MONTHLY WEATHER REVIEW.

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INTRODUCTION.

This REVIEW contains a general summary of the meteorological conditions which prevailed over the United States and Canada during February, 1887, based upon the reports of the regular and voluntary observers of the Signal Service, and co-operating state weather services.

Descriptions of the storms which occurred over the north Atlantic Ocean during the month are also given, and their approximate paths shown on chart i. In tracing the centres of the paths of these storms, data from the reports of one hundred and eighty-three vessels have been used. The weather over the north Atlantic during the month was very unsettled, and barometric pressure ranging below 29.00 (736.6) was reported on six days.

Icebergs and field ice were encountered in large quantities over the Banks of Newfoundland, and isolated bergs were passed southward to the fortieth parallel, and westward to Sable Island.

On chart i for this month are traced over the United States and Canada the paths of eleven areas of low pressure; the average number for February during the past thirteen years is 11.6. The most severe storms of the month occurred on the 11th, 17–18th, and 26–28th; the effects of the latter depression were felt in the vicinity of the Lakes and New England for over three successive days; it was accompanied by high winds with rain and snow. The storm of the 18th was peculiar, in being attended by very severe thunder-storms, for the season, in parts of New England, the middle Atlantic and west Gulf states, and the upper Mississippi valley.

Light frosts occurred in Florida and the Gulf States on the 28th.

A noteworthy feature in connection with the meteorology of the month is the unusually low temperature that prevailed in Montana and Dakota, the mean for the month in these territories being from 10° to 20° below the normal.

An excess over the average precipitation for February occurred in the greater part of the country.

In the preparation of this REVIEW the following data, received up to March 20, 1887, have been used, viz., the regular tri-daily weather-charts, containing data of simultaneous observations taken at one hundred and thirty-three Signal Service stations and twenty-one Canadian stations, as telegraphed to this office; one hundred and fifty-nine monthly journals; one hundred and sixty monthly means from Signal Service stations; twenty-one monthly means from Candian stations; two hundred and eighty-seven monthly registers from voluntary observers; fifty-four 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 Alabama, Arkansas, Illinois, Indiana, Kansas, Michigan, Minnesota, Mississippi, Missouri, Nebraska, New England, New Jersey, North Carolina, South Carolina, and Tennessee; and of the Central Pacific Railway Company; trustworthy newspaper extracts, and special reports.

ATMOSPHERIC PRESSURE.

[*Expressed in inches and hundredths.*]

The distribution of mean pressure for February, 1887, determined from the tri-daily telegraphic observations of the Signal Service, is shown by isobarometric lines on chart ii.

Two areas of high pressure appear on chart ii; the first covers the greater part of Minnesota, Dakota, and Montana, within this area the mean pressure of the month is 30.20 or more; in the extreme northern part of Montana and Dakota it is 30.25. The second area of high pressure extends over the middle and south Atlantic states, where the mean of the month is also 30.20 or more; in the eastern part of North Carolina the high mean of 30.25 is attained. Two areas of comparatively low pressure appear on the chart; the first extends along the coast of Washington Territory, and is shown by the isobar of 29.90; the lowest mean pressure of the month occurs within this area, one station, Tatoosh Island, Washington Territory, giving a mean of 29.89. From this area southeastward the pressure increases rapidly until the isobar of 30.00 is reached at Portland, Oregon. The second low area covers the greater part of the middle plateau, and shows a mean of 29.95 or less.

The departures from the normal pressure are given in the table of miscellaneous meteorological data, and are also shown on chart iv by lines connecting stations of equal departure. The pressure of the month is above the normal over the valleys of the Mississippi and Missouri rivers, and from thence eastward to the Atlantic. In the plateau region of the Rocky Mountains, and along the Pacific coast, it is considerably below the normal. The larger departures in excess of the normal occur in Maine and the Canadian Maritime Provinces, where they range from .11 at Portland, Maine, to .16 at Halifax, Nova Scotia. The pressure is also largely in excess of the normal in the northern part of Minnesota, Dakota, and Montana. The greatest departures below the normal occur in the middle plateau region, the pressure of the month at two stations within this area, Salt Lake City, Utah, and Winnemucca, Nevada, being .18 and .17, respectively, below the normal.

The mean pressure of February, 1887, exceeds that of January, 1887, in all districts of the United States, except in the middle and southern plateau regions of the Rocky Mountains and along the Pacific coast. The increase in the northern districts, especially in Montana, is large; at one station, Fort Assinaboine, Montana, the pressure of February is .28 above that of January. In the upper Mississippi valley, the Lake region, and New England, the increase averages about .18. In Utah, Nevada, Oregon, and northern and central California, the pressure of February is about .15 below that of January.

BAROMETRIC RANGES.

The monthly barometric ranges at the various Signal Service stations are given in the table of miscellaneous data. An examination of the table will show that they are unusually large in all parts of the country, and especially in New England and the middle Atlantic states; this is due to the very high pressure that prevailed on the 3d, 4th, and 5th, and the

low pressure of the 11th and 18th. The following are some of the extreme monthly ranges:

Greatest.	Inch.	Least.	Inch.
Mount Washington, New Hampshire	2.24	Key West, Florida	0.39
Omaha, Nebraska	1.92	San Diego, California	0.52
Albany, New York	1.87	Sanford, Florida	0.58
Yankton, Dakota	1.84	Cedar Keys, Florida	0.59
Alpena, Michigan	1.84	Los Angeles, California	0.68
Portland, Maine	1.83	Yuma, Arizona	0.68
Port Huron, Michigan	1.82	Jacksonville, Florida	0.70

AREAS OF HIGH PRESSURE.

Eight areas of high pressure were observed within, or near the limits of, the stations of observation during the month of February. These areas were generally first observed in the extreme northwest north of Montana and Dakota, and their general course was to the eastward north of the Lake region, the southern portions extending over the United States. Two of these areas first appeared on the Pacific coast, one of which passed eastward north of the United States, and the other passed southeastward to the Gulf of Mexico. Of the areas which were first observed in the Northwest, two passed southeastward to the upper Mississippi valley, and one of these moved eastward, while the other disappeared by gradual decrease of pressure. The following is a detailed account of the meteorological conditions attending the movements of these areas:

I.—On the morning of the 1st the barometric pressure exceeded 30.80 in the regions north of Minnesota, with temperatures ranging from —28° to —35°. This area of high pressure extended eastward to the Atlantic and westward to Idaho, while the southern limit was bounded by the thirty-eighth parallel, extending from Virginia to Colorado. An area of unusually low pressure extended over the central Rocky Mountain and plateau regions, where the temperature was above freezing. The 7 a. m. report of the 2d indicates that this extended high pressure to the northward had divided, one portion moving directly eastward to the Saint Lawrence Valley, where the pressure exceeded 30.90; the other portion moved slightly southward to the upper Missouri valley, where the pressure exceeded 30.70, with temperatures ranging from —30° to —46° in Montana and Dakota. Immediately to the south of the high area central in the mountain regions, the area of low pressure previously referred to was observed in central and western Colorado; the barometric gradient being marked between northern Colorado and southern Montana, the range of pressure being 29.55 at Montrose, Colorado, to 30.61 at Fort Custer, Montana. During the succeeding day the eastern portion of this high area disappeared off the north Atlantic coast, while that portion over the northern Rocky Mountain region remained almost stationary in Montana, where the pressure increased to 30.87 and above, attended by temperatures ranging from —30° to —48°. This increase of pressure was attended by a rapid flow of cold air from the northern and central Rocky Mountain slopes to the Missouri Valley. On the following day it was central in Minnesota, where the pressure exceeded 31.00. The cold wave attending this area of high pressure extended southward to the Gulf States on the morning of the 4th, and eastward over the Lake region and Ohio Valley. The succeeding reports during the 5th and 6th indicate that this area moved directly eastward, with a slight variation in barometric pressure at the centre. It passed off the New England coast on the night of the 5th and was central east of Nova Scotia on the 6th, leaving a secondary high area over the south Atlantic states.

II.—This area of high pressure was apparently a part of the preceding one and was separated from it by a slight depression, within which the barometer fell to 30.20, north of the Lake region. When central in the region north of Montana it was attended by pressures ranging from 30.70 and above. It passed eastward during the 6th and 7th along the fiftieth parallel. The temperature changes attending this high area were not as marked as those observed during the transit of number i in the interior, but the weather was cooler in the Maritime Provinces on the morning of the 8th, when the centre of greatest pressure was near to, and east of, the coast line.

III.—This area was first observed in the region north of Montana. The morning report of the 9th indicated the approach of a cold wave from Manitoba, where the temperature had fallen to —30°, while at the centre of the greatest pressure, the Saskatchewan Valley, it was ranging from —7° to —22°. In this case the lowest temperature being to the east of the centre of greatest pressure, was apparently an indication that the high area extended far to the northward, and that it would increase in energy and intensity. The trough of low pressure bounded the southern quadrants of this high area on the 10th, and extended from the upper Saint Lawrence valley to northern Texas, and thence northwestward to Oregon. The cold air from the region of highest pressure flowed rapidly southward over the eastern Rocky Mountain slope and the central valleys, apparently forcing the area of low pressure in the mountain regions to the south and west, and finally causing it to disappear by gradual increase of pressure. The barometric trough to the east contracted and developed great cyclonic energy, the winds being strongest from the west, owing to the rapid advance of this high pressure, attended by a cold wave which extended over regions eastward of the Mississippi during the 11th and 12th. After reaching the lower Missouri valley the direction of movement was to the east, the pressure increasing as the centre approached the Atlantic coast. When first observed this area was enclosed by the isobar for 30.50, and when last observed, passing off the New England coast, it was bounded by the isobar for 30.90. The entire Atlantic coast from Sydney to Florida was within its limits.

IV.—This area also first appeared in the region north of Montana, the a. m. report of the 14th indicating its movement to the southward. The centre was located in the region of the high mountain stations, and although the maximum pressure observed was only 30.34, the area was well defined and apparently possessed considerable energy, but after moving southeastward, without producing marked changes in temperature, it disappeared by gradual decline of pressure while passing over the central valleys and before reaching the coast.

V.—This area of high pressure approached from the Pacific, apparently moving northeast during the 16th and 17th, and it was probably central on the north Pacific coast on the morning of the 18th. A secondary area of high pressure developed east of the Rocky Mountains during the 18th, and moved eastward, north of the Lake region, during the 19th, 20th, 21st, and 22d, when it extended over the Maritime Provinces as a well-defined contracted area of high pressure, the barometer having risen at the centre over .20 in its passage over the centre of the continent to the coast line.

VI.—This area was observed north of Dakota on the afternoon of the 21st, and passed rapidly eastward, reaching the New England coast on the afternoon of the 23d, after which it disappeared rapidly, owing to the advance of the severe storm over the Lake region and the Saint Lawrence Valley. The temperature changes attending this and the preceding area were slight, and in each case light snows, followed by fair weather, were observed in the Northern States.

VII.—When this area appeared in the Northwest on the morning of the 23d, a low area was central in northern Texas and a second depression was approaching Washington Territory from the Pacific. The storm in the Southwest moved rapidly toward the Lake region, and was followed during the 24th by the advance of this high area over the central valleys, attended by clear and cold weather. The first movement was to the southward, the centre of greatest pressure reaching the forty-second parallel in the upper Mississippi valley, after which the movement was easterly over the Lakes during the 25th and 26th, when it disappeared to the east of Nova Scotia.

VIII.—This area appeared on the central Pacific coast on

the 25th, and, extending over the plateau region, was a well-defined area, remaining over the central Rocky Mountain region until the 27th. It then apparently caused the formation of a secondary high area to the southeastward over the Rio Grande Valley and the west Gulf during the 27th, after which the wind shifted to southerly in the Rocky Mountain regions, where the temperature rose and the barometer fell slowly until the end of the month.

AREAS OF LOW PRESSURE.

Eleven areas of low pressure were traced on the tri-daily weather charts during the month of February. In the region of greatest barometric disturbance, extending from the Saint Lawrence to the upper Mississippi valley, four well-defined depressions were traced from the Pacific coast over the Rocky Mountain region, and thence eastward to the north Atlantic coast. Three barometric disturbances passed eastward over the Rocky Mountains to the eastern slope, and were followed by secondary depressions which developed in the Mississippi Valley. These secondary areas moved eastward and developed greater energy as they approached the coast. The direction of movement of all areas in the Rocky Mountain regions was slightly to the southeast, and the direction of movement to the east of the one hundredth meridian was, in all cases, to the north of east. The only depression traced over the Southern States during the month was a secondary formation, with but slight energy.

The following table shows the latitude and longitude in which each area of low pressure was first and last observed, and the average hourly velocity of each:

Areas of low pressure.	First observed.		Last observed.		Average velocity of translation in miles per hour.
	Lat. N.	Long. W.	Lat. N.	Long. W.	
	° ′	° ′	° ′	° ′	
No. I	43 00	117 00	38 00	110 00	15.0
II	44 00	125 00	40 00	99 00	14.0
III	45 00	90 00	48 00	62 00	35.0
IV	42 00	116 00	38 00	104 00	46.0
V	42 00	90 00	47 00	59 00	37.0
VI	39 00	126 00	51 00	67 00	45.0
VII	38 00	126 00	50 00	66 00	28.0
VIII	38 00	107 00	29 00	100 00	25.0
IX	32 00	92 00	35 00	77 00	55.0
X	45 00	123 00	47 00	59 00	40.0
XI	47 00	125 00	48 00	65 00	38.0

Average rate of movement, 34.4 miles per hour.

The following is a brief description of the more important areas of low pressure traced during the month:

I.—The telegraphic reports received at 7 a. m. on the 1st indicated the presence of an extended area of low pressure central over the central plateau regions and reaching eastward to Colorado. These conditions continued until the morning of the 2d, when the low area had moved to the eastward from western Colorado, and the pressure had increased rapidly at the northern Rocky Mountain stations, there being a marked barometric gradient between southern Montana and northern Utah. In western Colorado the wind continued from the southwest during the 1st and 2d, with high velocities, and, during this continued southwest wind, the pressure was increasing rapidly to the northeast, and the high area was moving southward over the Rocky Mountains, apparently crowding the low area to the westward; the direction of the wind at Montrose, Colorado, was perpendicular to the isobars during the 2d, and toward the region of greatest pressure. This condition was also observed at Cheyenne, Wyoming, during the 2d, and continued until the 3d, when a cold wave extended southward as far as Texas, over the eastern Rocky Mountain slope. The low area over the plateau regions gradually filled up, but the attending southerly winds in the eastern quadrants caused continued high temperatures over western Colorado, the boundary line of the cold wave apparently extending over central Colorado southward to the southeast portion of New Mexico. The temperature was unusually low in Wyoming as far west as Fort Bridger, while at Salt Lake City, Utah, and neighboring stations generally, it did not fall below 20° at the regular tri-daily report during the continuance of the severe cold to the east and north of Salt Lake City.

II and III.—Number ii was observed on the northern California coast at midnight of the 3d, and it passed slowly eastward over the central plateau region, becoming well defined during the 4th and 5th, and remaining almost stationary over Nevada until the afternoon of the 6th. The storm-track on chart i is approximately given, showing the position of the centre of this disturbance, and indicating an apparent westerly movement during the 5th, when an area of unusually high pressure extended over the northern Rocky Mountain stations. The easterly movement of this area was resumed, and corresponded to the easterly movement of the high area above referred to, during the 6th and 7th, the former passing over the Rocky Mountains and the eastern slope along the fortieth parallel, and finally disappearing after the 10 p. m. report of the 7th, while central over Kansas. It filled up and a secondary area developed, which has been traced as number iii, and which was central in central Wisconsin at the report above referred to. This secondary area developed great energy as it passed over the Lake region, attended by general rains in the south and east quadrants; the rain-area extending southward to the Gulf States. The pressure decreased rapidly at the centre as this disturbance passed down the Saint Lawrence Valley, and reached the minimum on the morning of the 9th, when the barometer at Anticosti, Gulf of Saint Lawrence, was reported as 29.18. Strong westerly gales prevailed after this disturbance moved over the north Atlantic, and the precipitation was heavy in the Maritime Provinces.

IV and V.—On the 9th a low area formed over the central plateau region and was apparently forced slowly to the southeastward by the advance of a cold wave over the northern Rocky Mountain regions, attended by an unusually high barometer. As this low area moved southeastward it became compressed, and, in the form of a barometric trough, extended from southeastern Colorado to Oregon. It was forced southward over Colorado and New Mexico during the 10th, and by midnight of that day it had been replaced by the rapid flow of the cold air from the north, along the eastern slope. This movement from the north was accelerated by the formation of a secondary depression in the central Mississippi valley, which has been traced as low area number v. In advance of this low area, at stations east of the lower Mississippi valley, the temperature was unusually high; at midnight of the 10th there was a difference of 60° between the temperatures observed in southeastern and northern Kansas. Area number v moved northeasterly over the lower lake region and thence to the New England coast, the pressure decreasing rapidly at the centre. A cold wave followed quickly to the westward, attended by strong westerly winds and violent storms on the coast north of Hatteras. The barometer reached its minimum, 29.01, at Yarmouth, Nova Scotia, at midnight of the 11th. The strongest gales on the New England coast occurred on the 12th, when the centre of lowest pressure was northeast of Sydney, Nova Scotia. The precipitation was heavy in the lower lake region and the Ohio and lower Missouri valleys as the centre of the disturbance passed over these sections, while light showers occurred in the northern portions of the Gulf States and light snows in the Northwest.

The following notes from Signal Service observers are of interest:

Springfield, Illinois: heavy rain fell during the early morning of the 11th; at 9.40 a. m. snow began falling and continued until 8.40 p. m. High northerly and westerly winds prevailed all day, attaining at 6.30 and 7.30 a. m. a velocity of thirty-two miles per hour from the west.

Columbus, Ohio: the morning of the 11th opened with heavy clouds and occasionally light rain, with barometric pressure 29.32 at 7 a. m. Shortly after this hour a high wind set in from the southwest; it then veered to northwest, and moved with the velocity of a gale. The wind continued to increase in force until it reached its maximum velocity, fifty-four miles per hour, at about 1 p. m. The high velocity of from thirty-five to forty-five miles per hour was retained until 6 p. m., when the gale began to subside. Light and heavy rain fell during the prevalence of this gale, and light snow from 7.30 to 9.15 p. m. No

serious loss resulted from the storm, but telegraph and telephone companies experienced considerable delay in work. During the afternoon a tornado occurred at Carrollton, twenty-five miles southeast of Columbus, destroying considerable property.

Saint Louis, Missouri: from 5 a. m. until 9.20 p. m. of the 11th a northwesterly gale prevailed, the velocity of the wind being over forty miles per hour. Numerous signs, trees, fences, and roofs in different parts of the city were blown down. Light rain fell from 1.45 until 3.30 a. m., and light snow from 10.10 until 11.55 a. m.

Pittsburg, Pennsylvania: during the 11th the barometer fell rapidly until 10 a. m., when it stood at 29.32, after which it rose slowly. Brisk south and southwest winds prevailed in the morning; during the afternoon the wind shifted to northwest and blew hard.

Philadelphia, Pennsylvania: during the 11th the barometer fell rapidly until 2.40 p. m., when it stood at 29.26. In the afternoon the wind blew a gale of thirty to thirty-eight miles per hour from the southwest; at 2.40 p. m. it shifted to the northwest and diminished in force. After sundown the wind again increased in force, and from 7.30 until after 10 p. m. blew at the rate of from thirty-two to forty-four miles per hour from the northwest.

Baltimore, Maryland: on the 11th a heavy wind storm began at 8 a. m. and continued throughout the day, attaining at 8.15 p. m. a maximum velocity of thirty-four miles per hour from the northwest. Several houses were unroofed or otherwise damaged, and trees, awnings, and wires blown down. Vessels arriving on the 12th report the storm of the preceding day as having been very severe on the Chesapeake Bay. A tow of twelve canal boats loaded with coal encountered the storm when near Pooles Island; four of the boats were sunk and the rest beached.

VI.—This area of low pressure developed in the Pacific and was first observed west of northern California on the morning of the 12th. It apparently moved rapidly northward and was central north of Washington Territory by midnight of the 12th; after this date its movement was easterly, first to the southeast during the 13th, the centre reaching the Missouri Valley near Yankton, Dakota, it then moved northeastward north of Lake Superior, and thence followed the general course of the Saint Lawrence Valley, crossing the continent in eighty hours, the centre being located between the forty-fifth and fiftieth parallels of latitude. It developed but slight energy and was attended by no unusual changes in the meterological conditions within the limits of the United States.

VII.—This area appeared on the Pacific coast west of northern California on the morning of the 14th, and apparently moved southward along the coast line, after which it passed over southern California to Nevada during the 15th. It became well defined as an area of low pressure while on the Pacific coast, and the location of the centre of disturbance has been given for each telegraphic report from the time of its first appearance until it finally disappeared over the Gulf of Saint Lawrence; it crossed the Rocky Mountains near the fortieth parallel and was apparently retarded in its movements until it reached the Missouri Valley, after which the easterly movement was more rapid. The average velocity during its entire course, while under observation, was twenty-eight miles per hour. The barometric pressure was unusually low at the centre while passing over the eastern Rocky Mountain slope, and it was below 29.00 in the lower Missouri valley; the depression was almost circular in form, and when in the central Mississippi valley was bounded by eight continuous isobars, ranging from 29.1 to 29.8. After moving over the Lake region the pressure increased slightly at the centre of this storm, which evidently reached its maximum energy while crossing the upper Mississippi valley. The rain-area attending this disturbance included all sections of the United States, except the lower Rio Grande valley, although the precipitation was not unusually heavy, except on the southern Pacific coast.

The following notes relate to this low area:

Larned, Pawnee county, Kansas: a very heavy gale began at 5.30 a. m. of the 17th and continued about thirty hours. Considerable damage was done to buildings in course of construction in Larned and throughout Pawnee county.

Columbus, Ohio: light and heavy rain fell during the night of the 17–18th, with very low barometer; lowest reading, 29.29, at 9.40 a. m. of the 18th. At 10 a. m. the wind changed from southeast to southwest and blew hard, attaining at 10.40 a. m. the velocity of a gale; maximum velocity, forty-five miles per hour, at 1.50 p. m. The gale continued until 1.55 a. m. of the 19th.

Pittsburg, Pennsylvania: rain fell at intervals on the 18th until 10 a. m. At 1.38 p. m. rain, with thunder and lightning, set in; direction of wind before the storm commenced, south; after the storm had ended, west. For about ten minutes, before 2 p. m, hail fell, the stones being about the size of a pea. During the day the barometer fell rapidly, reaching 29.30 at 2. p. m.

Buffalo, New York: a severe gale, with rain, set in at 7.30 a. m. of the 18th and continued until 6.35 p. m. of the 19th, reaching at 2 a. m. of the 19th a velocity of sixty miles per hour from the southwest. Considerable damage was done in this city and over the surrounding country; trees, signs, fences, and two large houses were blown down by this gale, which was one of the most severe of the winter.

VIII and IX.—The telegraphic reports of the 18th indicated that a depression was forming in the central Rocky Mountain regions, and the succeeding reports show that this depression was moving slowly southeastward toward the Rio Grande Valley. The depression was slight, and the movement can only be approximately traced. It disappeared apparently in the lower Rio Grande valley, and was followed by the formation of a slight disturbance in the lower Mississippi valley at midnight of the 19th. This slight barometric disturbance was attended by heavy rains throughout the Gulf States during the 19th, and light rains over the states east of the Mississippi on the 20th. The depression moved rapidly to the eastward and passed off the coast near Hatteras, and probably disappeared by increase of pressure.

X.—This area was observed on the Pacific coast on the morning of the 21st, and moved directly southeastward, crossing the Rocky Mountains to northern Texas, where the direction changed to the northeast, and finally disappeared over New England on the 25th. Like the storms previously traced from the Pacific coast during this month, the location of the centre of disturbance is given for each eight hours from the time of first observation until the last telegraphic report received during the transit of the storm. In this case the time occupied in crossing the continent was four days. It appeared in the west and disappeared in the east near the forty-fifth parallel, but its centre moved as far south as the thirty-fourth parallel while passing over the eastern slope of the Rocky Mountains. It increased in energy as it moved eastward, the barometer reaching the minimum, 28.86, at Sydney, Nova Scotia, on the morning of the 25th. The most severe gales occurred on the New England coast during the 24th, but high westerly winds continued on the 25th.

XI.—This area also appeared on the north Pacific coast, and was first observed at midnight of the 23d west of Washington Territory. It moved over a path almost parallel to that described for the previous storm and about 5° of latitude to the north, except in the eastern portions of the United States, where the tracks approach each other. Its southeasterly course continued from Washington Territory to western Kansas, and its northeasterly course from western Kansas to the lower Saint Lawrence valley. This storm occupied eighty-eight hours in crossing from the Pacific to the Atlantic coast, moving with an average hourly velocity of thirty-eight miles; while the preceding storm crossed the continent in ninety-six hours, with an average hourly velocity of forty miles. This storm also increased in energy as it approached the Saint Lawrence Valley, and the minimum pressure of the storm, and of the month, was observed at Anticosti, Gulf of Saint Lawrence, on the afternoon of the 27th, when the barometer fell to 28.73. The westerly gales on the Atlantic coast were unusually severe on the 27th, and extended as far south as Georgia. After reaching northern New England the direction of movement apparently changed from east to northeast, and at the close of the month it had disappeared to the northeast of Newfoundland, followed by cold northwesterly winds and clear weather along the Atlantic coast.

The following notes, from Signal Service observers, are of interest in connection with the description of this severe storm:

Port-Huron, Michigan: at 11 p. m. of the 25th a heavy easterly wind set in and continued to blow hard until 2.20 a. m. of the 28th; at 5.30 p. m. of the 26th it shifted to the southwest and increased in force; reaching a maximum velocity of fifty-two miles per hour from the southwest at 7 p. m. The gale during the 26th was accompanied by heavy snow until 7.40 a. m., when light rain began falling.

Columbus, Ohio: heavy rain fell during the early morning of the 26th. At

3.15 p. m. a southwesterly gale set in and increased in force until 10 p. m., when it reached a velocity of sixty miles per hour.

Sandusky, Ohio: light rain and snow, with southwesterly winds, prevailed during the early morning of the 26th. From 5.15 a. m. until 10 a. m. the wind blew at the rate of from twenty to twenty-five miles per hour, attaining at one time a velocity of thirty-five miles per hour. At 10 a. m. it veered to the west and increased in velocity. The gale continued during the remainder of the day, throughout the 27th, and until 6 a. m. of the 28th. On the 27th it frequently attained a velocity of thirty to forty-six miles per hour, with snow squalls at intervals. The observer states that the wind storm was more severe and continued longer than any other that has occurred since the establishment of this station.

Buffalo, New York: rain and snow fell at intervals throughout the 26th. A severe southeasterly gale set in at 12.40 p. m. and continued until after midnight. The observer at this place states that this was the most destructive storm that has occurred here for several years. Six houses in course of construction were levelled to the ground, and one person killed; a number of persons were injured by falling signs, trees, etc. The gale continued throughout the night of the 26–27th and until 9.35 a. m. of the 28th, reaching at 6.55 a. m. of the 27th a velocity of sixty-one miles per hour.

Rochester, New York: during the night of the 25–26th the barometer fell rapidly, from 30.02 to 29.40; at 8 a. m. the wind increased in force and began blowing a gale from the south, reaching at 2 p. m. a velocity of fifty-four miles per hour. The gale continued during the day, but shifted after midnight to the west and northwest.

Pittsburg, Pennsylvania: from 4 to 5.15 a. m. of the 26th heavy snow fell, from 5.15 a. m. until 3.30 p. m. rain fell, also from 6.35 to 9 p. m.; total precipitation, 2.01 inches. High easterly winds prevailed during the greater part of the day; late in the afternoon a westerly gale set in, maximum velocity, forty miles per hour, at 7.40 p. m. The high wind damaged property to the extent of several thousands of dollars. Brisk westerly wind continued to blow all day of the 27th, attaining at 2.40 a. m. a velocity of thirty-two miles per hour.

Erie, Pennsylvania: on the 26th a very severe wind storm set in at 12.45 a. m., attaining at 2.10 p. m. a velocity of forty-four miles per hour from the south; for five minutes, at about 12.30 p. m., the wind blew at the rate of fifty miles per hour. Snow fell during the night of the 26–27th. On the 27th the wind blew hard all day from the northwest, greatest velocity forty-three miles per hour. The gale continued until 4.15 a. m. of the 28th. This gale was continuous for fifty-one hours and thirty minutes, and raised the water in the harbor higher than has been known for years, doing considerable damage to property on and about the wharves. Several light buildings were blown down, and one person killed.

Louisville, Kentucky: clear weather, high temperature, and heavy westerly winds prevailed during the 27th; in the afternoon the wind blew a gale and did considerable damage, especially along the river. The steamers "Residence" and "Hibernia" were thrown together by the force of the gale, the former was sunk and the latter badly damaged. The exposition buildings were also injured to the extent of about $1,000.

NORTH ATLANTIC STORMS DURING FEBRUARY, 1887.

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

The paths of the depressions that have appeared over the north Atlantic Ocean during the month are determined, approximately, from international simultaneous observations furnished by captains of ocean steamships and sailing vessels; abstracts of ships' logs and other data collected by the Signal Service agencies at the ports of New York, Boston, and Philadelphia; reports received through the co-operation of the "New York Herald Weather Service;" abstracts of ships' logs furnished by the proprietors of the "New York Maritime Register," and from other miscellaneous data received at this office up to March 21, 1887.

Twelve depressions are traced, of which six passed eastward over Newfoundland; one apparently developed south of Nova Scotia, and five first appeared over mid-ocean. The general course of direction of the depressions was east-northeast to northeast, the exceptions being number v, which moved northwest from northward of the Azores, and number vii, which passed north-northeast over mid-ocean.

The month opened with a deep depression central over mid-ocean in about N. 54°, which caused unsettled weather and gales from the Banks of Newfoundland to the British Isles. To the southward of Newfoundland, and over the entire ocean south of the fortieth parallel, the barometric pressure was high. During the 2d and 3d low pressure, with north to west gales and rain, continued over the ocean east of the Banks, while off the American coast and to the southward of the fortieth parallel the barometer was high. On the 4th, under the influence of a depression which passed eastward over the Gulf of Saint Lawrence and Newfoundland, there was a decided decrease in barometric pressure, and strong south to west gales and rain off the coasts of the United States and Canadian Maritime Provinces and south of the Banks; there was also an appreciable decrease in pressure over, and to the eastward of, the Azores. On the 5th fresh to strong gales encircled a deep depression which had advanced over mid-ocean from Newfoundland, and the barometer had risen rapidly west of the fiftieth meridian and over, and to the westward of, the Azores. By the 6th the centre of disturbance had moved northeast and the pressure continued high over the western portion of the ocean, exhibiting a barometric maxima off the coast of the United States, where rain and fresh gales indicated the approach, or development of, a cyclonic area.

By the 7th there had been a rapid increase in pressure over the ocean to the eastward of the Banks, and an area of low pressure, which evidently developed in the vicinity of Nova Scotia, was central south of Newfoundland. By the 8th the depression had advanced rapidly northeastward from the southern edge of the Banks of Newfoundland, accompanied by violent disturbances, which were encountered southward to the thirtieth parallel; over the eastern and western portions of the ocean the barometer was high. On the 9th two depressions, one to the northward of the Azores and the other over the Gulf of Saint Lawrence, contributed to cause stormy weather west of the twentieth meridian; over the British Isles the pressure was high. On the 10th two depressions appeared, one, of considerable depth, having moved southeast over the Banks from the Gulf of Saint Lawrence, and the other, relatively shallow, having advanced from the southeastward over mid-ocean; over the British Isles and off the coast of the United States the pressure was high.

On the 11th a depression of moderate depth was central over mid-ocean and the barometer was falling rapidly over, and to the southward of, the Canadian Maritime Provinces; over the eastern portion of the ocean the pressure continued high. On the 12th a depression central south of Newfoundland caused heavy gales over the Banks and southward to the thirtieth parallel; over the eastern half of the ocean the barometer was high, with generally settled weather. By the 13th a depression had advanced northeast over mid-ocean from south of Newfoundland, accompanied by fresh to strong gales and rain; the depression, while not exhibiting unusual barometric minima, dominated the wind-directions from coast to coast, and the barometric gradient was steep to the eastward and westward. On the 14th the pressure was generally high from coast to coast. On the 15th a depression of slight depth appeared to the eastward of the Banks; over the balance of the ocean the pressure was high. On the 16th a shallow depression was central off the coast of the United States, in N. 39°, and a cyclonic area of slight energy was located over mid-ocean in N. 50°; to the eastward of the twenty-fifth parallel and southeast of the Banks the pressure was high. On the 17th a depression central over the Gulf of Saint Lawrence caused unsettled weather over, and to the southward of, Newfoundland; over all other portions of the ocean the pressure was high and the weather generally settled.

By the 18th the passage of a shallow depression northward of the fiftieth parallel caused fresh gales and rain over the Banks, while over the eastern half of the ocean and off the coast of the United States the pressure was high. During the 19th and 20th the pressure continued high over the ocean, except that on the latter date the barometer fell rapidly over Newfoundland and the adjacent ocean, with winds shifting to southerly over the Banks, indicating the approach of a barometric depression from the westward. By the 21st a storm-area of considerable energy had passed rapidly northeast over mid-ocean from the Gulf of Saint Lawrence, and the barometer had fallen rapidly from the forty-fifth meridian to the British coasts. From the 22d to the close of the month the meteorological conditions over the ocean were very unsettled, and the depressions which appeared daily over mid-ocean were characterized by disturbances of pronounced strength.