

Grande River. The records from Brownsville, Texas, show that easterly gales occurred during the night of the 22d, the barometer reaching a minimum of 29.15, and the wind a velocity of fifty miles from the northeast at the 11 p. m. report. The winds shifted to west through north, and a velocity of thirty-six miles, west, was reported at the 7 a. m. report of the 23d. The rainfall which occurred at Brownsville, Texas, during the prevalence of this storm from the 20th to 23d, amounted to 25.98 inches. The barometer rose rapidly as this storm moved over the land, and it was difficult to locate the centre of disturbance after it had reached the interior of Texas.

The following notes from Signal Service observers indicate the severity of this storm during its presence in Texas:

Galveston, Texas: light and heavy rain fell during the greater part of the 21st and 22d. At 1.20 p. m. of the 22d an easterly gale of twenty-seven miles per hour set in; heavy rain and gale continued throughout the night. Light rain fell during the 23d; at 11.35 p. m. a southerly gale set in and continued until 9.40 a. m. of the 24th; maximum velocity thirty-four miles per hour. At Corpus Christi the storm was more severe than at Galveston; at 3 p. m. of the 24th the gale attained a velocity of sixty-eight miles per hour from the northeast, and was accompanied by very heavy rain. The tide was very high, overflowing the lower portion of the town and carrying away thousands of ties from the Mexican-National and Aransas Pass railways.

Brownsville, Texas: on the 21st heavy rain set in at 12.18 a. m. and continued, with short intervals of light rain, all day; total rainfall in twenty-four hours 10.32 inches. During the night of the 21st-22d high easterly winds prevailed, attaining at 10 p. m. a velocity of twenty-four miles per hour. Light and heavy rain continued during the 22d; total amount for twenty-four hours 11.91 inches. Fresh and high easterly winds prevailed during the day. At 1.30 p. m. the barometer began falling rapidly, reading 29.54 inches at 3 p. m. and 29.15 inches at 11 p. m. During the afternoon the wind increased in force, attaining at 9.30 p. m. a velocity of sixty-eight miles per hour from the east. The easterly gale continued until 12.30 a. m. of the 23d, when the wind lulled and the barometer began to rise. At 2 a. m. the wind veered to west and began blowing hard, attaining between 3 and 9.45 a. m. the force of a gale; maximum velocity thirty-nine miles. The heavy rain ended at 7.48 a. m., but the sky remained overcast until 4.53 p. m., when it began to clear. The gale did considerable damage by blowing down trees, fences, and telegraph poles; much property was also destroyed by flood. During the four days that this storm prevailed, 20th, 21st, 22d, and 23d, 25.98 inches of rain fell.

VIII.—When the preceding storm was moving northward along the west Gulf coast an extended area of low pressure was observed in the northern Rocky Mountain region. This disturbance moved slowly eastward extending southward to northern Texas, the barometer falling to 29.40 in northern Dakota on the afternoon of the 23d. The approximate track of the centre of this area is given on chart i, from which it will be seen that its movements were irregular and that it was attended by secondary disturbances. When the Gulf storm was central in northern Indian Territory number viii extended over the upper lake region, attended by strong southwesterly winds. The area of high pressure which covered the Atlantic coast during the 25th gave way rapidly on the approach of this storm, which disappeared to the northeast on the 26th, causing strong southwest winds on the New England coast.

IX.—This area probably developed in the north Pacific; it was observed as central in Montana on the morning of the 25th, and moved over the eastern slope of the Rocky Mountains north of the territories, disappearing to the northward before reaching Lake Superior, but leaving a barometric trough which extended southwestward to New Mexico, and within which the following-described low area developed:

X.—This area was central in eastern Colorado on the 26th, while low areas were central in the Saint Lawrence Valley and north of Manitoba, and high areas covered the south Atlantic and north Pacific coasts. This disturbance passed northeastward over the Lake region, attended by rains in the Northern States, but the barometer remained about stationary at the centre during the transit, and only light to fresh winds were reported in the Lake region.

The following notes relative to low areas number ix and x have been received from observers:

Fort Buford, Dakota: on the 26th a westerly gale set in at 1.45 a. m. and continued until 3 a. m.; maximum velocity thirty-eight miles per hour; light

rain fell from 6.30 to 8 a. m. The wind continued high and from the west all day; between 7 and 8.30 a. m. it blew at the rate of forty-five miles per hour. Fair weather and high westerly winds prevailed during the 27th; maximum velocity forty-eight miles per hour at noon.

Moorhead, Minnesota: on the 26th, at 9.35 a. m., a gale began to blow from the southeast; maximum velocity thirty-seven miles per hour at 12.45 p. m.

Saint Vincent, Minnesota: on the 26th, at 11.10 a. m., a gale set in, attaining at 1.15 p. m. a velocity of thirty-two miles per hour from the south. At 8.15 p. m. the wind became high again; maximum velocity twenty-eight miles per hour from the west.

XI.—This area appeared far to the north of Manitoba on the 29th and passed southeastward, developing great energy over the northern portion of the upper lake region during the night of that date, the barometer falling to 29.29 at Prince Arthur's Landing at the midnight report. At the close of the month this storm was central near Kingston, Ontario, with brisk to high westerly winds over Lakes Huron and Erie. The pressure had increased .30 near the centre of disturbance during its passage from Lake Superior to the Saint Lawrence Valley.

The following notes relate to this storm:

Moorhead, Minnesota: on the 29th high northwest wind prevailed from 3.40 to 8 p. m., maximum velocity thirty miles per hour, at 6.02 p. m. Light rain fell from 4.15 to 7.45 p. m.

Escanaba, Michigan: after 3 p. m. of the 29th the barometer began to fall very rapidly, at the same time increasing southwest wind set in, reaching at 10 p. m. a velocity of twenty-six miles per hour.

Saint Vincent, Minnesota: at 12.35 p. m. of the 29th light rain began and continued until 2.43 p. m., the rain was followed by a northwest gale from 2.30 until 8.45 p. m., with a maximum velocity of thirty-nine miles per hour. Light snow fell from 9 to 10.50 p. m.; depth, one inch.

Duluth, Minnesota: during the 29th the sky was overcast, heavy rain fell from 8.15 to 9.40 p. m. Wind southwest and increasing in velocity throughout the day, at 10.35 p. m. it veered to northwest and reached a velocity of thirty miles per hour.

Sandusky, Ohio: at 12.15 p. m. of the 30th a gale set in from the southwest; at 6 p. m. the wind veered from southwest to northwest and increased in force, maximum velocity forty-six miles per hour; the gale continued during the night. Heavy rain fell from 6.30 to 9 p. m. The cautionary signals which had been hoisted twelve hours previous to the storm, 12.45 a. m., gave all persons interested ample time to prepare for its coming.

#### NORTH ATLANTIC STORMS DURING SEPTEMBER, 1886.

[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 October 20, 1886.

Ten depressions are traced, of which six passed eastward over the Gulf of Saint Lawrence and Newfoundland; three are charted across the ocean from coast to coast; two originated to the westward of the British Isles; one first appeared southeast of Greenland, and one apparently developed over mid-ocean between the fortieth and forty-fifth parallels. Violent cyclonic disturbances were reported in the sub-tropical regions north of the West India Islands during the second and third decades of the month, but reports at hand will not admit of accurately locating the centres and tracing the tracks. It is not thought that these storms were of a general character.

The following presents the characteristics of the depressions traced for the present month, as compared with those traced over the north Atlantic for September, 1885:

In September, 1885, twelve storm-areas appeared, of which two were continuations of storms which first traversed the North American continent; one was a hurricane which originated and disappeared within the tropics, and one a somewhat severe storm which developed suddenly near the mouth of the English Channel. The weather over the north Atlantic was

generally stormy and unsettled, especially over the region east of the fortieth meridian, with frequent marked fluctuations of the barometer, and moderate to strong gales, mostly from nw. to sw.

In September, 1886, the weather was unsettled over the British Isles and the ocean to the westward during the first half of the month. Advices from Glasgow, under date of the 6th, state that the heaviest rain storm ever known in that part of Scotland occurred there and over the western portion of the country; it did much damage to the crops. The depressions traced were rather evenly distributed during the month, and with but one exception the tracks are located north of the forty-seventh parallel. While the depressions, in general, exhibited less energy than those traced and described for the preceding month (August 1886), and the destructive features accompanying their passage were not so marked, each decade embraced storms of considerable violence along, or in the vicinity of, the trans-Atlantic tracks. Numbers 3, 4, 5, 7, 8, and 9 were characterized by very low barometric pressure, and accompanied throughout by hard gales and generally rough weather. Irregular reports are at hand relative to violent disturbances encountered south of the region through which depressions are traced, but as these reports are neither sufficient in number nor, in cases, accurate in detail, the paths of the centres of cyclonic areas within which the storms were encountered cannot be charted.

The following are brief descriptions of the depressions traced:

1.—This storm passed northeast over Newfoundland during the 1st, with central pressure about 29.70 (754.4), and fresh to strong gales and rain-areas southward to the thirty-fifth parallel. By the 2d the depression had passed northeast beyond the region of observation.

The following special reports are from vessels which were located in the southern quadrants of the depression:

The s. s. "Columbia," Capt. T. Mitchell, commanding, on the 1st, in N. 41° 10', W. 63° 50', had a strong gale, force 9, from sw. veering to nw. and n.; lowest barometer, 29.80 (756.9), at noon. The bark "Hiram Emery," Capt. F. W. Gorham, commanding, on the 1st, in N. 37° 11', W. 69° 36' (at noon), had a strong gale beginning at 3 a. m. from the sw., which continued, with very high seas and heavy rain, until 1 a. m. of the 2d, then veered to nw. and moderated. The rain was so heavy that the water was ankle deep on the deck at times.

2.—This storm first appeared on the 4th, in N. 60°, W. 23°, and was, possibly, a continuation of number 1, although an absence of reports will not admit of establishing the fact. On the 4th central pressure about 29.50 (749.3) was shown. During this date the depression moved southeast to N. 56°, W. 15° by the 5th, with slightly higher pressure; thence passing northeast to the north of Scotland during the 6th, with areas of heavy rain and fresh to strong s. and sw. gales to the forty-sixth parallel. The storm-centre passed eastward beyond the region of observation during the 6th without apparent loss of energy.

The following special reports were made relative to storms encountered during the passage of this depression:

The bark "Sarah," Captain Atkins, commanding, on the 4th, in N. 59° 0', W. 19° 48' (at noon), had a fresh gale from ssw. in early a. m., moderating in p. m.; barometer 29.58 (751.3) at noon. Chief Officer Kinning, of the s. s. "Roman," Capt. D. Williams, commanding, reports: "6th, in N. 51° 8', W. 14° 20' (at noon); 4 a. m. strong wind from sw., heavy sea and rain; 6 a. m. wind veered to nw. and increased to fresh gale, and at 8 p. m. to strong gale; 2 p. m. wind moderated to strong breeze, and at 10 p. m. backed to sw., then veered to w., and increased at midnight to fresh gale; barometer 29.84 (757.9) at noon."

3.—This storm followed closely after the one last described, and on the 7th, when central in about N. 58°, W. 17°, exhibited central pressure below 29.20 (741.7), and occasioned strong gales over an area extending to latitude 45° N., longi-

tude 40° W. On the 8th the centre of depression was located northwest of Scotland, with slight changes in central pressure, whence it passed east beyond the limit of observation without apparent loss of energy.

The following special reports were made relative to this storm:

The s. s. "Roman," on the 7th, in N. 50° 35', W. 19° 46' (at noon), had a strong gale, w., with heavy showers of rain and high seas; at 10 a. m. wind backed to sw. and continued with heavy squalls, then veered to w. and nw.; barometer 29.74 (755.4) at noon; continued strong gale all day; 8th, in N. 50° 3', W. 23° 30' (at noon), very heavy seas and squally; wind backed to sw. at 3 p. m. and calmed down.

Chief Officer Evans, of the s. s. "Scaw Fell," Capt. J. Stanhope, commanding, reports: "7th, in N. 50° 15', W. 12° 11' (at noon), strong gale began at 8 a. m. from s., with high seas; continued all day; wind veering to w. in a. m. of the 8th in N. 50° 23', W. 15° 23' (at noon); 2 a. m. very strong gale, w., with showers of rain and high seas; 8 a. m., wind veered to wnw., and continued all day, backing to sw. at 1 a. m. of the 9th, in N. 50° 22', W. 18° 11' (at noon); 3 a. m., veered to nw., and moderated at 8 p. m." The s. s. "Assyrian Monarch," on the 7th, in N. 50° 30', W. 15° 36' (at noon), had a heavy gale from the w., with violent squalls; barometer fell to 29.10 (739.1) at midnight. Chief Officer Simpson, of the s. s. "Gallia," Capt. M. Murphy, commanding, reports: "8th, a moderate gale began at 8 a. m. from sw., while off Queenstown; veered to w. in p. m., with squalls, and continued increasing at 4 a. m. on 9th, in N. 51° 24', W. 15° 42' (at noon), to brisk gale sw., with heavy sea; backed to s., then veered to w. and nw., and moderated in p. m.; lowest barometer, 29.40 (746.7), at 4 a. m. of the 9th."

Capt. B. Gleadell, commanding the s. s. "Celtic," reports: "6th, fresh gale commenced from wnw., and continued until the p. m. of the 7th; lowest barometer, 29.81 (757.2), at 10.30 a. m. of the 7th, in N. 49° 11', W. 36° 04'. The winds preceding the disturbance were from northeastward, and the winds following were mostly from s., sw., and wnw., being moderate to strong breezes, with squalls." The s. s. "Normandie," Capt. G. de Kersabeic, commanding, on the 6th and 7th, had a whole gale from w., veered to nw.; lowest barometer, 29.37 (746.0), at 10 a. m. of the 7th, in N. 50° 50', W. 28° 10'. The s. s. "Wisconsin," Capt. E. Bentley, commanding, on the 6th, in N. 48° 38', W. 42° 37', had a hard gale from nw.; barometer 29.60 (751.8) at noon.

Chief Officer W. Thompson, of the s. s. "Stockholm City," Capt. K. Doyle, commanding, reports: "8th, in N. 49° 51', W. 13° 15' (at noon), at 5 a. m. a moderate gale began from w.; subsided at 4 p. m. to strong breeze, and increased at night to moderate gale, w., and increased on the 9th, in N. 50° 3', W. 16° 35' (at noon), to brisk gale, backing to sw. at 1 a. m.; 4 p. m., veered to nw., with heavy squalls and high seas, and then moderated; barometer 29.59 (751.6) at noon, then rising." The s. s. "Galileo," Capt. R. Potter, commanding, on the 9th, in N. 49° 20', W. 17° 33' (at noon), had a whole gale from midnight to 4 a. m.; wind ssw., with lightning, heavy rain, and high sea; wind veered to westward at 4 a. m.; lowest barometer 29.27 (743.4). The s. s. "Ethiopia," Captain Wilson, commanding, on the 9th, while lying at Greenock, Scotland, had a fresh gale from se., veering to westerly; lowest barometer, 29.23 (742.4), at noon.

The s. s. "Manitoban," Capt. R. Carruthers, commanding, left Merville on the 9th, with wind blowing a fresh gale from ssw. at 8 a. m.; veered to w. at night, and moderated at midnight; lowest barometer, 29.32 (744.7), from noon to 4 p. m. Capt. R. S. Thompson, commanding the s. s. "Sacabosco," reports: "8th, 2 a. m., in N. 49° 30', W. 24° 20', blowing hard gale from w., with high sea; barometer 29.60 (751.8) at 5 p. m.; wind gradually abated and backed to sse., with torrents of rain; barometer falling; 9th, 2 a. m., barometer 29.25 (742.9); wind blowing with hurricane force, and gradually hauling point by point with the sun to the nw.; shortly after

which the weather moderated; lowest barometer, 29.15 (740.4), at 3 a. m., in N. 50°, W. 19°." This vessel encountered the disturbed conditions which prevailed in the southwest quadrant of depression number 3 and along the extreme southeast edge of depression number 5.

4.—This depression was central on the 8th in the Gulf of Saint Lawrence and passed north of east over the northern portion of Newfoundland to N. 51°, W. 52° by the morning of the 9th, with pressure ranging below 29.20 (741.7), and moderate gales. Pursuing a generally easterly course the storm-centre passed south of Ireland during the 13th. In its eastward passage this depression had slight pressure changes and strong gales during the 9th, 10th, and 11th; during the 12th there was a slight rise in central pressure and moderate gales to the southeastward; on the 13th it had commenced to fill up and possessed small energy. Special reports submitted relative to this storm show that while generally stormy weather attended its path remarkable or unusual features were not noted.

5.—This storm apparently developed over mid-ocean in about latitude N. 55° on the 8th, but its centre was not well-defined until the 9th, when it was located in N. 58°, W. 34°; from this position it passed eastward, with pressure 29.10 (739.1) to 29.20 (741.7), and fresh to whole gales, disappearing north of Scotland during the 11th.

The following special reports are at hand relative to this storm:

The s. s. "Toronto," Capt. J. McAuley, commanding, on the 8th, had a moderate gale from n.w. to w.; lowest barometer, 29.43 (747.5), at noon, in N. 55° 30', W. 38° 10'. The s. s. "Scaw Fell," on the 10th, in N. 50° 12', W. 23° 1' (at noon), had a fresh gale, n.w., beginning at 4 a. m.; 10 a. m., backed to sw. and increased to strong gale, with heavy showers of sleet and high seas; 11 a. m., whole gale, sw.; 2 p. m., veered to w., and to n.w. at 10 p. m., moderating at midnight.

The s. s. "Gallia," on the 10th, in N. 50° 51', W. 24° 04' (at noon), had a fresh gale from sw., beginning at 10 a. m., with rain squalls and head seas; veered to w. and n.w. in p. m., and moderated at midnight; lowest barometer, 29.43 (747.5), at 4 p. m., then rose rapidly. The s. s. "Stockholm City," on the 10th, in N. 49° 47', W. 21° 22' (at noon), had a moderate gale from sw., beginning at noon; 4 p. m., increased to brisk gale, sw. by w., then veered to w., and moderated; lowest barometer, 29.59 (751.6), at 4 p. m. The s. s. "State of Georgia," Capt. G. Moodie, commanding, on the 10th, had a fresh gale from se., backing to e. and eue., then veering to sw., w., and n.w., and backing to ssw.; lowest barometer, 28.95 (735.3), at 10 p. m., in N. 55° 3', W. 18° 23'. The s. s. "Manitoban," on the 11th, in N. 55° 21', W. 17° 53' (at noon), had a fresh gale, beginning at 4 a. m. from sw., with heavy seas; 6 a. m., veered to n.w., and moderated to strong breeze at 8 a. m.; barometer read 29.02 (737.1) at 4 a. m., and 29.50 (749.3) at midnight.

The s. s. "Buenos Ayrean," Capt. J. Scott, commanding, on the 11th, had a fresh gale, sw., with squalls; lowest barometer, 29.45 (748.0), at noon, when in N. 55° 23', W. 8° 8'. Chief Officer Stembridge, of the s. s. "Norseman," Capt. E. Maddox, commanding, reports: "Left Liverpool on the 11th, with fresh gale blowing from ssw., which continued till 4 a. m. of the 12th (in N. 51° 54', W. 7° 54', at noon), veering to sw., and moderating." The s. s. "Istrian," Capt. T. H. Fox, commanding, left Liverpool on the 11th, with a fresh gale from sw., which subsided to moderate gale, sw., by a. m. of the 12th (in N. 51° 48', W. 6° 30', at noon), with heavy sea; barometer 29.88 (758.9) at noon of the 12th.

6.—This depression was central on the morning of the 11th near the mouth of the Saint Lawrence River, with pressure below 29.60 (751.8); passing over Newfoundland it apparently dissipated to the eastward during the 12th.

7.—This storm passed eastward over Newfoundland during the early morning of the 14th, but was unimportant until the 16th, when it developed strong force, with pressure about 29.70

(754.4). On the 17th the depression was central in N. 52°, W. 29°, with pressure about 29.50 (749.3), and strong to whole gales in the southwest quadrant; from the 18th to 20th, inclusive, the storm-area remained nearly stationary over mid-ocean in latitude 50° N., with pressure about 29.40 (746.7), and hard gales; from this position it moved slightly south of east and disappeared in the direction of the French coast during the 22d, without apparent loss of energy.

The following special reports have been received from vessels encountering storms within the area of this depression:

The s. s. "Wisconsin," Capt. E. Bentley, commanding, on the 16th and 17th had a whole gale from ssw., veering to nw.; lowest barometer, 29.58 (751.3), at 11 p. m. of the 16th, in N. 47° 36', W. 40° 30'. On the 16th, at 8 p. m., there was a heavy confused swell from sw. and ne.; ship labored heavily. On the 17th, at 4.40 a. m., shipped a heavy sea, damaging the funnel and bridge. The schooner "Passby," on the 16th, in N. 50°, W. 42° 30', during a heavy n.w. gale, was struck by a heavy sea which caused much damage to the vessel and cargo. The s. s. "Rhymland," Captain Jamison, commanding, on the 16th, had a strong gale from ssw. to nw.; lowest barometer, 29.58 (751.3), at midnight, in N. 49°, W. 37° 30'. The s. s. "Norseman," on the 16th, in N. 50° 6', W. 37° 19' (at noon), had a moderate gale from wnw. commencing at midnight, with heavy squalls and high seas; barometer at noon, 29.77 (756.1); wind increased to fresh gale, with heavy squalls and rain in a. m. of the 17th, in N. 49° 0', W. 41° 35' (at noon); veered to n.w. in p. m. and continued until 4 a. m. of the 18th, in N. 48° 16', W. 47° 1' (at noon).

The s. s. "Istrian," on the 16th, in N. 50° 4', W. 33° 45' (at noon), had a fresh gale from n.w., beginning at midnight and increasing to strong gale, n.w., with high seas and squalls; 17th, gale continued all day; barometer 29.70 (754.4) at 9.30 a. m.; 18th, in N. 47° 17', W. 42° 40' (at noon), strong gale continued from n.w., with high seas and heavy squalls until noon, then moderated. The s. s. "Waesland," Capt. J. Uberweg, commanding, had a strong gale from n.w. to w. on the 17th and 18th; lowest barometer, 29.60 (751.8), at 2 p. m. of the 18th, in N. 48° 30', W. 32° 18'. The s. s. "Schiedam," Capt. A. Potjer, commanding, on the 18th and 19th had a strong gale from sw. to wnw.; lowest barometer, 29.50 (749.3), at 4.30 a. m. of the 18th, in N. 48° 20', W. 34° 50'. The s. s. "Buenos Ayrean," Capt. J. Scott, commanding, had a strong gale from w. to n., with heavy squalls, on the 16th and 17th; lowest barometer, 29.70 (754.4), at noon of the 16th, in N. 53° 0', W. 48° 6'.

The s. s. "Warwick," Capt. W. James, commanding, on the 18th, in N. 48° 35', W. 35° 2' (at noon), had very high sea and violent squalls accompanied by heavy rain and hail; barometer 29.62 (752.3). The s. s. "Donan," on the 20th, in N. 49° 30', had a moderate gale from n.w., moderating at daylight of the 21st. Chief Officer Walker, of the s. s. "British Queen," Capt. R. Wills, commanding, reports: "21st, in N. 49° 32', W. 31° 12' (at noon), moderate gale from n.w. commenced at 4 a. m., with squalls; moderated in p. m. and backed to sw.; barometer 29.65 (753.1) at 4 a. m."

Chief Officer Galbraith, of the s. s. "Durham City," Capt. M. P. Lund, commanding, reports: "20th, in N. 50° 7', W. 30° 14' (at noon), at 4 p. m. fresh gale from n.w., and heavy sea; 8 p. m., strong gale n.w.; barometer at noon 29.47 (748.5); gale continued on 21st, in N. 49° 58', W. 35° 32' (at noon), backing at noon to w. and sw., then moderating to strong breeze, se., with heavy squalls; barometer at 8 p. m. 29.73 (755.1)." The s. s. "Waesland" had a strong gale from the 20th to 22d, from e. backing to n. and veering to n.e.; lowest barometer, 29.59 (751.6), at 3 a. m. of the 21st, in N. 49° 50', W. 15° 45'.

8.—This depression passed northeastward over the northern portion of Newfoundland during the night of the 20th to N. 52°, W. 50° by the morning of the 21st, during which dates it exhibited central pressure about 29.40 (746.7), and caused strong gales to the southward; from the 22d to 24th, inclusive,

it merged into an area of low pressure central in about N. 55°, W. 45°, and dominated the weather conditions over nearly the entire ocean north of the fortieth parallel; it then circled eastward and disappeared north of Scotland during the 27th, being attended throughout its course by strong gales and generally rough weather.

The following special reports have been received relative to this storm:

The s. s. "Stockholm City," on the 20th, in N. 42° 53', W. 68° 31' (at noon), had a brisk gale, nw., beginning at 1 a. m.; wind backed to wsw. at 4 a. m., with furious squalls and heavy rain; 8 a. m., veered to nw. and continued with hard nw. squalls at 6 p. m., and moderated at midnight; barometer at 4 a. m. 29.91 (759.7). The s. s. "Istrian," on the 20th, in N. 42° 49', W. 52° 15' (at noon), had a strong gale from sw. beginning at 4 p. m., with heavy rain, moderating to fresh gale, sw., in a. m. of 21st, in N. 42° 33', W. 57° 4' (at noon), then veered to nw. and moderated; lowest barometer, 29.74 (755.4), at 8.20 a. m. of the 21st. The s. s. "Norseman," on the 20th, in N. 45° 13', W. 58° 32' (at noon), had a moderate gale from sse., beginning at 9.20 a. m., with heavy rain squalls; veered to wsw., w., and wnw., and moderated at 4 a. m. of 21st, in N. 43° 44', W. 62° 21' (at noon).

The s. s. "America," on the 21st, from N. 44° 29', W. 55° 13' to N. 43° 48', W. 57° 42', had a strong gale from wnw., with heavy sea. The s. s. "Nova Scotian," Capt. R. H. Hughes, commanding, had a fresh gale from s. to wsw., from the 19th to 22d; lowest barometer, 29.38 (746.2), at 5.15 p. m. of the 21st, in N. 49° 4', W. 48° 40'. The s. s. "Austrian," Capt. J. Ambury, commanding, had a moderate gale from ssw. to nw. on the 21st; lowest barometer, 29.62 (752.3), at 11 p. m., in N. 48° 45', W. 41° 0'.

Chief Officer C. von Qualen, of the s. s. "Island," Capt. W. Skjodt, commanding, reports: "On the 21st, in N. 52° 40', W. 33° 19' (at noon), had a whole gale, beginning at 8 p. m.; wind set in from the se. and shifted to s.; rain, with heavy increasing sea, from sw. and w. 22d, in N. 50° 30', W. 38° 8' (at noon), at 4 a. m. wind changed suddenly to w., with rising barometer and clearing weather; wind continued blowing hard, with a heavy sea; from 10 p. m. to midnight wind changed to s., with very heavy rain, then changed to sw. 23d, blowing hard all day from w., with heavy squalls and very rough sea."

The s. s. "Hermann," Capt. A. Kohlmann, commanding, on the 20th, in N. 50° 11', W. 33° 1' (at noon), at midnight, barometer 29.73 (755.1); southerly gale. 21st, 2 a. m., barometer 29.64 (752.8); wind shifted to nw. in a strong gale, with heavy sea from nw.; barometer then commenced to rise slowly, with a whole gale from wnw.; gale continued until the 23d, in N. 48° 59', W. 43° 41' (at noon). The s. s. "Douan," on the 22d, had a strong gale from w. during the early a. m.; position at noon, N. 47° 16', W. 41° 53'. The s. s. "City of Richmond," Captain Redford, commanding, on the 22d, in N. 44° 45', W. 54° 45', had a gale, force 7 to 8, from wnw.; lowest barometer, 29.78 (756.4), at 6 a. m.

Capt. B. Woolfenden, commanding the s. s. "Pavonia," reports, "21st, strong breeze began in early a. m. from sw., with squally weather and high sea; 4 a. m., lightning in nw.; 7 a. m., wind veered to wnw., and at 1 p. m. increased to fresh gale. 22d, veered to nw. in a. m., with hard squalls, high seas, and heavy rains; 4 a. m., backed to sw.; veered to w. at 8 a. m., and at noon to nw., then moderated; lowest barometer, 29.65 (753.1), at 8 a. m. of 21st, in N. 44° 28', W. 52° 23'." The s. s. "British Queen," on the 22d, in N. 48° 50', W. 37° 8' (at noon), had a fresh gale from wsw. at 10 p. m., with heavy sea; wind veered to nw. in a. m. of the 23d, in N. 48° 2', W. 37° 10' (at noon), then backed to w. and increased at noon to fresh gale, w., with heavy sea, and moderated at midnight.

The s. s. "Durham City," on the 22d, in N. 49° 27', W. 40° 11' (at noon), had wind increasing to heavy gale, sse.; 12.30 a. m., suddenly shifted to w., and increased to very heavy gale with high sea; 8 p. m. backed to sw., blowing a terrific gale; 10 p. m., veered to w. 23d, in N. 48° 30', W. 42° 6' (at noon);

1 a. m., heavy gale, w., continuing all day, with very high sea, moderating in a. m. of 24th. Chief Officer Potts, of the s. s. "Palestine," Capt. W. Whiteway, commanding, reports: "23d, in N. 50° 32', W. 33° 44' (at noon), a moderate gale began at midnight from wsw., with squalls and high seas, and continued on the 24th, in N. 49° 51', W. 37° 27' (at noon), with rain squalls; veered to w. at noon, and moderated at 8 p. m."

Chief Officer Davies, of the s. s. "Virginian," Capt. M. Fitt, commanding, reports: "23d, in N. 48° 0', W. 35° 43' (at noon), a moderate gale began from sw. at noon, with rain; veered to w. and nw., and moderated at night." The s. s. "Adriatic," Capt. H. Parsell, commanding, on the 26th, in N. 51° 0', W. 20° to 25°, had a heavy gale from sw. veering to nw., with very high sea; lowest barometer, 29.25 (742.9), at 10 a. m.; at 2.30 p. m., the wind veered to nw., with decreasing force and clearing weather. The s. s. "British Princess," Capt. E. H. Freeth, commanding, on the 25th, in N. 51° 22', W. 24° 17', had wind south, with falling barometer; 26th, in N. 51° 16', W. 26° 39', had a gale of force 11, wind ssw.; barometer 29.10 (739.1); wind shifted slowly to nw. and moderated, and barometer began to rise; sea very heavy from sw.

The s. s. "Devonia," Capt. H. Young, commanding, on the 26th, had a whole gale from sse. to nw.; lowest barometer at 2 p. m., in N. 54° 27', W. 22° 5'. The s. s. "Hibernian," Capt. John Brown, commanding, on the 26th, had a strong gale from se. to wsw.; lowest barometer, 29.12 (739.6), at 4 p. m., in N. 54° 56', W. 15° 6'. Chief Officer Barwise, of the s. s. "Iowa," Capt. S. Walters, commanding, reports: "26th, 8 p. m., moderate gale began from sw., increasing at midnight to fresh gale, sw., with high sea and thick weather; 27th, 1 a. m., in N. 51° 29', W. 13° 9' (at noon), gale veered to w., and at 3 a. m. to nw., and moderated in p. m.; lowest barometer, 29.78 (756.4), at 4 a. m. of 27th."

The s. s. "State of Nebraska," Capt. A. G. Braes, commanding, on the 26th and 27th, had a whole gale from s., veering to wnw.; lowest barometer, 29.40 (746.7), at midnight of the 26th, in N. 55° 26', W. 10° 26'. The s. s. "Bulgarian," on the 27th, in N. 51° 40', W. 7° 41' (at noon), had a moderate gale, wsw., beginning at 4 a. m.; veered to w. and moderated at noon.

Capt. F. Bouchette, commanding the s. s. "Montreal," reports: "26th, in N. 55° 43', W. 14° 45' (at noon), in the afternoon wind backed to sw. and sse., with rough confused sea, barometer falling one and one-half tenths inches per hour; 4 p. m., barometer 29.14 (740.1), a whole gale with mist and rain; 6 p. m., wind began to veer to westerly; sea high and confused; midnight, wind wsw., barometer rising slowly, and wind moderating slightly.

9.—The development of this depression, in about N. 43°, W. 43°, was indicated by reports of the 24th; by the 25th the centre of the depression was clearly defined slightly to the northwest of this position, with pressure about 29.50 (749.3) and fresh to whole gales within an extended area to the westward. The depression moved southeast during the next two days and then circled northeastward, passing towards the north coast of Scotland during the 30th. This depression was accompanied by severe disturbances throughout its course, the general character of which may be determined by the following special reports of shipmasters:

The s. s. "Virginian," on the 25th, in N. 44° 27', W. 46° 20', had a strong gale from e. at noon, backing to ne., with rain and rising sea; increased at 8 p. m., with heavy sea, and moderated at 10 p. m. The ship "New City," on the 26th, in N. 44°, W. 39°, had a hurricane from wsw., lasting seven hours. The ship "Alice D. Cooper," on the 28th, in N. 45° 13', W. 36° 5', had a hurricane from nw., veering to ne., lasting twelve hours, and causing considerable damage.

Capt. F. Manley, commanding the s. s. "Borderer," reports, "29th, in N. 49° 20', W. 16° 0' (at noon), from noon to 8 p. m. moderate gale from sw., backing to s.; 10 p. m., encountered a terrific squall, lasting half an hour; barometer 29.50 (749.3); wind hauled to wsw. 30th, 4 a. m., a whole gale from the w., with heavy wind squalls; 8 a. m., fresh gale from wnw. and

hard squalls, accompanied with rain; barometer rising; noon, moderate gale from wnw., barometer rising, sea very high, squalls less severe."

Capt. A. McKay, commanding the s. s. "Catalonia," reports: "29th, 6.20 p. m., off Fastnet, experienced the first of a gale, veering from s. through sw. to w.; 8 p. m., barometer 30.08 (764.0), wind south, strong, and increasing, with drizzling rain and rough southerly swell; midnight, barometer 30.06 (763.5), wind and swell the same. 30th, 4 a. m., barometer 29.92 (760.0), wind s. by w., force 7, high ssw. sea; 8 a. m., barometer 29.77 (756.1), wind ssw., force 8, high sw. sea; noon, in N. 51° 21', W. 14° 0', barometer 29.76 (755.9), wind ssw., force 8, high sw. sea; 4 p. m., similar; 8 p. m., inclined to moderate, barometer 29.82 (756.9), wind wsw., force 6; gale moderated from w. during October 1st."

Mr. H. W. Holland, observer on the s. s. "Bulgarian," Capt. E. Parry, commanding, reports: "29th, in N. 51° 24', W. 16° 55' (at noon), 9 hours, wind commenced to blow in fitful gusts from the se., veering gradually to westward; 16 hours, flew to mnw., and increased in strength; 17 hours, blew a whole gale, accompanied by rain and hail squalls; 19 hours, the wind commenced to moderate, sea very heavy and regular. 30th, 6 hours, took the crew from the bark "Antwerp," of Saint John, New Brunswick, water-logged and masts gone. Captain Dakin, of the "Antwerp," fired his vessel in three places. The "Antwerp" was abandoned in N. 51° 17', W. 22° 1', dead reckoning since leaving the Fastnet." The s. s. "Zaandam," Capt. H. C. von der Zee, commanding, on the 29th and 30th, had a storm from s. veering to n.; lowest barometer, 29.17 (740.9), at 1.45 a. m., in N. 49° 42', W. 16° 35'.

The s. s. "Navarro," Capt. S. de Aldecocea, commanding, on the 29th, in N. 51° 7', W. 20° 30' (at noon), had variable winds from the second quadrant, which increased to strong southerly; the barometer fell to 29.05 (737.9) at 17 hours, and the wind increased to force 10 from the sw.; at 17 hours 15 minutes the wind shifted to ssw. and moderated. Capt. Wm. Tyson, commanding the s. s. "Holland," reports: "Gale commenced at 10 a. m. of the 29th from se., force 6, and continued, with little or no increase in force, until 5 p. m., when the barometer had fallen to 28.88 (733.5), the sea at the time being very confused, and the sky obscured by dark heavy clouds, attended by rain. The wind then suddenly shifted to nne. strong gale. The ship apparently passed through the centre of the storm; lowest barometer, 28.84 (732.5), at 6 p. m., in N. 49° 50', W. 25° 17'. After blowing about eight hours the gale gradually moderated."

The s. s. "Belgenland," Capt. W. A. Beynon, commanding, on the 29th had a strong gale from ne., backing to westerly; lowest barometer, 29.01 (736.8), in N. 50° 40', W. 24° 12'. The s. s. "Iowa," on the 29th, in N. 50° 59', W. 25° 58' (at noon), had a moderate gale, beginning at 4 p. m., from ne.; 8 p. m., fresh gale, nne., high seas and squalls; barometer 29.50 (749.3) at 4 p. m.; gale continued from nne. on the 30th, in N. 50° 20', W. 31° 53' (at noon), with high seas and squalls, backing to n. and nw., and moderating in p. m.

**10.**—This depression passed eastward over Newfoundland during the night of the 29th and morning of the 30th, with fresh gales and rain to the southward. At noon (Greenwich mean time) of the 30th it was central in about N. 50°, W. 50°, without evidence of special energy.

The following reports describing storms which occurred in the vicinity of the West India Islands during September give the positions in which the disturbances were encountered. It has not been possible, however, to trace the tracks of areas of low pressure which originated in, or traversed portions of, that region during the month. A fairly well-defined depression apparently passed westward south of Hayti and Cuba during the 16th, 17th, and 18th, and entered the southern portion of the Gulf of Mexico on the 19th:

Capt. J. H. Bennett, commanding the s. s. "Edith Godden," reports: "15th, from N. 21°, W. 74° 18' to N. 30°, W. 75° 30', had moderate gales and strong easterly winds, with

heavy squalls and high easterly sea. 16th, noon, barometer 29.85 (758.2); 4 p. m., 29.79 (756.7); 8 p. m., 29.79 (756.7); midnight, 29.79 (756.7). 17th, 8 a. m., barometer 29.74 (755.4); at noon, in N. 23° 06', W. 74° 30', the barometer had risen slightly; 3.30 p. m., heavy and frequent squalls and every appearance of bad weather; 4 p. m., barometer 29.73 (755.1); 6 p. m., barometer 29.70 (754.4), moderate easterly gale, high sea, heavy squalls; gale moderated during the evening; winds continued easterly; 8.30 p. m., barometer 29.73 (755.1), squalls getting heavier and more frequent; 11 p. m., barometer 29.70 (754.4), moderate easterly gale, high sea, e., and heavy squalls."

Capt. R. B. Kelly, commanding the s. s. "Ozama," reports: "September 16th, commenced with fresh sse. wind and cloudy sky; noon, wind freshened, with high sea; 6 p. m., barometer 29.85 (758.2), wind increased to a storm, with tremendous sea; hove ship to, heading east, riding easy. 17th, 4 a. m., in N. 23° 30', W. 70° 45', barometer 29.82 (757.4); 6 p. m., barometer rising. During the last twenty-four hours tremendous rain squalls. 18th, at noon, arrived at Turk's Island. The wind during the storm was from se. to ne."

Capt. Charles Acocks, commanding the bark "Mary," reports: "22d, in N. 24° 40', W. 66° 0' (at noon), had a hard gale from ese. veering to ne., with terrific squalls of wind and rain, and very high cross seas from ese. to ne. 23d, in N. 25° 20', W. 66° 20' (at noon), 2 a. m., hard gale, barometer falling, terrific squalls of wind and rain; 8 a. m., blowing a hurricane, with very hard rain; clouds settling down upon the ship like a pall, and could not see jib-boom end, very heavy cross sea, wind ne., ship's head mnw., barometer falling to 29.25 (742.9), sea sweeping the decks; 1 p. m., barometer slightly higher, terrific hurricane, with rain; 8 p. m., wind backing to n., heavy squalls, barometer 29.40 (746.7); midnight, moderating, squally, with rain. On the 26th, in N. 25° 17', W. 67° 59' (at noon), had very heavy sea from ne., n., and nw.; midnight, hard gale, with heavy squalls, barometer 29.60 (751.8), frightful sea. 27th, in N. 25° 17', W. 67° 30' (at noon), had hard gale, with heavy rain and frightful sea, barometer 29.50 (749.3); vessel shipped seas fore and aft, tearing off all bulwarks; 6 a. m., barometer 29.45 (748.0), hard gale, clouds breaking, wind w. by n., ship's head n. by w. The appearance of the weather at this time was very peculiar, with clouds a slaty gray; noon, barometer 29.60 (751.8), weather clearing to the sw."

Capt. J. B. Zimmer, commanding the brigantine "Pearl," reports: "24th, in N. 25° 40', W. 63° 45' (at noon), barometer falling, weather gloomy and threatening. 25th, at 4 p. m., heavy sw. swell running through a sse. swell; 6 p. m., violent squalls; at night, bluish lightning in the form of balls and big flashes, at an altitude of about 25°, commencing in the ssw. and ending in the ene.; 11 p. m. of the 25th, had Saint Elmo's light at the yard-arms and royal trucks, with heavy rain; barometer falling all day; position at noon of the 25th, N. 26° 38', W. 64° 11'. 26th, day commenced with a ne. wind of great violence and heavy rain, moderating at 6 p. m. to a severe gale; at 8 p. m. the sea began to run very high, breaking heavily; put oil bags overboard; position at noon, N. 26° 38', W. 65° 31'; barometer 29.72 (754.9). 27th, severe gale throughout the day; wind hauling from ene to s., with heavy rain; compelled to use oil bags to save the vessel. Experienced heavy weather until the 30th, in N. 32°, W. 68°."

#### OCEAN ICE.

On chart i are also exhibited the eastern and southern limits of the region within which icebergs and field ice have been reported during September, 1886. These limits have been determined from reports furnished by shipmasters, and from trustworthy data published in the "New York Maritime Register" and other newspapers.

During this month the easternmost ice was encountered on the 21st, in N. 48°, W. 48° 40', by the s. s. "Crystal," and the southernmost ice reported was observed on the 10th, ten miles northeast of Cape Race, by the s. s. "Normandie."

But three icebergs were observed south of the fifty-first parallel. In the Strait of Belle Isle and eastward in the track to longitude 51° bergs were observed at intervals during the month. As is usual at this season of the year, the aggregate number of icebergs observed in the trans-Atlantic track was small; it is noticeable, however, that the quantity of ice encountered on the Banks of Newfoundland during September, 1886, was somewhat less than the average for corresponding months of previous years.

A comparison with the chart for the preceding month (August, 1886), shows the number of icebergs observed to be about the same, and the area within which they appeared to be extended about two degrees to the southward and contracted less than one degree to the westward. A scarcity of ice over the Banks was also a feature for August.

The following table shows the comparison between September, 1886, and the four preceding years:

Southern limit.			Eastern limit.		
Month.	Lat. N.	Lon. W.	Month.	Lat. N.	Lon. W.
September, 1882.....	o /	o /	September, 1882.....	o /	o /
September, 1883.....	48 25	47 10	September, 1883.....	49 01	44 33
September, 1884.....	46 06	53 21	September, 1884.....	47 39	49 14
September, 1885.....	45 40	48 22	September, 1885.....	48 40	46 27
September, 1886.....	46 40	53 00	September, 1886.....	48 00	48 40

Icebergs were reported during the month, as follows:

8th and 9th.—The s. s. "Toronto" passed seven icebergs between N. 52° 40', W. 51° 0' and N. 51° 40', W. 56° 10'.

10th.—The s. s. "Normandie," at 9 a. m., passed a small iceberg ten miles northeast of Cape Race.

13th.—The s. s. "Montreal" passed three icebergs in the Strait of Belle Isle.

17th.—The s. s. "Buenos Ayrean," in N. 52° 6', W. 53° 8', at noon, saw an iceberg to the northward; passed one at 4 p. m. thirty miles se. of Belle Isle; also one at midnight off Point Amour. The s. s. "Circassian," in N. 52° 26', W. 53° 0', passed an iceberg; also passed one off Point Amour.

20th.—The schooner "Lady Agnes" collided with a large iceberg thirty-eight miles southeast of Baccalieu Island, or about sixty miles east of Saint John's, at 8 p. m. The schooner was badly damaged and drifted helplessly at sea for seven days, finally reaching Saint John's.

21st.—The s. s. "Crystal," in N. 48° 0', W. 48° 40', passed a medium sized iceberg.

22d.—The s. s. "Sarnia" passed two icebergs one hundred and thirty miles east of Belle Isle.

25th.—The s. s. "Ontario," at 6.35 a. m., passed a large iceberg one hundred and thirty miles east of Belle Isle.

FOG.

The following table shows the limits of fog-areas encountered on the north Atlantic Ocean during September, 1886, as reported by shipmasters:

Dates.	Vessel.	Entered.		Cleared.	
		Lat. N.	Lon. W.	Lat. N.	Lon. W.
September 13-14th.....	S. S. "Gallia".....	o /	o /	o /	o /
September 14-15th.....	S. S. "Galileo".....	45 56	47 08	44 19	54 17
September 15-16th.....	S. S. "Stockholm City".....	44 14	44 0	42 13	47 58
		46 35	33 38	45 18	48 55

A table similar to the one above will hereafter be a feature of this department; and, as fog is one of the recognized dangers of navigation, it is thought that a continuous record showing the limits within which it has been observed will be of value in determining under what conditions and in what localities it is most likely to be encountered. It is hoped that captains of trans-Atlantic and coasting vessels will co-operate

in this work by giving the positions in which fog banks were entered and cleared.

SIGNAL SERVICE AGENCIES.

Signal Service agencies have been established in the Maritime Exchange buildings at New York City and Philadelphia, and in the Custom-House, Boston, where the necessary blanks and other information will be furnished to ship-masters.

In pursuance of the arrangements made with the Meteorological Office of London, England, there were cabled to that office from New York during September, 1886, four reports concerning storms and icebergs encountered by vessels in the Atlantic west of the forty-fifth meridian. Two messages were sent from Boston.

TEMPERATURE OF THE AIR.

[Expressed in degrees, Fahrenheit.]

The distribution of mean temperature over the United States and Canada for September, 1886, is exhibited on chart ii by the dotted isothermal lines; and in the table of miscellaneous data are given the monthly mean temperatures, with the departures from the normal, for the various stations of the Signal Service. On chart iv the departures from the normal temperature are illustrated by lines connecting stations of normal or equal abnormal values.

By chart iv it will be seen that the mean temperature of the month exhibits no large departures from the normal; with the exception of Hatteras, North Carolina, Augusta, Georgia, Columbus, Ohio, and five stations along the Gulf coast, the temperature averaged about one degree in excess of the normal over all that portion of the United States lying south of the forty-second parallel and east of the one hundred and third meridian. The mean temperature of Washington Territory and Oregon has also been about one degree higher than the average September. In Maine, New Hampshire, Vermont, the upper lake region, Minnesota, Dakota, the Rocky Mountain region and the southern plateau the mean temperature is slightly below the normal, the largest departures occurring in Minnesota and Dakota.

The following are some of the most marked departures from the normal temperature at Signal Service stations:

Above normal.	Below normal.
Cairo, Illinois.....	o
Leavenworth Kansas.....	3.9
Fort Sill, Indian Territory.....	3.4
Omaha, Nebraska.....	3.2
Chattanooga, Tennessee.....	3.1
Huron, Dakota.....	2.6
Philadelphia, Pennsylvania.....	2.5
Pittsburg, Pennsylvania.....	2.5
Duluth, Minnesota.....	o
Yuma, Arizona.....	5.5
Helena, Montana.....	4.7
Portland, Maine.....	3.0
Rio Grande City, Texas.....	2.4
Los Angeles, California.....	2.1
Saint Vincent, Minnesota.....	2.1
Oswego, New York.....	1.8

RANGES OF TEMPERATURE.

The monthly, and the greatest and least daily, ranges of temperature, are given in the table of miscellaneous meteorological data.

The following are some of the greatest and least monthly ranges at Signal Service stations:

Greatest.	Least.
Fort Yates, Dakota.....	o
Bismarck, Dakota.....	o
Poplar River, Montana.....	17.7
Fort Klamath, Oregon.....	19.5
Moorhead, Minnesota.....	19.9
Huron, Dakota.....	21.1
Fort Buford, Dakota.....	22.0
Winnemucca, Nevada.....	23.6
	24.1
San Diego, California.....	o
Hatteras, North Carolina.....	17.7
Kitty Hawk, North Carolina.....	19.5
Fort Macon, North Carolina.....	19.9
Cedar Keys, Florida.....	21.1
Pike's Peak, Colorado.....	22.0
Tatoosh Island, Washington Ter.....	23.6
Edgartown, Massachusetts.....	24.1

DEVIATIONS FROM NORMAL TEMPERATURES.

In the table below are given, for certain stations, as reported by voluntary observers, the normal temperatures for