



MONTHLY WEATHER REVIEW.

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No. 12.

INTRODUCTION.

This REVIEW contains a general summary of the meteorological conditions which prevailed over the United States and Canada during December, 1886, based upon the reports from the regular and voluntary observers of the Signal Service and from 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 sixty-seven vessels have been used.

No ocean ice has been reported during the month in, or to the southward of, the trans-Atlantic routes.

On chart i for this month are traced the paths of eleven areas of low pressure; the average number for December during the past fourteen years being 12.4. No severe storm occurred during the month, although the storm of the 1st on the Lakes displayed considerable energy, and the low area that passed across the east Gulf states and southern part of the south Atlantic states on the 4th, and thence up the coast on the 5th and 6th, was notable for the very heavy snowfall that attended its passage through the Southern States.

The mean atmospheric pressure of the month is slightly above the normal over the greater part of the United States; the departures are comparatively large in the upper Mississippi valley, the Missouri Valley, and in Dakota and Minnesota.

From the one hundred and fifth meridian eastward the temperature of the air has been below the normal, westward of that meridian the month has been warmer than the average December.

The precipitation of December, 1886, is nearly normal in all parts of the country, except in California and the south Atlantic and Gulf states where it is deficient, and in the north Pacific coast region where it is excessive.

In the preparation of this REVIEW the following data, received up to January 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-two Canadian stations, as telegraphed to this office; one hundred and sixty-five monthly journals; one hundred and fifty-nine monthly means from the former, and twenty-two monthly means from the latter; two hundred and ninety-three monthly registers from voluntary observers; forty-five 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, Colorado, Indiana, Illinois, Iowa, Minnesota, Missouri, New England, Ohio, and Tennessee; trustworthy newspaper extracts, and special reports.

ATMOSPHERIC PRESSURE.

[Expressed in inches and hundredths.]

The distribution of mean pressure for December, 1886, determined from the tri-daily telegraphic observations of the Signal Service, is shown by isobarometric lines on chart ii.

It will be seen from this chart that the mean pressure of the month is greatest over Dakota, Minnesota, the Missouri Valley, and the upper Mississippi valley; in these districts it averages 30.23, and varies from 30.20 to 30.25; another area of high pressure, enclosed by the isobar of 30.20, extends over southern Idaho, southeastern Oregon, and the northern part of Nevada and Utah. The area of minimum pressure covers the western part of Washington Territory, in this district the pressure averages about 29.95; at one station, Tatoosh Island, the mean pressure of the month is only 29.88. Another area of comparatively low pressure extends over New England and the Canadian Maritime Provinces; in these districts the mean pressure of the month varies from 30.08 at Boston, Massachusetts, and Block Island, Rhode Island, to 30.01 at Father Point, Canada.

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 in almost every district of the United States, but the excess is nowhere very great; the largest departures are found in the same region as the area of maximum pressure, viz., Dakota, Minnesota, the Missouri Valley, and the upper Mississippi valley, in this region the departures in excess of the normal vary from .08 at Fort Buford, Dakota, and Davenport, Iowa, to .13 at Bismarck, Dakota. The departures in the Lake region and in New England are comparatively large, varying from .04 at Block Island, Rhode Island, to .09 at Chicago, Illinois. The pressure in California, Nevada, Utah, and western Arizona is also in excess of the normal, the departures averaging .06. In the middle and south Atlantic states, Florida, and the Gulf states, the mean pressure is normal or very nearly so, no departures occurring in these districts larger than .03. In the northern plateau region and along the north Pacific coast the mean pressure of the month is below the normal, but the deficiencies are small, the largest departure being .10 at Tatoosh Island, Washington Territory.

As compared with the pressure of the preceding month very large differences, both above and below, occur in nearly all parts of the United States; in the northern plateau region and along the north Pacific coast the pressure for December averages about .20 below that of November, and varies from .16 below at Walla Walla, Washington Territory, to .28 below at Tatoosh Island, Washington Territory. Along the eastern slope of the Rocky Mountains and eastward to the Atlantic the pressure for December is considerably above that of November, the greatest increase is in Dakota, Montana, the Missouri Valley, and the upper Mississippi valley, and the Lake region, in these districts it averages about .17.

BAROMETRIC RANGES.

The monthly barometric ranges at the various Signal Ser-

vice stations are given in the table of miscellaneous data. The following are some of the extreme monthly ranges:

Greatest.	Inch.	Least.	Inch.
Mount Washington, New Hampshire.....	1.53	San Diego, California.....	0.30
Eastport, Maine.....	1.53	Los Angeles, California.....	0.32
Saint Vincent, Minnesota.....	1.50	Yuma, Arizona.....	0.40
Portland, Maine.....	1.44	Key West, Florida.....	0.41
Fort Buford, Dakota.....	1.41	San Francisco, California.....	0.48
Fort Totten, Dakota.....	1.38	Sacramento, California.....	0.54
Rochester, New York.....	1.36	Fort Grant, Arizona.....	0.54
Moorhead, Minnesota.....	1.34	New Orleans, Louisiana.....	0.60

AREAS OF HIGH PRESSURE.

[Prepared by Lieut. JOHN P. FINLEY, Signal Corps, U. S. Army, Assistant.]

The tracks of eight areas of high pressure were traced within the limits of the Signal Service charts for the month of December, 1886. With three exceptions these areas entered the United States from the region of country north of Montana and Dakota. One area began its progressive movement eastward from Washington Territory, one northeastward from North Carolina, and another eastward from Lower Canada.

Area number i passed nearly due southward from Manitoba, British America, to the Rio Grande Valley, Texas, following in rear of depression number iii, which was moving eastward along the northern coast of the Gulf of Mexico.

The information relating to the development and movement of high pressure areas is given in the accompanying table, and the designations employed are explained as follows:

The times, 7 a. m., 3 p. m., and 10 p. m., are the hours (75th meridian time) at which the tri-daily telegraphic meteorological observations are made at Signal Service stations.

These observations are used in the preparation of the daily weather maps from which indications are made, and from a study of which the tracks of high pressure areas are charted and described.

Barometric departure refers to the maximum deviation of of pressure from the normal within the central area, which deviation in all cases will have the plus sign.

Temperature departure refers to the maximum deviation of temperature from the normal within the central area, which deviation in all cases will have the minus sign.

Table of high pressure areas.

Number of area.	Date.	Hour of observation.	Location of central storm area.	Barometer departure.	Temperature departure.	Remarks.
I	3	3 p. m.	Manitoba.....	+0.81	0	This area remained stationary off the Texas coast for the succeeding 48 hours, when the central area of maximum pressure was suddenly shifted to Georgia, in which region it again became stationary until the morning of the 11th, when it moved north-eastward as No. III.
		10 p. m.	Northern Minnesota.....	+0.83	-26	
		7 a. m.	Southeast Dakota.....	+0.84	-46	
		3 p. m.	Southwest Iowa.....	+0.73	-34	
		10 p. m.	Eastern Kansas.....	+0.57	-23	
5	7 a. m.	7 a. m.	Northern Texas.....	+0.51	-35	
		3 p. m.	Southern Texas.....	+0.45	-25	
II	6	7 a. m.	Lower Canada.....	+0.40	-25	This area disappeared eastward over the Atlantic during the day.
		3 p. m.	Upper Canada.....	+0.47	-15	
		10 p. m.	Northern Maine.....	+0.59	-14	
7	7 a. m.	7 a. m.	New Brunswick.....	+0.58	-11	This area disappeared eastward over the Atlantic during the day.
		3 p. m.	Gulf of Saint Lawrence.....	+0.50	-3	
11	7 a. m.	7 a. m.	Southwest Virginia.....	+0.21	-15	This area disappeared eastward over the Atlantic during the day.
		3 p. m.	Eastern Pennsylvania.....	+0.19	-2	
12	10 p. m.	10 p. m.	Upper Canada.....	+0.38	-1	This area disappeared eastward over the Atlantic during the day.
		7 a. m.	New Brunswick.....	+0.48	-4	
IV	18	3 p. m.	Gulf of Saint Lawrence.....	+0.45	-6	The development of this area was probably influenced by a region of high pressure (30.20 to 30.60) which remained about stationary in Nevada and Utah from the morning of the 11th to the morning of the 16th, when it appeared to move northward, and finally gave rise to the movement southeastward of No. IV.
		7 a. m.	Washington Territory.....	+0.32	-3	
		3 p. m.	Western Montana.....	+0.40	-5	
		10 p. m.	Northern Colorado.....	+0.43	-6	
		7 a. m.	Southwestern Kansas.....	+0.44	-15	
19	3 p. m.	3 p. m.	Northern Texas.....	+0.40	-12	This area disappeared eastward over the Atlantic during the day.
		10 p. m.	Southern Texas.....	+0.34	-7	
20	7 a. m.	7 a. m.	Texas coast.....	+0.29	-16	This area disappeared eastward over the Atlantic during the day.
		3 p. m.	Southern Mississippi.....	+0.25	-12	
		10 p. m.	Central Georgia.....	+0.19	-15	
21	7 a. m.	7 a. m.	South Carolina.....	+0.22	-18	This area disappeared eastward over the Atlantic during the day.

Table of high pressure areas—Continued.

Number of area.	Date.	Hour of observation.	Location of central storm area.	Barometer departure.	Temperature departure.	Remarks.
V	20	10 p. m.	North of Montana.....	+0.11	-11	This area remained about stationary in Georgia and South Carolina during the succeeding 48 hours, at the expiration of which time it merged with area No. V, then central in the Ohio Valley.
		7 a. m.	Southeastern Dakota.....	+0.19	-15	
		3 p. m.	Northern Kansas.....	+0.19	-9	
		10 p. m.	Northern Missouri.....	+0.21	-7	
		7 a. m.	Southern Illinois.....	+0.25	-17	
22	3 p. m.	3 p. m.	Central Ohio.....	+0.31	-4	This area disappeared eastward over the Atlantic during the day.
		10 p. m.	Lake Erie.....	+0.39	-9	
		7 a. m.	New Hampshire.....	+0.49	-15	
23	3 p. m.	3 p. m.	Eastern Maine.....	+0.54	-2	This area disappeared eastward over the Atlantic during the day.
		10 p. m.	Nova Scotia.....	+0.62	-9	
		7 a. m.	South of Newfoundland.....	+0.59	-2	
VI	24	3 p. m.	North of Dakota.....	+0.27	-31	This area disappeared eastward over the Atlantic during the day.
		10 p. m.	Northern Minnesota.....	+0.22	-34	
		7 a. m.	Northern Michigan.....	+0.24	-24	
		3 p. m.	Lower Canada.....	+0.33	-23	
		10 p. m.	Upper Canada.....	+0.35	-34	
26	7 a. m.	7 a. m.	New Brunswick.....	+0.44	-20	This area remained stationary over Illinois and Indiana until the morning of the 29th, when it merged with area No. VIII, then central over Lake Superior.
		3 p. m.	Gulf of Saint Lawrence.....	+0.50	-18	
VII	25	10 p. m.	Eastern Montana.....	+0.36	-37	This area remained stationary over Illinois and Indiana until the morning of the 29th, when it merged with area No. VIII, then central over Lake Superior.
		7 a. m.	Central Dakota.....	+0.29	-42	
26	3 p. m.	3 p. m.	Southeastern Dakota.....	+0.31	-43	This area disappeared eastward over the Atlantic during the day.
		10 p. m.	Eastern Nebraska.....	+0.34	-44	
27	7 a. m.	7 a. m.	Southern Iowa.....	+0.42	-45	This area disappeared eastward over the Atlantic during the day.
		3 p. m.	Northeastern Missouri.....	+0.41	-39	
VIII	28	10 p. m.	Central Illinois.....	+0.40	-30	This area disappeared eastward over the Atlantic during the day.
		3 p. m.	North of Dakota.....	+0.37	-21	
29	7 a. m.	7 a. m.	Northern Minnesota.....	+0.41	-24	This area disappeared eastward over the Atlantic during the day.
		3 p. m.	Lake Superior.....	+0.42	-24	
30	7 a. m.	7 a. m.	Lower Canada.....	+0.48	-29	This area disappeared eastward over the Atlantic during the day.
		3 p. m.	Upper Canada.....	+0.54	-35	
		10 p. m.	Northeastern Maine.....	+0.63	-37	
30	3 p. m.	3 p. m.	New Brunswick.....	+0.69	-32	This area disappeared eastward over the Atlantic during the day.
		10 p. m.	Gulf of Saint Lawrence.....	+0.74	-35	

AREAS OF LOW PRESSURE.

[Prepared by Lieut. JOHN P. FINLEY, Signal Corps, U. S. Army, Assistant.]

The tracks of eleven areas of low pressure have been charted from a study of the tri-daily weather charts of the Signal Service for the month of December, 1886.

In the majority of cases the depressions began their progressive movement to the eastward, within the limits of observation, west of the one hundred and second meridian.

Areas numbers iv and viii, during their progressive movement eastward, were generally without the limits of Signal Service stations, and, therefore, their paths are approximately located.

Areas numbers ix, x, and xi, during their progressive movement to the eastward, made a decided curve to the southward in the vicinity of 35° N., 102° W., under the influence of high-pressure areas numbers vi, vii, and viii, advancing southeastward from British America.

The following table shows the latitude and longitude in which each area of low pressure was first and last observed, with the average rate of translation in miles per hour:

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.....	45 00	69 00	48 00	61 00	17.0
II.....	49 00	82 00	47 00	58 00	22.0
III.....	28 00	100 00	46 00	58 00	23.0
IV.....	51 00	112 00	51 00	61 00	46.0
V.....	35 00	109 00	50 00	62 00	25.0
VI.....	43 00	86 00	47 00	62 00	24.0
VII.....	52 00	111 00	48 00	63 00	34.0
VIII.....	51 00	109 00	51 00	67 00	45.0
IX.....	47 00	124 00	51 00	62 00	38.0
X.....	42 00	107 00	47 00	58 00	33.0
XI.....	40 00	106 00	41 00	77 00	39.0

Average rate of movement, 31.4 miles per hour.

The information descriptive of low-pressure areas is given in the accompanying table, and that the designations em-

ployed may be more clearly understood the following explanations are necessary:

The times, 7 a. m., 3 p. m., and 10 p. m., are the hours (75th meridian time) at which the tri-daily telegraphic meteorological observations are made at Signal Service stations.

Barometric departure refers to the maximum deviation of pressure from the normal within the central area, which deviation in all cases will have the minus sign.

Precipitation refers to all rain or snow that has fallen during the past eight hours, or since the last observation. In order to show, approximately, the distribution of precipitation about and within the central area of low pressure, the four quadrants of the depression are separately considered by designating the number of stations in each at which precipitation has taken place.

Table of low-pressure areas.

Table with columns: Number of area, Date, Hour of observation, Location of central area of low pressure, Barometric departure, No. of stations reporting precipitation (NE, SE, SW, NW quadrants), Remarks.

Table of low-pressure areas—Continued.

Continuation of the table with columns: Number of area, Date, Hour of observation, Location of central area of low pressure, Barometric departure, No. of stations reporting precipitation (NE, SE, SW, NW quadrants), Remarks.

No reports.

None.

The following notes from observers relate to the weather conditions prevailing during the presence of low area number ii:

Saint Vincent, Minnesota: rising barometer and fresh northwesterly winds prevailed during the early morning of the 1st; the wind gradually increased in force until 9.50 a. m. when a gale set in and continued until 7.55 p. m., attaining its maximum velocity, thirty-nine miles per hour from the north, at 11.45 a. m.

Milwaukee, Wisconsin: at 5.50 a. m. of the 1st a westerly gale set in and continued until 11.15 p. m.; maximum velocity, thirty-nine miles per hour, at 11.07 p. m. The temperature fell rapidly during the morning and remained low throughout the day; steadily rising barometer. During the night of the 1st-2d a westerly gale again set in and reached a velocity of thirty-four miles per hour. Between midnight and 1 a. m. of the 1st the steam barge "Maggie Marshall" and schooner "Arundel" were driven on the beach near Manistee, Michigan. Shortly after 1 a. m. of the 1st the schooner "Mineral State" went ashore at Jacksonport, Wisconsin, but was gotten off with only slight damage.

Port Huron, Michigan: light snow fell on the 1st from 7.35 a. m. until 3.45 p. m.; at 12.40 p. m. a westerly gale set in and reached its height, thirty-eight miles per hour, at 4.10 p. m. The gale continued throughout the night of the 1st-2d, and was accompanied by extremely cold weather, a fall of 22°.5 having occurred during the afternoon of the 1st.

Mackinaw City, Michigan: light snow began at 12.10 a. m. of the 1st and continued until the morning of the 2d, with rising barometer and falling temperature. A westerly gale set in at 8.50 a. m. and continued throughout the night, reaching at 10 p. m. a velocity of thirty-six miles per hour. On the 2d the wind blew hard from the northwest.

Chicago, Illinois: light snow fell at intervals during the 1st, with high southwest winds; maximum velocity, twenty-eight miles per hour, at 2.46 p. m. After 8 a. m. the weather began clearing, with falling temperature, attaining a minimum of -1°.0.

Buffalo, New York: the 1st was cloudy, with snow squalls at intervals; at 4.45 p. m. a westerly gale set in and continued until 7 p. m. of the 3d; maximum velocity, forty-four miles per hour, at 7.30 a. m. of the 2d.

Rochester, New York: cloudy weather, with snow, prevailed during the afternoon and night of the 1st, with brisk variable winds, increasing to high westerly, which attained the force of a gale at 11.15 p. m. and continued until 7.20 p. m. of the 2d; maximum velocity forty miles per hour.

Oswego, New York: snow began falling during the early morning of the 2d and continued until 6.30 p. m. of the 3d. The storm was accompanied by high westerly wind, which attained at 12.15 a. m. a velocity of thirty-one miles per hour. At 8 a. m. the wind shifted from west to northwest, and blew from the latter direction at the rate of thirty-three miles per hour at 3.40 p. m. Numerous reports from vessels indicate that the storm was more severe on the lakes than at this station; the schooner "Ariadne," Capt. Hugh McKay, from Toronto, Canada, for this port, laden with barley, was driven ashore in Mexico Bay, and lost, with part of the crew. The schooner "Ocean Wave" was driven ashore at Port Ontario at 2.30 p. m. of the 3d, but was gotten off with only slight damage.

The following notes from observers relate to the weather conditions prevailing along the Atlantic coast during the presence of low area number iii:

Pensacola, Florida: a heavy southeasterly wind set in during the early morning of the 4th, maximum velocity thirty-seven miles per hour. Light rain commenced at 10.30 a. m. and continued until 9.20 p. m. During the storm the Norwegian bark "Dagmar," lying alongside the wharf, was blown on her beam's end, but was righted without any serious damage. The bark "Flora" dragged her anchors and ran aground; the schooner "Wallace" was capsized, and several other vessels suffered slight damage.

Hatteras, North Carolina: heavy rain, with brisk northerly winds, occurred during the night of the 4-5th; heavy and light rain fell on the 5th, total precipitation for the thirty-six hours, 2.65 inches. At 4 p. m. of the 6th a northwesterly gale set in, reaching at 4.30 p. m. a maximum velocity of thirty-seven miles per hour. A second storm began at 11.15 p. m. and continued until 12.05 p. m. of the 7th, maximum velocity, thirty-one miles per hour, at 1.30 a. m.

Kitty Hawk, North Carolina: the 4th was cloudy, with high northeasterly winds, which attained at 5.30 p. m. the velocity of a gale, and reached at 6.15 and 10 p. m. a maximum velocity of forty miles per hour. Snow and rain fell during the night of the 4-5th and throughout the 5th; at the same time a heavy gale was blowing, attaining a velocity of forty-eight miles per hour at 2.30 a. m., 8.30, 9, and 9.30 p. m.

Smithville, North Carolina: rain began at 10.40 a. m. of the 4th and continued at intervals throughout the day. A northeasterly gale set in at 10.45 p. m., maximum velocity thirty-two miles per hour. The wind continued high during the 5th, and during the afternoon backed from ne. to n. and nw. The steam-tug "Howland" and the Norwegian bark "Elena" dragged their anchors during the storm, but no material damage was sustained by vessels in the harbor.

Baltimore, Maryland: heavy snow fell during the 4th and 5th to a depth of several inches; street cars kept up travel with considerable difficulty and all railroad trains arrived late. Light snow and rain fell during the 6th, with fresh northwesterly winds. Vessels arriving on the 5th, 6th and 7th reported a severe storm on Chesapeake Bay.

Atlantic City, New Jersey: light snow fell during the night of the 4-5th, and snow and sleet throughout the 5th. Brisk to high north and northeasterly winds prevailed on the 5th; maximum velocity, thirty-three miles per hour, at 1.50 p. m. The snow continued until 8.30 a. m. of the 6th, with high northerly winds all day; maximum velocity, thirty-six miles per hour, at 7.25, 8.10, and 11.20 p. m.

Block Island, Rhode Island: high northeasterly winds prevailed during the 5th, maximum velocity forty-eight miles per hour; the storm was accompanied by heavy snowfall, total depth for the day 8.8 inches. Sleet and light rain fell during the 6th, and the northeasterly gale of the previous day continued, attaining a velocity of fifty-one miles per hour.

Boston, Massachusetts: heavy snow began at 8.15 p. m. of the 5th and continued until 2.00 a. m. of the 6th. During the 5th the wind blew briskly from the northwest veering to northeast, highest velocity, twenty-seven miles per hour from the northeast, at 9 p. m.; total snowfall 9.5 inches. On the 6th the wind blew a gale from the north and northeast. Light snow, with northeasterly gale, prevailed during the 7th, maximum velocity thirty-six miles per hour. The heavy fall of snow which accompanied this gale seriously interfered with travel on the streets. The storm did some slight damage to vessels in the harbor; a scow used for dredging purposes was torn from its fastenings and broken up on the beach.

NORTH ATLANTIC STORMS DURING DECEMBER, 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 January 21, 1887.

Ten depressions are traced, of which five passed northeastward over Newfoundland; four apparently developed over the ocean to the southward of Nova Scotia, two of which are traced south of the fortieth parallel; one first appeared over mid-ocean in about N. 55°, and one is given a probable easterly course in the vicinity of the Azores.

The depression traced as number 1 occasioned storms of almost unprecedented violence over the British Isles during the 7th and 8th, and exhibited the lowest barometric readings ever recorded in London and Liverpool. This storm first appeared south of Nova Scotia on the 2d, and, pursuing a generally northeast course, was central in the vicinity of Aberdeen, Scotland, at noon, Greenwich mean time, of the 8th. Number 2 is first charted in N. 55°, W. 27° under date of the 2d, from which position it circled southeast and northeast, disappearing over Ireland after the 3d. Number 3 was a continuation of an area of low pressure which passed into the Atlantic Ocean from the Gulf of Mexico. This storm is traced northeastward across the Atlantic Ocean to the northern portion of Scotland by the 12th, after which date it disappeared beyond the region of marine observation. Number 4 developed south of Nova Scotia on the 6th, and, moving rapidly northeast, disappeared over mid-ocean after the 7th.

Number 5 passed northeast over northern Newfoundland during the night of the 11th; after reaching the twenty-fifth meridian the depression moved southeast and passed to the south of Ireland beyond the region of observation after the 16th. Number 6 moved east over Newfoundland during the night of the 14th, and apparently moved southeast after passing the forty-fifth meridian. Number 7 was, possibly, a continuation of number 6, and is given a probable track north of the Azores to the fifteenth meridian by the 18th, after which date its course cannot be traced, owing to an absence of reports. Number 8 appeared over the ocean south of Nova Scotia on the 20th, and, moving northeast, disappeared east of Newfoundland after the 21st. Number 9 passed northeast from the northern extremity of Florida and disappeared in the direction of the British Isles after the 22d. Number 10 is first charted south of Newfoundland, in N. 40°, under date of the 27th, and moved northeast until the 29th, after which it passed to the northward of the fifty-fifth parallel.

The first decade of the month was characterized by a succession of terrific west and northwest gales, accompanied by high seas; the disturbances being more severely felt in European waters. During this period the barometric pressure was high over and to the southwestward of the Azores, and the depressions were deflected to a northeast course after leaving the North American coast. During the second decade the weather was stormy and unsettled over the ocean east of the twentieth meridian, and gales of considerable severity were frequent over and in the vicinity of the British Isles.

The area of high pressure which occupied the ocean in the neighborhood of the Azores during the first decade gave way and apparently moved southwestward, allowing a storm-area of considerable energy to pass eastward in about N. 40° from the 16th to the 18th. From the 22d to the 24th, inclusive, the pressure was high south of Newfoundland and Nova Scotia, while during the same period, and until the 28th, low pressures and frequent storms of marked severity were experienced off the west coast of Europe. From the 25th to the 30th the weather conditions were unsettled over the ocean in the vicinity of Newfoundland and Nova Scotia. The month closed with relatively fair weather prevailing off the American and European coasts, and a depression of slight depth central over mid-ocean.

For December, 1885, the paths of ten areas of low pressure were traced, of which four were continuations of low areas which entered the Atlantic Ocean from the Gulf of Saint Lawrence; one was a continuation of an area of low pressure which developed near the coast of Florida; one developed in

Rochester, New York: cloudy weather, with snow, prevailed during the afternoon and night of the 1st, with brisk variable winds, increasing to high westerly, which attained the force of a gale at 11.15 p. m. and continued until 7.20 p. m. of the 2d; maximum velocity forty miles per hour.

Oswego, New York: snow began falling during the early morning of the 2d and continued until 6.30 p. m. of the 3d. The storm was accompanied by high westerly wind, which attained at 12.15 a. m. a velocity of thirty-one miles per hour. At 8 a. m. the wind shifted from west to northwest, and blew from the latter direction at the rate of thirty-three miles per hour at 3.40 p. m. Numerous reports from vessels indicate that the storm was more severe on the lakes than at this station; the schooner "Ariadne," Capt. Hugh McKay, from Toronto, Canada, for this port, laden with barley, was driven ashore in Mexico Bay, and lost, with part of the crew. The schooner "Ocean Wave" was driven ashore at Port Ontario at 2.30 p. m. of the 3d, but was gotten off with only slight damage.

The following notes from observers relate to the weather conditions prevailing along the Atlantic coast during the presence of low area number iii:

Pensacola, Florida: a heavy southeasterly wind set in during the early morning of the 4th, maximum velocity thirty-seven miles per hour. Light rain commenced at 10.30 a. m. and continued until 9.20 p. m. During the storm the Norwegian bark "Dagmar," lying alongside the wharf, was blown on her beam's end, but was righted without any serious damage. The bark "Flora" dragged her anchors and ran aground; the schooner "Wallace" was capsized, and several other vessels suffered slight damage.

Hatteras, North Carolina: heavy rain, with brisk northerly winds, occurred during the night of the 4-5th; heavy and light rain fell on the 5th, total precipitation for the thirty-six hours, 2.65 inches. At 4 p. m. of the 6th a northwesterly gale set in, reaching at 4.30 p. m. a maximum velocity of thirty-seven miles per hour. A second storm began at 11.15 p. m. and continued until 12.05 p. m. of the 7th, maximum velocity, thirty-one miles per hour, at 1.30 a. m.

Kitty Hawk, North Carolina: the 4th was cloudy, with high northeasterly winds, which attained at 5.30 p. m. the velocity of a gale, and reached at 6.15 and 10 p. m. a maximum velocity of forty miles per hour. Snow and rain fell during the night of the 4-5th and throughout the 5th; at the same time a heavy gale was blowing, attaining a velocity of forty-eight miles per hour at 2.30 a. m., 8.30, 9, and 9.30 p. m.

Smithville, North Carolina: rain began at 10.40 a. m. of the 4th and continued at intervals throughout the day. A northeasterly gale set in at 10.45 p. m., maximum velocity thirty-two miles per hour. The wind continued high during the 5th, and during the afternoon backed from ne. to n. and nw. The steam-tug "Howland" and the Norwegian bark "Elena" dragged their anchors during the storm, but no material damage was sustained by vessels in the harbor.

Baltimore, Maryland: heavy snow fell during the 4th and 5th to a depth of several inches; street cars kept up travel with considerable difficulty and all railroad trains arrived late. Light snow and rain fell during the 6th, with fresh northwesterly winds. Vessels arriving on the 5th, 6th and 7th reported a severe storm on Chesapeake Bay.

Atlantic City, New Jersey: light snow fell during the night of the 4-5th, and snow and sleet throughout the 5th. Brisk to high north and northeasterly winds prevailed on the 5th; maximum velocity, thirty-three miles per hour, at 1.50 p. m. The snow continued until 8.30 a. m. of the 6th, with high northerly winds all day; maximum velocity, thirty-six miles per hour, at 7.25, 8.10, and 11.20 p. m.

Block Island, Rhode Island: high northeasterly winds prevailed during the 5th, maximum velocity forty-eight miles per hour; the storm was accompanied by heavy snowfall, total depth for the day 8.8 inches. Sleet and light rain fell during the 6th, and the northeasterly gale of the previous day continued, attaining a velocity of fifty-one miles per hour.

Boston, Massachusetts: heavy snow began at 8.15 p. m. of the 5th and continued until 2.00 a. m. of the 6th. During the 5th the wind blew briskly from the northwest veering to northeast, highest velocity, twenty-seven miles per hour from the northeast, at 9 p. m.; total snowfall 9.5 inches. On the 6th the wind blew a gale from the north and northeast. Light snow, with northeasterly gale, prevailed during the 7th, maximum velocity thirty-six miles per hour. The heavy fall of snow which accompanied this gale seriously interfered with travel on the streets. The storm did some slight damage to vessels in the harbor; a scow used for dredging purposes was torn from its fastenings and broken up on the beach.

NORTH ATLANTIC STORMS DURING DECEMBER, 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 January 21, 1887.

Ten depressions are traced, of which five passed northeastward over Newfoundland; four apparently developed over the ocean to the southward of Nova Scotia, two of which are traced south of the fortieth parallel; one first appeared over mid-ocean in about N. 55°, and one is given a probable easterly course in the vicinity of the Azores.

The depression traced as number 1 occasioned storms of almost unprecedented violence over the British Isles during the 7th and 8th, and exhibited the lowest barometric readings ever recorded in London and Liverpool. This storm first appeared south of Nova Scotia on the 2d, and, pursuing a generally northeast course, was central in the vicinity of Aberdeen, Scotland, at noon, Greenwich mean time, of the 8th. Number 2 is first charted in N. 55°, W. 27° under date of the 2d, from which position it circled southeast and northeast, disappearing over Ireland after the 3d. Number 3 was a continuation of an area of low pressure which passed into the Atlantic Ocean from the Gulf of Mexico. This storm is traced northeastward across the Atlantic Ocean to the northern portion of Scotland by the 12th, after which date it disappeared beyond the region of marine observation. Number 4 developed south of Nova Scotia on the 6th, and, moving rapidly northeast, disappeared over mid-ocean after the 7th.

Number 5 passed northeast over northern Newfoundland during the night of the 11th; after reaching the twenty-fifth meridian the depression moved southeast and passed to the south of Ireland beyond the region of observation after the 16th. Number 6 moved east over Newfoundland during the night of the 14th, and apparently moved southeast after passing the forty-fifth meridian. Number 7 was, possibly, a continuation of number 6, and is given a probable track north of the Azores to the fifteenth meridian by the 18th, after which date its course cannot be traced, owing to an absence of reports. Number 8 appeared over the ocean south of Nova Scotia on the 20th, and, moving northeast, disappeared east of Newfoundland after the 21st. Number 9 passed northeast from the northern extremity of Florida and disappeared in the direction of the British Isles after the 22d. Number 10 is first charted south of Newfoundland, in N. 40°, under date of the 27th, and moved northeast until the 29th, after which it passed to the northward of the fifty-fifth parallel.

The first decade of the month was characterized by a succession of terrific west and northwest gales, accompanied by high seas; the disturbances being more severely felt in European waters. During this period the barometric pressure was high over and to the southwestward of the Azores, and the depressions were deflected to a northeast course after leaving the North American coast. During the second decade the weather was stormy and unsettled over the ocean east of the twentieth meridian, and gales of considerable severity were frequent over and in the vicinity of the British Isles.

The area of high pressure which occupied the ocean in the neighborhood of the Azores during the first decade gave way and apparently moved southwestward, allowing a storm-area of considerable energy to pass eastward in about N. 40° from the 16th to the 18th. From the 22d to the 24th, inclusive, the pressure was high south of Newfoundland and Nova Scotia, while during the same period, and until the 28th, low pressures and frequent storms of marked severity were experienced off the west coast of Europe. From the 25th to the 30th the weather conditions were unsettled over the ocean in the vicinity of Newfoundland and Nova Scotia. The month closed with relatively fair weather prevailing off the American and European coasts, and a depression of slight depth central over mid-ocean.

For December, 1885, the paths of ten areas of low pressure were traced, of which four were continuations of low areas which entered the Atlantic Ocean from the Gulf of Saint Lawrence; one was a continuation of an area of low pressure which developed near the coast of Florida; one developed in

about N. 42°, W. 59°, and the remaining depressions apparently developed over the ocean east of the fortieth meridian and between N. 45° and 55°. The general direction of movement of the storm-centres was northeasterly or east-northeasterly. The general character of the weather over the north Atlantic was unsettled. During the first seven days the pressure was generally low; about the 7th an area of high pressure formed over mid-ocean and continued, with slight fluctuations, until the 13th, when it was replaced by areas of low pressure over the ocean east of the fortieth meridian. The pressure continued comparatively low over mid-ocean from the 13th to the 19th, while areas of high pressure appeared off the American and European coasts. During the balance of the month the pressure was generally high from the Banks to the European coasts, and low near the coast of the United States.

As compared with the corresponding month of previous years the weather over the north Atlantic during December, 1886, was exceptionally severe over the eastern portion of the ocean, and the barometric pressure exhibited over the British Isles during the storm of the 7th and 8th was probably the lowest ever recorded. Irregular reports are at hand relative to a severe storm which prevailed over England and France on the 26th, but data at present available fails to indicate the presence of a depression over the ocean immediately prior, or subsequent to, that date.

The following are brief descriptions of the depressions traced:
1.—The development of this depression was probably subsidiary to an area of low pressure which passed northeastward over New England and Nova Scotia during the 2d and 3d. The storm, however, possessed individual strength, and on the 2d, when central south of Nova Scotia, exhibited pressure about 29.50 (749.3).

On the morning of the 3d the storm was central off the southeast extremity of Newfoundland, with fresh gales to the southward and eastward; during the next twenty-four hours the depression moved rapidly northeast to N. 55°, W. 38°, after which it is given a probable northeasterly course until the 7th, when the centre of depression was apparently central northwest of the British Isles. By noon of the 8th the storm-centre had passed to the vicinity of Aberdeen, Scotland, and the fall of the barometer over England was probably without a parallel in the history of that country; the barometric minima reported being 27.45 (697.2) at the Orme's Head, and 27.48 (698.0) at Liverpool. At Leith, Scotland, the barometer fell with great rapidity during the day, reaching 27.65 (702.3) at nineteen hours thirty minutes. This is reported as being by far the lowest reading of the barometer that has occurred at Leith since January 26, 1884, on which date the lowest reading ever made at that place was recorded at 10 p. m., viz., 27.45 (697.2).

The following special reports have been rendered relative to this depression:

Capt. F. Manly, commanding the s. s. "Borderer," reports a heavy westerly gale at Halifax, Nova Scotia, from the 2d to the 4th. Capt. John Schade, of the s. s. "Polaria," reports a whole nw. gale from the 2d to 4th; lowest barometer, 29.47 (748.5), at 8 p. m. of the 2d, in N. 42° 18', W. 62° 22'. Capt. W. Tyson, of the s. s. "Holland," reports a strong gale from the 2d to 4th; lowest barometer, 29.35 (745.5), at noon of the 2d, in N. 41° 18', W. 66° 15'. The gale commenced very suddenly in a squall from wsw., with furious rain, the weather having been unsettled and barometer gradually falling for forty-eight hours previous; the wind shifted almost immediately to w. by n., blowing a strong gale with heavy squalls, attended with snow, for about twenty-four hours, then gradually moderated. Capt. B. Gleadell, of the s. s. "Germanic," reports a whole gale from the 2d to 4th; lowest barometer, 29.47 (748.5), at midnight of the 2d, in N. 43° 30', W. 57° 42'; gale set in from s. and veered to nw., with heavy squalls, hail, and sleet.

Mr. F. Wilson, observer on the s. s. "Bulgarian," Capt. E. Parry, commanding, reports: "On the 7th, 8th, and 9th, be-

tween N. 50° 55', W. 16° 0', and N. 50° 15', W. 18° 30', experienced a very heavy gale; at about 2.30 p. m. on the 7th, wind a moderate gale from the w.; then backed to ssw. and increased in force, hauling more to the westward, until at midnight it was blowing a terrific gale, with squalls of hurricane force and tremendous seas; at 3 a. m. of the 8th a sea struck the ship on the starboard side amidships, breaking up two boats and doing other damage; 8 a. m., wind wnw., settling into a steady gale with terrific hail squalls, accompanied with heavy and frequent lightning; at noon of the 9th the gale moderated, squalls became less frequent, though still heavy." Capt. J. G. Braes, of the s. s. "State of Nebraska," reports a hurricane from wnw. backing to sw., and veering to nw. and n. from the 7th to the 9th; lowest barometer, 28.49 (723.6), at 8 p. m. of the 7th, in N. 55° 1', W. 18° 52'. The storm was accompanied by tremendous head seas, and terrific hail and snow squalls were encountered during entire passage.

Chief Officer E. C. King, of the s. s. "Umbria," Capt. W. McMickan, commanding, reports the storm of the 7th and 8th as being of exceptional violence the wind at times blowing with hurricane force, with a tremendous sea running; lowest barometer, 29.16 (740.7), at 2 p. m. of the 7th, in N. 49° 45', W. 31° 50'. The wind set in from west by south and veered to nw. Capt. J. H. Malet, of the s. s. "Buffalo," reports a whole westerly gale from the 6th to 8th; lowest barometer, 29.20 (741.7), at 3 p. m. of 7th, in N. 50° 0', W. 25° 30'. The s. s. "England" had a strong gale on the 7th and 8th; wind veered from w. by s. to nw.; lowest barometer, 29.29 (744.0), at 4 p. m. of the 7th, in N. 50° 16', W. 28° 30'. Captain Franguel, of the s. s. "La Bourgogne," reports a westerly storm attaining hurricane force from the 5th to 13th; lowest barometer, 29.10 (739.1), at 4 p. m. of the 7th, in N. 50° 6', W. 27° 13'. The storm was accompanied by a tremendous high and short chopping sea from nw. and sw.

The following half-hourly readings, made by Messrs. J. Bolam and G. Redpath, observers at Leith Navigation School, mark the progress of the depression over that place:

Hours.	Minutes.	Inches.	Millimeters.	Hours.	Minutes.	Inches.	Millimetres.
6	0	28.463	722.4	14	30	27.824	705.6
6	30	28.381	720.8	15	0	27.796	705.1
7	0	28.286	718.6	15	30	27.770	705.3
7	30	28.220	716.8	16	0	27.729	704.3
8	0	28.168	715.5	16	30	27.721	704.1
8	30	28.128	714.5	17	0	27.707	703.8
9	0	28.111	714.0	17	30	27.690	703.3
9	30	28.081	713.2	18	0	27.675	702.8
10	0	28.060	712.7	18	30	27.664	702.6
10	30	28.032	711.9	19	0	27.660	702.6
11	0	28.011	711.4	19	30	* 27.651	702.3
11	30	27.985	710.7	20	0	27.656	702.6
12	0	27.959	710.2	20	30	27.664	702.6
12	30	27.935	709.4	21	0	27.671	702.8
13	0	27.909	708.9	21	30	27.693	703.3
13	30	27.880	708.4	22	0	27.707	703.8
14	0	27.855	707.4				

* Lowest.

The following extract relative to this remarkable storm, from the Liverpool "Courier," of December 11, 1886, is furnished by Third Officer J. H. Mills, of the s. s. "Aurania," Capt. W. H. P. Hains, commanding:

A storm of great severity has prevailed in Liverpool, Birkenhead, and district. On Tuesday evening, the 7th, a strong gale sprang up in this neighborhood, and as the night wore on the storm increased in intensity. Heavy showers of hail, sleet, and rain fell at frequent intervals, and these continued all Wednesday, the 8th. There were occasional lulls in the violence of the storm, but they were only of short duration, and last night the wind was blowing very strong. No serious casualties have been reported. At nine on Wednesday evening, although it was only a thirteen feet and ten inches tide, the force of the gale drove the water near the stages to a depth of twenty feet. Shortly after ten o'clock the violence of the wind, which came principally from the northwest, abated considerably, but the rain squalls continued with fury. The New Brighton boats stopped running in the evening, and the traffic to the southern ferries was also suspended.

The following extraordinary fall of the barometer is recorded by Mr. Wood, optician, Lord street: "The fall in the barometer on Wednesday afternoon has been, as far as our knowledge goes, unparalleled, reading at 3.30 o'clock the extraordinary figures 27.880 (708.1), and still falling. We have looked back over our record of past years as far as the year 1840, and find the fol-

lowing nearest approaches to to-day's barometer: November 3, 1841, 28.350 (720.1); May 1, 1858, 28.105 (713.7); January 6, 1863, 28.345 (719.8); March 24, 1872, 28.140 (714.7)."

At sunset in the evening the barometer was observed to have fallen at the Orme's Head, to 27.450 (697.2), whilst in Liverpool it stood at 27.480 (698.0). This fall in the barometer is certainly unparalleled in the history of Liverpool, and many nautical men are of opinion that it has never been equalled in any part of the world.

Capt. R. Bussius, of the s. s. "Werra," had a whole gale from ssw., veering to nw., from the 8th to the 10th; lowest barometer, 28.30 (718.8), at midnight of the 8th, in N. 52° 50', E. 3° 0'. Capt. F. S. Land, of the s. s. "City of Berlin," reports a hurricane on the 8th while off Waterford in the Irish Channel; lowest barometer, 28.18 (715.8), at 4 a. m. Wind veered from wsw. to w. and wnw., and backed to wsw., and the storm continued until the 12th. The bark "Saint Patrick," on the 9th, in N. 42° 45', E. 5° 27', encountered a heavy ssw. gale, which carried away fore, main, and mizzen topsails, stay sail and jib; shifted cargo to port side and stove one boat; shipped much water.

Capt. J. C. Jamison, commanding the s. s. "Rhyndland," reports: "8th, at 11.15 a. m., in N. 50° 18', W. 17° 34', a heavy gale from wnw., with a fierce hail squall, during which a large meteor burst with a loud report between the fore and main masts about twenty feet above the bridge, emitting a strong, sulphurous smell, and covering the ship with a shower of sparks." Capt. E. Smit, of the s. s. "Pieter de Coninck," reports a whole gale from ssw., veering to nw., during the 8th and 9th; lowest barometer, 28.53 (724.6), at 6 a. m. of the 9th, in N. 50° 20', W. 0° 10'. Capt. R. T. Jones, of the s. s. "Galileo," reports a hurricane from sw., veering to nw.; lowest barometer, 28.34 (719.8), from noon to 4 p. m. of the 8th, in N. 49° 41', W. 6° 5'. Capt. J. Glasspoole, of the s. s. "Thales," reports: "7th, p. m., barometer fell very fast and wind backed to ssw.; barometer falling at the rate of one-tenth inch an hour for five hours; 8 p. m., wind increased to heavy gale; midnight, terrific gale and furious squalls from west, with much hail; 8th, 7.30 a. m., in N. 51° 0', W. 8° 30', very heavy gale from wnw.; tremendous sea broke on board, smashing wheel and after house, and gutting the saloon and captain's and officers rooms; barometer smashed and thermometer washed overboard; force of wind 12 and mountainous sea. The chief officer was washed along deck and had both legs broken; provisions, and captain and officers' effects, destroyed and washed overboard. At midnight of the 8th the weather began to moderate, with wind wnw."

Mr. H. Runtton, observer, on the s. s. "Galileo," Capt. R. S. Jones, commanding, reports: "8th, encountered a strong sw. wind, accompanied with high, head sea; 2 a. m., wind increased to a gale, with falling barometer; sea increasing and the deck constantly flooded; 4 a. m., Wolfe Rock abeam, distance six miles; 8 a. m., strong, unsteady westerly gale; very high and dangerous sea; noon, wind still increasing, with violent squalls of hail, rain, and sleet; 4 p. m., wind increased to a hurricane, with tremendous sea; wind w.; at this time we were nearest the centre of the storm; 8 p. m., strong gale, high sea, with violent squalls, which continued until the 9th, at 4 a. m., when wind went wnw., with high sea and rising barometer. The progressive motion of the storm-centre was apparently towards the ese."

Mr. James Miller, observer, on the s. s. "Scandinavian," Capt. John Park, commanding, reports: "9th, 2 a. m., Lam-lash abeam two miles; 3 a. m., clouds suddenly overspread the sky from the nw. and wind increased to a gale; 4 a. m., blowing a heavy gale from nnw.; 4.07 a. m., gale increasing to hurricane force; heavy seas, breaking and deluging the ship fore and aft, and, as wind was blowing a hurricane on the north coast of Ireland, bore up for Lam-lash; 6 a. m., wind nnw., force 11; 8 a. m., wind nnw., force 10; 9 a. m., anchored in Lam-lash harbor, noon, weather improving; 3.45 p. m., weighed anchor." Capt. A. McKay, commanding the s. s. "Catalonia," reports: "8th and 9th, in the George's Channel, during passage from Liverpool to Queestown, encountered a terrific gale from the

w. and wnw. of such violence at times as to bring ship to a standstill; during the height of the gale the ship was completely enveloped in a mass of drifting spray and foam, obscuring everything from view beyond a half-ship's length, the sea running tremendously high."

2.—This depression appeared over the ocean, in about N. 55°, W. 27°, on the 2d, with pressure ranging below 29.70 (754.4), whence it passed southeast to N. 51°, W. 15° by the 3d, and then circled northeast over the British Isles. The depression was shallow and of slight energy throughout its course.

3.—This depression apparently developed off the New England coast and was central on the morning of the 6th south of Nova Scotia, with central pressure about 29.70 (754.4) whence it moved rapidly northeastward and disappeared over mid-ocean after the 7th, being probably drawn into the extended area of low pressure which extended from the British Isles westward over a considerable portion of the ocean.

The following special reports refer to this depression:

Second Officer Francis Potts, of the s. s. "British Crown," Capt. Archibald Smith, commanding, reports a fresh gale, veering from s. by e. to n. by e., on the 6th; lowest barometer, 29.65 (753.1), at 5 p. m., in N. 46° 15', W. 54° 20'. The gale was accompanied by heavy rain. Captain Yungst, of the s. s. "Ems," reports a whole gale on the 5th and 6th from ese., veering to s., w., and ne.; lowest barometer at 2 a. m. of the 6th, in N. 40° 45', W. 68° 0'. Second Officer W. Barton, of the s. s. "British King, Capt. John Kelly, commanding, reports a fresh to strong gale, from se., veering to w. and ne., from the 5th to 7th; lowest barometer, 29.74 (755.4), at 4 a. m. of the 6th, in N. 40° 30', W. 67° 0'.

4.—This depression was a continuation of an area of low pressure which entered the Atlantic Ocean off the north coast of Florida and passed northeast over Newfoundland by the 8th. On the 9th the storm was central in about N. 54°, W. 39°, with evidence of great energy, and central pressure ranging to about 29.30 (744.2); by the 10th the depression had moved slowly northeast to W. 32°, where pressure ranging to about 28.60 (726.4) was shown; during the next twenty-four hours the storm-centre passed eastward to W. 17°, with an apparent slight decrease in pressure; at noon (Greenwich mean time) of the 12th the centre of depression had advanced eastward to the northern portion of Scotland, with a slight increase in central pressure, after which it disappeared to the eastward beyond the region of observation.

The following special reports give the general characteristics of the disturbances accompanying this depression.

The s. s. "Umbria," on the 9th, had a fresh westerly gale; lowest barometer, 29.56 (750.8), at 8 a. m., in N. 46° 30', W. 44° 25'. Capt. M. Fitt, of the s. s. "Virginian," reports a strong gale on the 8th and 9th; lowest barometer, 29.84 (757.9), on the 9th, in N. 43° 19', W. 55° 49'. The gale began on the 8th from se., force 7, and veered to s. with heavy rain, and increased at midnight to strong gale, w.; continuing throughout the 9th from sw. to w., and moderating at night. Chief Officer Falkner, of the s. s. "Kansas," Capt. W. Gleig, commanding, reports: "8th, in N. 45° 0', W. 52° 35', fresh sw. gale, barometer, 29.62 (752.3); gale began on the 8th from sse. and veered to sw., with snow-squalls; veered to w. and continued on 9th, in N. 44° 10', W. 57° 0'; then veered to nw. and moderated.

Chief Officer Potts, of the s. s. "Palestine," Capt. W. White-way, commanding, reports: "10th, in N. 51° 7', W. 25° 26' (at noon), a moderate gale began from wsw., increasing at 4 p. m. to heavy gale, w. by s., with hard squalls, high seas, and hail; barometer 29.00 (736.6) at 4 p. m.; gale continued, moderating slightly in the a. m. of the 11th, in N. 50° 59', W. 27° 44', and continued during the 11th, with squalls and high seas; barometer 29.05 (737.9) at 4 p. m., then rising."

Capt. W. H. Smith, of the s. s. "Sardinian," reports: "10th, in N. 54° 8', W. 21° 47' (at noon), at 4 a. m. the wind shifted suddenly to wnw. in a heavy squall, which rose to a strong gale; at 6.30 a. m. the wind moderated and backed to wsw."

On the 11th and 12th the s. s. "Catalonia" experienced a fresh gale from the wsw. veering to wnw., with terrific squalls and very high west sea; position at noon of the 11th N. 51° 13', W. 18° 45', at noon of the 12th, N. 50° 48', W. 21° 30'. The s. s. "Werra" on the 11th had a strong westerly gale; lowest barometer, 29.25 (742.9), at noon, in N. 51° 7', W. 13° 42'. Chief Officer Barwise, of the s. s. "Iowa," Capt. S. Waters, commanding, reports a fresh gale from sw., veering to wnw., on the 11th and 12th; lowest barometer, 29.02 (737.1), at 8 p. m. of the 11th; ship left Liverpool on the 11th; position at noon of the 12th, N. 51° 46', W. 7° 39'.

5.—This storm was a continuation of land depression number iv, which passed over the Gulf of Saint Lawrence and the northern portion of Newfoundland during the 11th; on the 12th the storm-centre had advanced northeast to about N. 54°, W. 40°, with strong gales over a considerable area; by the 13th the centre of depression had moved to N. 57°, W. 27°, where pressure ranging below 29.00 (736.6) was exhibited; from this position the storm passed southeast to N. 53°, W. 18° by the 14th, and N. 50°, W. 13° by the 15th, when it moved eastward five degrees by the 16th, after which it passed northeastward beyond the region of observation. From the 13th to the 16th the depression possessed great strength, and had central pressure ranging below 29.00 (736.6).

The following are special reports received from shipmasters relative to the passage of this depression:

The s. s. "Werra," on the 13th, experienced a strong westerly gale; lowest barometer, 29.21 (741.9), at 4 a. m., in N. 49° 25', W. 24° 38'. Capt. T. L. Weiss, of the s. s. "Wells City," reports: "14th, noon, strong gale and heavy squalls from w., barometer 29.15 (740.4); 4 p. m., hard gale and violent squalls, barometer 28.98 (736.1); 6 p. m., gale increased to force 11, violent squalls and tremendous sea; 8 p. m., squalls of hurricane force, black, overcast sky; 10 p. m., barometer 28.90 (734.0), sky partly cleared, and storm abated in twenty minutes to force 8; 11.20 p. m., sky again became overcast, barometer fell to 28.85 (732.8); midnight, in N. 51° 12', W. 18° 0', wind hauled to n., force 9; 15th, 3 a. m., gale had hauled to ne., force 10, barometer rising; barometer continued to rise during the 15th, and gale moderated from ene." Capt. R. Ringk, of the s. s. "Fulda," reports a whole w. to nw. gale on the 14th and 15th; barometer lowest on the 15th, in N. 49° 41', W. 15° 25'.

6.—This depression was a continuation of land area number v, which passed eastward over the Gulf of Saint Lawrence and Newfoundland during the night of the 14th. On the morning of the 15th the storm was central in N. 51°, W. 45°, with pressure ranging below 29.00 (736.6), after which it apparently passed southeast in the direction of the Azores.

The following special reports refer to this storm:

Capt. H. W. Brown, of the s. s. "Pontiac," reports a whole gale, from wsw., backing to s. by e., and shifting to wnw., during the 13th and 14th; barometer lowest at 11.30 a. m. of the 14th, in N. 35° 20', W. 55° 5'. Capt. G. D. Spicer, of the ship "Charles S. Whitney," reports a heavy gale on the 14th, commencing from the sw., in N. 40° 20', W. 50° 20' (at noon); gale began at midnight and continued four hours, blowing very hard, with heavy rain; lowest barometer 29.45 (748.0).

The s. s. "Aurania," on the 15th and 16th, had a whole gale from se., veering to w. and nw. and backing to wsw. and s.; lowest barometer, 29.45 (748.0), at midnight of the 15th, in N. 48°, W. 40°. The gale was accompanied by a very high nw. sea, very confused at times. Captain Traub, of the s. s. "La Champagne," reports a storm of force 11 on the 15th and 16th; wind set in from se. and shifted to nw.; lowest barometer, 29.49 (749.0), at 5 a. m. of the 16th, in N. 47° 15', W. 42° 30'. Capt. J. C. Jamison, of the s. s. "Rhyndland," reports a whole gale from the 14th to 16th; wind veered from se. to n.; lowest barometer, 29.22 (742.2), at 5.15 a. m. of the 15th, in N. 47° 10', W. 43° 11'. Third Officer Prager, of the s. s. "Ems," Capt. T. Yungst, commanding, reports a heavy gale from sse., veering to nw. on the 15th, in N. 47° 10', W. 41° 30' (at noon).

The weather was fearful during the morning, with heavy seas from all directions, and heavy rain showers; lowest barometer 29.17 (741.0).

The s. s. "Bulgarian," on the 15th, between N. 48° 20', W. 41° 40' and N. 47° 20', W. 43° 21', had wind backing at 9 a. m. from nw. to sse.; wind quickly freshened until it blew a strong gale; at 3 p. m., during a few minutes' lull, and very heavy rain, the wind suddenly shifted to w. by s. and continued to increase in force to very heavy gale at midnight, with terrific hail squalls and very heavy sea. At 9 a. m. of the 16th a terrible sea broke partially over the bow and starboard side of the upper bridge, carrying away iron stanchions and rails and drove the stanchions through the wooden deck, stove in the wheel-house door, and caused other damage. (The upper bridge is twenty-five feet above the water.) At noon the gale was gradually moderating, with rising barometer. On the 15th, the s. s. "Catalonia," in N. 48° 56', W. 37° 47' (at noon), experienced a moderate gale from ese., veering to w. and nne.

Capt. C. Thomas, commanding the s. s. "Monte Rosa," reports: "On the 15th, in N. 49°, W. 45° (at noon), experienced the heaviest gale I have met since I first went to sea (now twenty-six years). The gale commenced at 7 a. m. from ese., with heavy sea and very heavy rain; the barometer commenced to rise as soon as the gale came on; at noon the wind hauled to w. and nw.; while going westward we had fearful weather and mountainous seas; the wind blew mostly in squalls, but from 3 a. m. to 6 a. m. of the 16th it blew a perfect hurricane. The gale continued twenty-four hours." Capt. H. Perry, commanding the s. s. "Britannic," reports: "15th, 6 a. m., barometer falling, wind se., increasing to a fresh gale, with rain; 9 a. m., barometer falling, wind suddenly shifted to sw. and increased to a strong gale; 11 a. m., barometer falling, wind veered to w., thick, rainy weather; noon, in N. 48° 32', W. 42° 25', barometer, 29.00 (736.6); 4 p. m., barometer rising, whole gale, with violent squalls and heavy westerly sea; 8 p. m., wind wnw., whole gale, dangerous sea; 11 p. m., whole gale nw., very dangerous wsw. and nw. seas; shipped a heavy sea, carrying away two boats and damaging engine house; 16th, gale moderating."

7.—This depression was, evidently, a continuation of number 6, and, approaching the Azores from the northwest, was central on the 16th in N. 43°, W. 33°, with pressure ranging below 29.50 (749.3); from this position it is given a probable south of east course to N. 39°, W. 15° by the 18th, after which date its course cannot be traced, owing to absence of reports. The storm was possessed of considerable strength throughout, but, owing to a scarcity of reports from the region through which it passed, its track and severity cannot be accurately determined.

Under the influence of a depression which was central off the New England coast on the morning of the 16th, and which passed northeast over Nova Scotia during that date, strong gales were experienced over the ocean to N. 40° and W. 60°.

8.—This depression was central on the 20th in N. 37°, W. 65°, whence it moved northeast and disappeared off the coast of Newfoundland after the 21st. The depression was not attended by disturbances of marked violence, and exhibited minimum pressure, about 29.80 (756.9), on the 21st.

9.—This depression apparently entered the ocean in the vicinity of the Strait of Belle Isle during the 20th, and is given a probable northeast track to about N. 56°, W. 40° by the 21st, from which position it is traced to N. 59°, W. 25° by the 22d, after which it disappeared to the southeastward, probably passing over Scotland into the North Sea. The storm apparently possessed great energy, but passed too far to the northward to cause serious disturbances south of the fiftieth parallel.

10.—This depression first appeared in N. 40°, W. 59° on the 27th, with strong gales and rain to the northward and north-eastward, whence it moved rapidly northeast to N. 50°, W. 44° by the 28th, where pressure about 29.50 (749.3) was shown; passing northeast, the depression is traced to N. 54°, W. 38°

by the 29th, after which it disappeared to the northeastward beyond the region of observation.

The following special reports have been rendered relative to disturbances encountered within the area of this depression:

Capt. W. Abbott, of the s. s. "Marengo," reports: "27th, 4 p. m. to 28th, 2 a. m., experienced a hurricane in N. 44° 42', W. 51° 56'; wind veered from s. through sw. and w. to wnw; barometer lowest at 7 p. m. of the 27th." Capt. J. Uberweg, of the s. s. "Waesland," reports a whole northerly gale on the 27th; lowest barometer, 29.20 (741.7), at 8.30 p. m., in N. 44° 35', W. 56° 29'. The gale was accompanied by heavy rain. Capt. P. Slierendregt, of the s. s. "Leerdam," reports a whole gale from se., veering to wsw., during the 27th and 28th; lowest barometer, 29.30 (744.2), at 10 p. m. of the 27th, in N. 46° 50', W. 47° 35'. Capt. R. Wills, of the s. s. "British Queen," reports a whole gale to hurricane during the 27th and 28th; wind set in from ne. and veered to sse. at noon of the 27th, in N. 46° 24', W. 48° 8', and during p. m. to nw., from which direction it blew a hurricane, with violent squalls and mountainous seas; lowest barometer, 29.44 (747.8), from 10 to 11 p. m. of the 27th. Chief Officer Kinning, of the s. s. "Roman," Capt. D. Williams, commanding, reports a gale from sw., force 9, at 4 a. m. of the 27th, in N. 44° 29', W. 53° 0'; barometer 29.05 (737.9).

Capt. W. Rippeth, of the s. s. "Otranto," reports a hurricane on the 27th from sse., veering to nw.; lowest barometer, 29.64 (752.8), in N. 42° 18', W. 55° 41'. Third Officer J. H. Mills, of the s. s. "Aurania," Capt. W. H. P. Hains, commanding, reports: "27th, between N. 43° 16', W. 54° 45' and N. 43° 39', W. 53° 12', and between the hours of 8 p. m. and 12 midnight, Greenwich mean time, experienced a storm; wind shifted from s. to w. and nw., with thick mist and rain; for about two hours it blew a hurricane from the w. and abated about midnight; lowest barometer, 29.28 (743.7), at 8 p. m., and at midnight it had risen to 29.59 (751.6).

Capt. B. Gleadell, of the s. s. "Germanic," reports a strong gale from se. veering to nw. during the 27th and 28th; lowest barometer, 29.65 (753.1), at 4.15 a. m. of the 28th, in N. 48° 50', W. 40° 50'.

During the 30th the presence of a depression of considerable energy was indicated to the northward of the Banks of Newfoundland, but its course lay too far to the northward of the region of observation to allow of accurately locating its centre.

OCEAN ICE.

No icebergs have been reported during the month.

In December, 1885, several icebergs were observed on the Newfoundland coast, and over the Banks during the latter portion of the month.

For December of the three preceding years no icebergs were reported.

FOG.

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

1st.—The s. s. "Fulda," from N. 45° 0', W. 51° 30' to N. 43° 0', W. 57° 0', had dense fog, continuing from 8 a. m. to midnight; winds southerly; barometer about normal.

8th.—The s. s. "Siberian" had dense fog from 1 a. m. to 3 a. m., in N. 43°, W. 62°; wind strong from e. to s.; barometer considerably below the normal.

17th.—The s. s. "Palestine" had dense fog from 8 a. m. to 11 a. m., in N. 45° 51', W. 51° 24'; winds southerly; pressure below the normal.

20th.—The s. s. "Cephalonia" had dense fog during p. m., in N. 45° 40', W. 48° 0'. The s. s. "Bavarian" had dense fog from 10 to 11 p. m., in N. 44° 01', W. 48° 51'; winds southerly; pressure about normal.

From above reports it will be seen that fog was encountered during the month over, and to the southwestward of, the Banks of Newfoundland, with southerly winds and barometric pressure about, or below, the normal. As in the preceding

month (November, 1886), the conditions favorable to the development of fog seemed to exist to the eastward of barometric depressions.

TEMPERATURE OF THE AIR.

[Expressed in degrees, Fahrenheit.]

The distribution of mean temperature over the United States and Canada for December, 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.

In northeastern Montana and in all districts, except the Rio Grande Valley, from the one hundred and fifth meridian eastward, the temperature of the air for the month has been decidedly lower than the average December; the departures are especially large in Dakota, Minnesota, the Missouri Valley, and the upper Mississippi valley, the mean temperature of the air at Signal Service stations within these districts averages 7°.7 below the normal; in Minnesota and eastern Dakota the month has been 10°.0 colder than the average December. In the Lake regions, the Ohio Valley, and Tennessee, the departures average about six degrees below the normal. From the one hundred and fifth meridian westward the temperature of the month has been above the normal; the larger departures within this area occur in Washington Territory, Oregon, Idaho, and Nevada, where they range from 5°.7 at Boise City, Idaho, to 4°.4 at Olympia, Washington Territory. It is worthy of note in this connection that the area of greatest departure below the normal coincides with the area of maximum pressure.

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

Above normal.		Below normal.	
Denver, Colorado.....	6.5	Moorhead, Minnesota.....	11.1
Boise City, Idaho.....	5.7	Huron, Dakota.....	10.6
Roseburg, Oregon.....	5.4	La Crosse, Wisconsin.....	10.4
Fort Grant, Arizona.....	5.4	Bismarck, Dakota.....	10.0
Winnemucca, Nevada.....	5.1	Davenport, Iowa.....	9.8
Helena, Montana.....	4.9	Des Moines, Iowa.....	9.6
Fort Davis, Texas.....	4.8	Duluth, Minnesota.....	7.6
Portland, Oregon.....	4.6	Keokuk, Iowa.....	7.4

In the following table are given the mean temperatures for the several geographical districts, with the normals and departures, as deduced from Signal Service observations:

Average temperatures for December.

Districts.	Average for December, Signal-Service observations.		Comparison of Dec., 1886, with the average for several years.
	For several years.	For 1886.	
New England.....	30.4	27.3	- 3.1
Middle Atlantic States.....	36.9	32.0	- 4.9
South Atlantic States.....	48.6	45.5	- 3.1
Florida Peninsula.....	61.4	58.1	- 3.3
Eastern Gulf States.....	49.9	46.0	- 3.9
Western Gulf States.....	59.0	46.8	- 12.2
Rio Grande Valley.....	60.1	61.1	+ 1.0
Tennessee.....	41.4	36.2	- 5.2
Ohio Valley.....	35.1	28.7	- 6.4
Lower Lake region.....	39.1	24.0	- 15.1
Upper Lake region.....	24.3	18.6	- 5.7
Extreme Northwest.....	10.2	2.7	- 7.5
Upper Mississippi Valley.....	28.0	20.6	- 7.4
Missouri Valley.....	23.4	15.4	- 8.0
Northern slope.....	22.4	23.6	+ 1.2
Middle slope.....	31.2	32.3	+ 1.1
Southern slope.....	41.6	43.6	+ 2.0
Southern plateau.....	43.1	47.3	+ 4.2
Middle plateau.....	32.4	36.8	+ 4.4
Northern plateau.....	39.5	35.2	- 4.3
North Pacific coast region.....	44.2	45.7	+ 1.5
Middle Pacific coast region.....	49.4	51.0	+ 1.6
South Pacific coast region.....	55.5	57.0	+ 1.5