X.—This disturbance probably originated on the north Pacific coast. It was central north of Washington Territory on the morning of the 28th, with severe southerly gales reported at the mouth of the Columbia River. These gales continued during the 28th, while the centre of disturbance apparently moved rapidly eastward, passing to the north of Montana and Dakota. After passing to the eastward of the Rocky Mountains the pressure decreased at the centre, the barometer falling to 29.24 in Manitoba on the morning of the 30th. At the close of the month this depression was apparently central north of and near Lake Superior, the barometric pressure at Port Arthur, Ont., being 29.24 at 8 p. m. of the 30th, and brisk to high southwesterly winds were reported from the lake stations.

NORTH ATLANTIC STORMS FOR SEPTEMBER, 1889 (pressure in inches and millimetres; wind-force by Beaufort scale).

The paths of the depressions that appeared over the north Atlantic Ocean during September, 1889, are shown on chart i. These paths have been determined from international simultaneous observations by captains of ocean steamships and sailing vessels received through the co-operation of the Hydrographic Office, Navy Department, and the "New York Herald Weather Service." Descriptions of the storms that appeared over the West Indies, the Caribbean Sea, and the Gulf of Mexico have been received through the courtesy of the Rev. Father Benito Viñes, S. J., Director of the Magnetic and Meteorological Observatory of the Royal College of Belen, Havana, Cuba, and the thanks of this office are also due to co-operating observers in the West Indies and the Bermudas for reports rendered relative to these storms.

Seven depressions have been traced for September, 1889; the average number traced for the corresponding month of the last six years being 9.3. Of the depressions traced for the current month, two were continuations of areas of low pressure which first appeared over the North American continent; two were of tropical origin, one of which advanced from east of the Windward Islands to the Virginia coast from the 1st to 13th, and the other recurved northeast of the Windward Islands on the 4th and 5th and apparently passed thence northeastward to the Azores by the 11th; one depression, described under the heading "Areas of low pressure," advanced westward over the Caribbean Sea from the 13th to 17th, and from the 18th to 22d probably moved westward over Yucatan and recurved northward to the middle Gulf coast; three first appeared over mid-ocean; and two advanced from the Gulf of Saint Lawrence northeastward over Newfoundland and disappeared north of the region of observation. No storm traversed the ocean from coast to coast, and the movements of the depressions over the north Atlantic were irregular. Over the western portion of the ocean disastrous storms and unusually high tides occurred along the coast from New England southward to the Carolinas, attending the advance of the depression traced northwestward from the Windward Islands, and in the Gulf of Mexico a storm devastated the Campeche coast during the latter part of the second decade of the month. On the 19th a severe storm was central on the middle New England coast, while during the last decade of the month unsettled weather prevailed over New England and the Canadian Maritime Provinces, attending the passage of depressions over the Gulf of Saint Lawrence and Newfoundland. Over mid-ocean the pressure continued low, with fresh to strong gales, from the 1st to 13th, and from the 22d to 26th stormy weather prevailed north and northeast of Newfoundland and the Grand Banks. Over the eastern part of the ocean in the vicinity of the British Isles fair weather prevailed until the 8th, from which date until the 12th the influence of the depressions over mid-ocean was felt, and from the 19th to the 24th the pressure was low and the weather unsettled over and near the British Isles.

Compared with the corresponding month of previous years, the storms that appeared over the north Atlantic Ocean during September, 1889, were slightly deficient in number, although their slow and irregular movements over mid-ocean occasioned a continuation of stormy weather along the trans-Atlantic steamship routes throughout the greater part of the month. The storms traced over the north Atlantic in September for preceding years varied in number from five in 1883 to thirteen in 1884. Well-defined and destructive September cyclones have averaged about one per year over the West Indies, their usual path being westward from or near the Windward Islands to the Gulf of Mexico where they recurved northward. Among notable September West Indian storms charted and described in the REVIEW are: 1882, storm appeared north of San Domingo on the 2d, moved westward over Cuba to the central Gulf where it recurved to the Alabama coast by the night of 9th, following the usual parabolic path. 1883: storm moved from off the eastern extremity of Cuba on the 6th northwestward over the Bahamas to the North Carolina coast by the 11th. 1886: storm off the west Gulf coast moved northward to the middle Texas coast from the 22d to 24th. 1887: one storm advanced from east of the Windward Islands on the 11th westward over the Caribbean Sea and north of west over the Gulf of Mexico to the Texas coast by the 21st, and one moved northeast from the western extremity of Cuba over the Bahamas. 1888: one storm moved from north of Puerto Rico on the 1st westward over Cuba and Yucatan to the Mexican coast near Vera Cruz by the 7th, a very unusual course, and one passed from the Bahamas westward over southern Florida where it recurved northward during the 8th and 9th.

The following are brief descriptions of the depressions traced for September, 1889:

1.—Vessel reports indicate that this disturbance existed to the eastward of the Windward Islands on September 1st, probably central in latitude N. 14°, longitude W. 57°. Later reports indicate that it moved westward, passing over Saint Christopher during the night of the 2d, where the barometer fell to 29.50 (749), with wind northeast. From 10.15 p. m. of the 2d to 12.45 a. m. of the 3d winds light and calm, with falling barometer. At 2 a. m. of the 3d, the barometer had fallen to 29.38 (746), and the wind had shifted to southwest, indicating that the centre of the disturbance had passed to the northwest of this island. The approximate course of the centre of this storm is given on chart i, and the meteorological conditions attending its movement from day to day are exhibited on chart iv, upon which are traced isobarometric lines for each two-tenths of an inch from observations taken at noon, Greenwich time, by steamships and sailing vessels, and observations taken at 1 p. m., Greenwich time, at land stations. In tracing the isobarometric lines bounding this disturbance care has been taken to accurately represent the data received, and lines over extended areas from which reports have not been received depend for their values on adjacent reports. It will be seen from chart iv that this storm was central near Saint Thomas on September 3d, there being an extended area of barometric pressure covering a greater portion of the West India Islands at noon of that date, while a second barometric depression covered the middle north Atlantic, and an area of high pressure extended along the coast of the United States from Georgia to New England. On the 4th the depression over the West Indies had moved slightly to the northwestward, and vessel reports show that severe storms were experienced over the ocean in latitude N. 22° 55′ and 36° 55′, longitude W. 55°. The centre of disturbance passed to the northwestward near the Island of Saint Thomas on the 3d, and was near to and north of the Island of Puerto Rico on the 4th. It was especially severe and caused much damage to crops over these Islands, but it did not extend over San Domingo and the Islands to

the westward as a storm of marked energy. On the 5th it was probably central north of Puerto Rico near latitude N. 21°, longitude W. 67°, with an apparent tendency to move northward. Marine observations on the 6th indicate an extended depression covering more than ten degrees of latitude. Within this depression and near the extremities the following vessel reports indicate two centres of disturbance: Schooner "Gertrude," "6th, in N. 28° 44′, W. 64° 52′, barometer 29.52 (750), wind south, force 12; at 7 a. m., in N. 27° 32′, W. 64° 49′, barometer 29.49 (749); shifts of wind, se., sse., s., and sw.; highest force of wind 12." S. S. "Excelsior," "6th, in N. 28° 41′, W. 78° 18′, barometer 29.52 (750), wind northeast, force 4." No reports were received from the central portion of this barometric trough covering the 6th, but from observations taken in the vicinity the indications are that the barometric pressure was greater at intervening points than at the two centres of disturbance above referred to. Considerable weight is given to the observations above quoted, as these vessels afterwards approached the coast, and the readings of the barometers compared with those of land stations showed a probable error of less than one-tenth of an inch. The centre of disturbance in the eastern portion of the barometric trough developed the greatest energy, and its tendency to recurve to the northeast between the 5th and 6th would indicate that it was the continuation of the storm traced over the Windward Islands. There was an apparent tendency for this disturance to recurve after the 5th and follow a normal northeast track, but the presence of an area of high pressure to the north and east interrupted this northeasterly movement and changed the course to the northwest. The mid-day report of the 7th indicated that the principal disturbance moved to the northwest, while that to the westward had disappeared.

During the 7th and 8th no reports were received from the central area covering at least 200,000 square miles, and it is therefore impossible to definitely locate the centre of the disturbance on those dates. Its northwesterly course continued until the 11th, the storm evidently increasing in energy as it approached the coast. After the centre reached N. 38°, W. 72° it was apparently forced to the southwestward by a still further re-enforcement of the area of high pressure to the northward, which not only retarded its easterly movement but caused it to disappear by a gradual increase of pressure while central on the middle Atlantic coast. The westerly movement of areas of low pressure is unusual in high latitudes, and when such movements occur they are usually attended by areas of high pressure to the northward which are apparently drawn to the east or southeast by a barometric depression far to the eastward. [Such a storm occurred on March 25, 1878, when the centre of the disturbance passed from east of Newfoundland westsouthwest over New England and the middle Atlantic coast, the pressure decreasing more than two-tenths of an inch during the westerly movement.] The approach of the centre of disturbance toward the coast was attended by great increase of energy. While this storm was severe and caused great damage to shipping and loss of life, the records of this service show numerous instances of storms which were more destructive both to life and property. "The hurricane of August 14 to 27, 1873, was the most destructive storm that ever visited the Atlantic coast; it recurved between the island of Bermuda and Cape Hatteras, and its centre at no time touched the coast line, although warning signals were ordered for stations on the northeast coast. Twelve hundred and twenty-three vessels were known to have been destroyed, and two hundred and twenty-three human lives were definitely reported as lost. The storm of September 15, 1875, caused a loss of one hundred and seventy-six lives, and three-fourths of the town of Indianola, Tex., was swept away. The hurricane of October 21 to 24, 1878, probably caused more damage. It entered the United States near Wilmington, N. C., and moved due north, and passed over Washington City and eastern Pennsylvania, after which it curved eastward, and crossing New England left the coast near Portland, Me. At Philadelphia, Pa., over seven hundred substantial buildings were totally destroyed or seriously damaged, bridges injured, and twenty-two vessels sunk, entailing a loss variously estimated at from $1,000,000 to $2,000,000. Other loss of life and great damage by freshets and winds occurred elsewhere in Pennsylvania. A large number of steamers, ships, and coasting vessels were dismantled, wrecked, or sunk along the New Jersey, Virginia, and North Carolina coasts, entailing loss of life and immense pecuniary damage. The wind reached seventy-two miles per hour at Philadelphia, and from eighty to eighty-eight miles along the coast. The hurricane of August 16-20, 1879, entered the United States at Cape Lookout, N. C., and skirted the Atlantic coast thence northeastward to Eastport, Me. An enormous amount of damage resulted from this storm. Not only was the damage to inland property very excessive, but the damage to maritime interests may be estimated from the fact that over one hundred large vessels were shipwrecked, dismantled, or disabled, and two hundred yachts or smaller vessels injured. The wind reached a measured velocity of one hundred and thirty-eight miles per hour at Cape Lookout, where the anemometer was carried away. The barometer fluctuated with extraordinary rapidity, there being a fall of .85 inch in five and one-half hours off the New Jersey coast, followed by a rise of .93 inch in six and one-half hours. August 23d-28th, 1881: a storm entered the United States near Savannah, Ga., and followed a very unusual course to the northwestward to Minnesota. The loss of life and damage to property in Charleston, S. C., Tybee Island, and along the adjacent coast was very great. About four hundred persons lost their lives, and hundreds of houses were totally destroyed. The loss of property was estimated at over one and one-half million of dollars. A similar storm passed over Charleston August 23d-24th, 1885, where damage to the extent of nearly two millions of dollars was done, and twenty-one lives were lost. On August 19-20, 1886, a storm completely destroyed Indianola, Tex., which was nearly swept away in September, 1875. Not a house was left standing, and over twenty lives were lost. Galveston, Tex., also suffered great damage."

The following telegrams and reports furnished by the Rev. Benito Viñes, S. J., are descriptive of this depression and of the destructive storms which attended it over the West Indies: "3d.—Saint Christopher, W. I.: last night, 2d, barometer, 29.50 (749); wind, ne. From 10.15 p. m., 2d, to 12.45 a. m., 3d, wind light and calm with falling barometer; 2 a. m., 3d, barometer, 29.38 (746), wind changing to sw.; 2.30 a. m., 3d, barometer, 29.70 (754), wind and sea dreadful. English s. s. 'Roraima' and schooner 'Circe' were lost; the crews were saved. Havana, Cuba, 3d: a cyclone of great intensity appeared this morning near Santa Cruz and Saint Thomas. The vortex was approximately to the ese. of Puerto Rico. Santiago de Cuba: at Puerto Rico yesterday, 2d, at 7 a. m., barometer, 29.92 (760); at 3 p. m., 29.84 (758); to-day, 7 a. m., 29.76 (756); wind, nne. The barometer at this place at 3 p. m. to-day, 29.85 (758); at Santa Cruz, at 3 p. m. to-day, barometer, 29.65 (753); wind, sw., cyclone path, wnw. Santa Cruz, 5 p. m.: cyclone very severe from 9 a. m. to noon; wind yet strong from sw.; no communication to-day with Saint Thomas. San Domingo, 4 p. m.: barometer, 29.72, (755); strong north sea; thunder-claps. Havana: the last cablegrams received indicate that the vortex of the cyclone remained this afternoon between Santa Cruz and Puerto Rico, and that the trajectory of the cyclone is to the wnw. Supposing this direction, the storm will probably cross over the island of Puerto Rico, will later touch the north coast of San Domingo, and will make itself felt with more or less intensity on the north coast of Cuba from the 6th to the 7th. 4th.—Santiago de Cuba: 7 a. m., barometer, 29.88 (759); cirro-cumulus from e., high cumulus from ene.; 2 p. m., barometer, 29.81 (757), blue sky with only one current cumulus high from ene.; wind se., fine weather; 3 p. m., barometer, 29.81 (757), mist, wind n. and light variable; 10 p. m., barometer, 29.90 (759), calm, cloudy. San Domingo: 9 a. m., barometer, 29.80 (757), clear, wind n., strong. Puerto Plata:

3.45 p. m., wind nnw., light, rainy, swelling sea. San Domingo: 5 p. m., a violent storm with torrents of rain since 1 p. m., barometer, 29.75 (756), wind changed from e. to nw. Saint Thomas: the storm of yesterday, 3d, caused great damage in the country; the barometer fell to 28.97 (736). The telegraphic and traffic lines are interrupted. Santa Cruz: during the storm of yesterday, 3d, much damage was caused. Havana, 4th: from cablegrams received here it is understood that the cyclone passed a short distance north of Saint Thomas, and this morning its vortex remained approximately to the wnw. of the capital of Puerto Rico, slowly advancing to the north coast of San Domingo. According to reports it appears that the storm is of great diameter and intensity, and notwithstanding it is announced from Santiago de Cuba with path towards wnw., its trajectory appears to incline somewhat more to the n., in which case it is possible that its influence, not its effects, will be felt in this island. 5th.—San Domingo: 7 a. m., barometer, 29.88 (759), cloudy, wind n., light; storm ceased 11 p. m., 4th. Santiago de Cuba: 7 a. m., barometer, 29.89 (759), wind ne., light, cloudy. Havana, 5th: according to telegrams just received the winds from the left side of the trajectory of the cyclone have at present made themselves felt very forcibly on the north coast of San Domingo, and it is probable that from the 6th to 7th, according to the general rule, it will make itself felt with more or less severity on the north coast of the eastern part of Cuba. The cyclone is apparently violent and of short radius, and advances slowly. The direction of the trajectory, which in the neighborhood of Puerto Rico will be toward wnw., approximately, will probably incline more to the n. in proportion as the cyclone advances in latitude, thus preparing to recurve, which will probably take place in the proximity of Florida in a latitude between 27° and 29°. The reports confirm the opinion of yesterday with regard to the course of the cyclone; in diameter it is not apparently as great as thought in the beginning. 6th.—Havana: meteorological reports indicate a rise of the barometer and good weather; from this I deduce that the cyclone followed a very large trajectory; there is, in consequence, no probability that it can pass over this island. The vortex of the cyclone passed over the island of Saint Christopher from 10 p. m. to midnight of the 2d, and on the 3d it crossed a short distance north from Saint Thomas, and from the strong velocity of the wind, the low minimum barometer, and the difference of barometer between Saint Thomas and San Juan de Puerto Rico, a difference of more than .71 (18), between points in near proximity to each other, makes me suppose a strong barometric gradient and a very rapid barometric fall, which only verifies itself in violent cyclones of a certain radius and in the proximity of the vortex. From the known position of the cyclone on the 4th and 5th, the velocity of translation of the storm is shown to be a little more than eight miles per hour, a movement which is indeed remarkably slow. The diameter of the vertical calm during its passage over Saint Christopher was, according to this, a little more than sixteen miles."

The following reports indicate the character of the disturbances which attended this depression off the coast of the United States. The first positive information that this storm had reached the coast of the United States was received from the Signal Service station at Block Island, R. I., at 8 a. m., on the 9th, when during a sudden squall, the wind rose to forty-eight miles per hour from the northeast. The observer reports that the storm did not begin until 5 p. m. of that day: Atlantic City, N. J.: the high northeast winds which prevailed from the 8th to the 12th attained a maximum velocity of seventy-two miles per hour at 2.30 p. m. of the 10th, causing the tide to rise very high on those dates, the highest point being reached during the night of the 10–11th, when the meadows along the water front and a portion of the city were inundated. Great destruction to property occurred in this city and along the beach by the wind and tide.—*Report of W. J. Blythe, observer, Signal Corps.* Philadelphia, Pa.: high northeast wind, maintaining a steady velocity of forty to forty-five miles an hour, prevailed throughout the day of the 10th, and continued into the day of the 11th, with an extreme velocity of sixty miles per hour on the 10th. All telegraphic communication between here and Atlantic City was cut off during the 10th and 11th.—*Report of L. M. Dey, observer, Signal Corps.* Egg Harbor City, N. J., 10th: during last night and to-day a severe northeast storm has prevailed. Much damage has been done to crops and fruit trees in this section.—*Report of H. Y. Postma, voluntary observer.* Baltimore, Md.: the storm which prevailed with great persistence from the 10th to the 12th was very severe on Chesapeake Bay. All steamers arriving in this port have been delayed six to twelve hours by the storm.—*The Baltimore, Md., Sun, September* 12. Lewes, Del.: a most destructive storm raged in this section from the 8th to the 12th. The telegraph station was washed away, the marine hospital dashed from its moorings, and the life-saving station, located forty feet above high water mark, was flooded and the foundation undermined. Humphreyville, a suburb between the town and the beach, was submerged, and its two hundred inhabitants fled for their lives. Thirty-one vessels are known to have been wrecked or washed ashore, and the damage to shipping is estimated at $570,000. The total number of lives lost will probably exceed forty.—*The Baltimore, Md., Sun, September* 13. It is estimated that the bulk of the losses caused by the storm to railroad and vessel owners will reach $1,786,000. —*The Record, Philadelphia, Pa., September* 13. Reports from Signal Service stations show that violent storms and unusually high tides occurred along and off the Atlantic coast from New England to North Carolina from the 8th to the 12th.

Upon the receipt of information from the West Indies that a severe storm existed over the Windward Islands, the principal ports on the coast of the United States from New England to Florida, and the Hydrographic Office, U. S. Navy, were notified. The probable course of the storm was also indicated, as shown by the following telegrams, sent by order of the Chief Signal Officer:

WASHINGTON, D. C., *September* 5—10.35 a. m.

Secretary, Maritime Exchange, New York City:

Cyclone in West Indies passed over San Domingo yesterday at 6 p. m. Variable winds from east to northeast. ALLEN.

WASHINGTON, D. C., *September* 5—2.58 p. m.

Observers, Norfolk, Wilmington, Southport, Charleston, Savannah, and Jacksonville:

Cyclone reported north of Hayti apparently moving north. ALLEN.

The following correspondence was had with Capt. J. M. Lachlan, General Manager of the United States and Brazil Mail Steamship Company, relative to this storm:

[Telegram.]

OFFICE OF THE UNITED STATES & BRAZIL MAIL STEAMSHIP COMPANY,
NEW YORK CITY—6.28 p. m., *September* 10, 1889.

GENERAL GREELY, *U. S. Signal Service, Washington, D. C.:*

This company intends to dispatch their steamship "Advance" to-morrow, 11th, to Newport News, en route for Brazil, calling at Saint Thomas. Please wire indications and recommendations as to judiciousness of postponement. We are informed heavy meteorological disturbances exist off Hatteras region. Will thankfully pay for reply.

J. M. LACHLAN,
General Manager U. S. & B. M. S. S. Co.,
Mills Building, 23 Broad St., New York City.

[Telegram.]

WASHINGTON, D. C., *September* 10, 1889—9.30 p. m.

CAPT. J. M. LACHLAN, *General Manager U. S. & B. M. S. S. Co.,*
Mills Building, 23 Broad St., New York City:

Dangerous to sail; violent gale off Hatteras. Will wire you again by 11 a. m. to-morrow morning.

GREELY,
Chief Signal Officer.

[Telegram.]

WASHINGTON, D. C., *September* 11, 1889—11 a. m.

CAPT. J. M. LACHLAN, *General Manager U. S. & B. M. S. S. Co.,*
Mills Building, 23 Broad St., New York City:

Gale still continues from New York to Hatteras; dangerous to sail. If storm has abated by night will advise you.

GREELY,
Chief Signal Officer.

[Telegram.]

WASHINGTON, D. C., *September* 11, 1889—10.50 p. m.

CAPT. J. M. LACHLAN, *General Manager U. S. & B. M. S. S. Co., Mills Building*, 23 *Broad St., New York City:*

Storm has not moved since morning. High northeasterly winds to the Capes of the Delaware, and thirty to thirty-five miles per hour from the northeast from there south.

GREELY,
Chief Signal Officer.

[Telegram.]

NEW YORK, *September* 12, 1889—6.13 p. m.

GENERAL GREELY, *U. S. Signal Service, Washington, D. C.:*

Many thanks for your most valuable information and aid to commerce. I have again postponed sailing "Advance" till ten a. m. to-morrow. Nearly all ships that sailed since last Monday are at anchor in lower bay; some have returned after having been outside. Our ship is lying securely fast at dock.

J. M. LACHLAN,
General Manager U. S. & B. M. S. S. Co.

[Letter.]

OFFICE OF THE UNITED STATES & BRAZIL MAIL STEAMSHIP COMPANY,
NEW YORK, *September* 12, 1889.

GENERAL GREELY, *U. S. A., Chief Signal Officer, Washington, D. C.:*

DEAR SIR: On Tuesday, 10th, I wired you as per enclosed copies, which I now confirm, and here received the following replies from your office, copies herewith annexed. I wired your good self this p. m., copy herewith, which I also confirm.

I desire, on the part of this company, to sincerely thank you for the prompt and valuable information furnished in respect to the indications, and to state, so sure was the writer of the absolute certainty of your messages, that I had no hesitation whatever in postponing the steamship "Advance." A number of foreign and coasting steamships sailed from here, but it did not give us the slightest uneasiness as we were quite sure they could not go far. We now find that nearly all of these ships are at anchor in the lower bay, with two anchors down, rolling and tumbling about in the heavy swell down there. Our ship is lying secured, fast to her wharf, not burning coal, nor doing any damage. If any ship can go outside ours can, but is it prudent to do so when it can be avoided? On Saturday, the 7th, we received a cable from Saint Thomas, W. I., advising of arrival and sailing from thence, bound south. The cable further stated: "Hurricane, no damage."

There is no doubt but what this is the same cyclone on its way northward and I have no doubt also that you have observed the slownesss of its speed in its track; however fast it may be revolving it seems to have a large area. Seeing the extraordinary high tides on Sunday a. m., and not seeing the ebb go down to its normal level put the writer on the *qui vive*, and he determined to consult your office before despatching the s. s. "Advance." No doubt we shall hear of numerous casualties shortly on this coast and off shore.

Again thanking you,

I am, yours truly,

J. M. LACHLAN,
Manager.

2.—This depression was central over mid-ocean north of the fiftieth parallel on the 1st, with central pressure about 29.70 (754) and moderate to fresh gales, after which it apparently moved northeastward beyond the region of observation.

3.—This depression apparently originated northeast of the Grand Banks, where it was central on the 2d with pressure about 29.50 (749). During the 3d and 4th the centre of depression moved slowly eastward to about the thirty-fourth meridian. From the 5th to the 13th, inclusive, this depression pursued a slow, irregular course over mid-ocean, its advance eastward being apparently obstructed by an area of high pressure that occupied the British Isles and the adjacent ocean. It will be noted that during this period the severe storm described as number 1 was advancing north-northwest from the West Indies, and that a depression was moving northeast and east between the West Indies and the Azores. It will also be observed that a ridge of high pressure appeared over the Canadian Maritime Provinces and extended thence southward over the ocean, and that a second area of high pressure occupied the extreme eastern part of the ocean. In the region dominated by depression number 3 the barometric pressure was reported below 29.00 (737), and gales attaining hurricane force were encountered on the 10th. After the 10th the depression appeared to lose energy, and by the 14th had apparently dissipated.

4.—The approximate path of this depression is given northeast of the Windward Islands on the 4th and 5th, after which its probable course northeastward to the thirty-fourth parallel by the 8th is indicated. From the 8th to the 11th the storm-centre moved north of east to the Azores with low pressure and disturbances of great violence, after which latter date it apparently passed northward and united with number 3.

5.—This was probably a subsidiary development to depression number 3, and on the 9th was central over mid-ocean south of the fiftieth parallel, with central pressure about 29.30 (744), and moderate to fresh gales, after which it moved northward and united with number 3.

6.—This depression was a continuation of low area vii, and on the 22d was central over the Gulf of Saint Lawrence, with pressure below 29.40 (747), and fresh to strong gales west of the fortieth meridian. On the morning of the 23d the storm was central over Newfoundland, where the pressure was below 29.40 (747), whence it moved northeastward and disappeared north of the region of observation after the 25th, without evidence of loss of energy.

7.—This depression was a continuation of low area viii, and on the 27th was central over the Gulf of Saint Lawrence, with pressure below 29.70 (754), whence it moved north of east over northern Newfoundland during the 28th, after which it disappeared north of the region of observation.

OCEAN ICE IN SEPTEMBER.

The following table shows the southern and eastern limits of the region within which icebergs or field ice were reported for September, during the last seven years:

Southern limit.			Eastern limit.		
Month.	Lat. N.	Long. W.	Month.	Lat. N.	Long. W.
	° ′	° ′		° ′	° ′
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
September, 1887	45 37	40 50	September, 1887	45 37	40 50
September, 1888	Off Cape	Race.	September, 1888	53 00	52 08
September, 1889	46 21	48 22	September, 1889	48 59	46 48

In September, 1889, the southernmost ice reported, which consisted of a large and a small iceberg, observed on the 14th in the position given, was less than one-half degree south of the average southern limit, and the easternmost ice reported, a small iceberg observed on the 26th, was less than one-half degree east of the average eastern limit of ice for the month. Ice was most frequently encountered from the Straits of Belle Isle eastward to the fiftieth meridian, and on the northeast edge of the Banks of Newfoundland. No ice was reported near the east coast of Newfoundland south of Belle Isle. Compared with the corresponding month of previous years, there was about the usual distribution of Arctic ice for September, 1889, although the aggregate quantity reported was somewhat in excess of the average for the month.

The following positions of icebergs and field ice reported are shown on chart i by ruled shading:

1st.—N. 50° 40′, W. 50°, two large bergs; N. 50° 25′, W. 50° 20′, three bergs, one very small.

3d.—N. 50° 55′, W. 50° 57′, three bergs; N. 51° 50′, W. 55° 15′, small bergs.

4th.—N. 52° 49′, W. 51° 46′ to Belle Isle, a number of large bergs; N. 52° 21′, W. 51° 06′, small bergs.

5th.—N. 48° 45′, W. 49° 19′, two moderate sized bergs.

6th.—N. 52° 59′, W. 51° 35′, bergs of all sizes; N. 52° 50′, W. 52°, two large bergs, and from thence to Cape Norman, six bergs, mostly partly submerged and surrounded by small pieces.

6–8th.—N. 52° 59′, W. 51° 35′ to Straits of Belle Isle, bergs of all sizes four to five miles apart.

7–8th.—N. 53° 05′, W. 51° 27′, a large number of small bergs; off Belle Isle, several large bergs.

8th.—Off Belle Isle, several bergs, some rather large; in Straits of Belle Isle, bergs of all sizes; from Cape Norman to Belle Isle, bergs, many aground north side of straits.

9th.—N. 48°, W. 48° 40′, two bergs, one eighty the other one hundred and twenty feet high.

10th.—N. 47° 52′, W. 48° 38′, one berg; N. 47° 40′, W. 48°

40′, two large and three small bergs; N. 48° 09′, W. 48° 47′, two bergs.

11th.—N. 46° 54′, W. 48° 25′, a berg two hundred by eighty feet.

11–12th.—From N. 53° 13′, W. 50° 48′, to Point Amour, several very large and small bergs.

12th.—N. 53° 08′, W. 50° 50′, one small berg; N. 52° 36′, W. 53° 00′, two large bergs; N. 47° 52′, W. 48° 29′, a large square berg thirty to forty feet high; N. 47° 40′, W. 49° 07′, a small peaked berg.

13th.—N. 46° 40′, W. 47° 50′, two large and one small berg; N. 48° 07′, W. 49° 27′, a large and a small berg and large pieces; N. 47° 49′, W. 49° 58′, two large bergs; N. 47° 57′, W. 49° 11′, one medium-sized berg; N. 48° 00′, W. 49° 20′, two large bergs fifteen miles apart.

14th.—N. 46° 21′, W. 48° 22′, a large and a small berg; N. 48° 15′, W. 48° 55′, three bergs; N. 47° 35′, W. 49° 15′, three large bergs about one hundred and fifty feet high, irregular shape, peaked at ends.

15th.—N. 46° 40′, W. 47° 50′, two large and a small berg and several pieces of ice; N. 47° 28′, W. 49° 25′, bergs.

17th.—N. 46° 50′, W. 48° 12′, three very large and several small bergs at intervals of several miles.

19th.—N. 47° 29′, W. 51° 00′, a small berg.

21st.—N. 47° 40′, W. 50° 06′, a high berg with complete arch through the centre.

23d.—From Belle Isle to 50′ east, five moderate-sized bergs; N. 52° 15′, W. 53° 28′, two large bergs; three bergs near Belle Isle.

24th.—N. 48° 52′, W. 46° 56′, a small berg; from N. 48° 22′, W. 48° 27′, to N. 48° 01′, W. 49° 12′, three bergs and small pieces of ice.

25th.—N. 48° 03′, W. 48° 32′, a berg; N. 48° 26′, W. 48° 02′, two bergs and detached pieces.

26th.—N. 47° 41′, W. 48° 29′, a large berg; N. 48° 59′, W. 46° 48′, a small berg; N. 48° 32′, W. 47° 55′, very large bergs; N. 53° 00′, W. 52° 06′, two large bergs, and from this position to off Belle Isle on the 27th, a number of large bergs; from N. 52° 00′, W. 54° 55′, to N. 52° 09′, W. 54° 21′, four large bergs right in the track of vessels bound through the Straits of Belle Isle.

27th.—From ninety miles from Belle Isle to entrance of straits, several very large bergs.

28th.—N. 48° 30′, W. 46° 51′, a small berg.

29th.—N. 52° 22′, W. 53° 25′, two small bergs.

FOG IN SEPTEMBER.

The limits of fog-belts west of the fortieth meridian are shown on chart i by dotted shading. In the vicinity of the Banks of Newfoundland fog was reported on nineteen dates, as compared with twenty-two dates for August, 1889, and sixteen dates for September, 1888. Between the fifty-fifth and sixty-fifth meridians fog was reported for six dates, as compared with six dates for August, 1889, and twelve dates for September, 1888. West of the sixty-fifth meridian fog was reported on eight dates, as compared with nine dates for August, 1889, and eleven dates for September, 1888. Compared with the preceding month there has been a slight decrease in fog frequency over and near the Grand Banks, while to the west of the fifty-fifth meridian the aggregate number of days for which fog was reported was the same for each month. Fog was reported for seven dates along the steamship track north of Newfoundland. Fog was reported over and near the Grand Banks on the 1st, 15th, and 15th to 18th, and in the ice region north of Newfoundland on the 6th, 7th, and 8th, with variable winds and relatively high barometric pressure; on the remaining dates for which fog was reported in those regions the approach or passage of areas of low pressure was noted. Between the fifty-fifth and sixty-fifth meridians fog was reported on the 1st with northeasterly winds and high pressure, and from the 5th to the 9th, inclusive, within the area of high barometer and variable or easterly winds that occupied that region during the approach of the cyclone from the West Indies to the middle Atlantic coast. West of the sixty-fifth meridian dense fog attended the approach of the West Indian hurricane from the 6th to the 9th; during the 14th, 15th, and 16th, fog was reported in that region with southeasterly winds and high pressure, and on the 26th, attending the advance off the middle Atlantic coast of an area of low pressure.

The following are limits of fog-areas on the north Atlantic Ocean during September, 1889, as reported by shipmasters:

Date.	Entered.		Cleared.		Date.	Entered.		Cleared.	
	Lat. N.	Lon. W.	Lat. N.	Lon. W.		Lat. N.	Lon. W.	Lat. N.	Lon. W.
	° ′	° ′	° ′	° ′		° ′	° ′	° ′	° ′
1	45 05	51 53	43 21	57 32	16–17	48 08	44 31	46 17	48 15
4	Saint Johns N. F.,		fog at sea.		17	46 50	46 40	46 27	48 00
4	47 30	45 40	46 01	49 21	17–18	48 34	41 50	45 34	49 53
4	48 28	43 11	48 07	44 10	18–19	44 23	48 37	43 31	52 56
4–5	46 13	45 46	45 00	50 08	18–19	46 45	45 30	44 28	52 20
5	42 23	61 24	42 19	61 45	19	Saint Johns, N. F.			
6	42 59	60 39	42 50	61 12	20	47 41	44 17	47 20	45 40
6–7	52 36	52 34	Cape Norman.		20–21	53 15	48 35	52 07	51 15
6–7	41 16	66 32	40 20	69 31	21	46 58	47 10	46 56	47 46
7	43 20	59 55	42 15	62 30	21	45 02	51 10	46 00	45 58
7–8	46 45	49 00	47 50	44 15	22	43 50	50 15	43 30	51 32
7–8	41 12	66 42	40 23	70 09	22	49 25	47 00	47 40	50 45
8	52 04	54 15	51 48	55 30	23	48 18	46 30	48 12	47 00
8	41 00	66 45	40 25	67 53	23–24	48 30	45 57	47 58	47 35
8–9	42 20	67 30	42 23	65 00	23	52 45	52 22	53 10	50 51
9	49 18	63 36	49 14	65 00	24	46 10	45 16	46 45	43 15
9	41 00	68 14	41 17	67 45	25	55 30	41 00	56 00	37 13
14–15	New York.		40 15	73 52	26	40 57	73 23	40 57	73 23
15	42 50	50 30	42 35	53 00	28–29	54 36	43 38	55 51	33 47
15–16	42 41	66 05	42 25	70 00	28–29	46 35	52 21	46 25	52 44
16	47 36	43 14	47 15	44 48					

TEMPERATURE OF THE AIR (expressed in degrees, Fahrenheit).

The distribution of mean temperature over the United States and Canada for September, 1889, is exhibited on chart ii by dotted isotherms. In the table of miscellaneous meteorological data the monthly mean temperature and the departure from the normal are given for regular stations of the Signal Service. The figures opposite the names of the geographical districts in the columns for mean temperature and departure from the normal show, respectively, the averages for the several districts. The normal for any district may be found by adding the departure to the current mean when the departure is below the normal and subtracting when above. The monthly mean temperature for regular stations of the Signal Service represents the mean of the maximum and minimum temperatures.

In September, 1889, the mean temperature was highest in the extreme southeastern part of California and the adjoining part of Arizona, where it rose above 85°, the highest mean reading, 91°.3, being reported at Cactus, Cal. In southeastern California, south of the thirty-sixth parallel, southern Nevada, central and western Arizona, extreme southern Louisiana, central and southern Florida, and at one station each in south-central Alabama, and eastern Texas the mean values were above 80°. South of a line traced irregularly westward from North Carolina to southern New Mexico, in central Kansas, and in the Sacramento and San Joaquin valleys, Cal., the mean temperatnre was above 70°. Exclusive of Pike's Peak, Colo., where 31°.7 was reported, monthly mean temperature below 32° was not reported, and the only stations noting monthly mean values below 50° were located in central Colorado, south-central Oregon, central Montana, southeastern Idaho, central Utah, northwestern Wyoming, and in the British Possessions north of Dakota and Montana. At Mount Washington, N. H., and Mount Killington, Vt., the mean temperature was 43°.2 and 47°.6, respectively.

The mean temperature was below the normal, except at sta-