°; Bismarck, 78°, 10°; Pembina, 75°, 27°; Virginia City, 78°, 31°; Portland, Or., 90°, 44°; *at southern stations:* Key West, 93°, 77°; Jacksonville, 97°, 56°; Savannah, 96°, 55°; St. Marks, 93°, 59°; Montgomery, 95°, 52°; Mobile, 92°, 55°; New Orleans, 91°, 69°; Vicksburg, 94°, 52°; Shreveport, 95°, 52°; Corsicana, 99°, 51°; Galveston, 94°, 62°; Indianola, 93°