

The following reports relative to this storm have been rendered: Mr. James Mainwaring, observer on the s. s. "Athos," Capt. Horatio Low, commanding, reports: "17th, off the south-east end of Jamaica; weather very dark and thick, with torrents of rain, vivid lightning, and strong gusts of wind from se.; continued very squally and unsettled, with heavy rain, until the 18th." Capt. John Legoc, of the s. s. "Pomona," reports: "17-18th, in Montego Bay, Jamaica; very heavy rain, wind from sw., in heavy, short squalls, making a bad sea at times; at night very dark; lowest barometer, 29.71 (754.6), on the 18th. This was an unusually heavy wind for Jamaica, for the time of year." Second Officer Sengzelius, of the s. s. "Alvena," Captain Mackay, commanding, reports: "17th, from Kingston to Lucea, Jamaica, experienced very rough weather after leaving Port Royal at 10 a. m., Greenwich mean time. 18th, the wind commenced to blow from the southward, with heavy rain squalls, and increased in strength up to 4 p. m., during which time the wind hauled to the westward and a heavy sea was running from sw.; the barometer (mercurial) being down to 29.60 (751.8) at the last-mentioned hour. After 4 p. m. the wind and squalls decreased in strength, but wind continued to blow strong from the westward." The s. s. "Athos," on the 20th, in N. 26° 13', W. 74° 12', encountered an easterly gale, accompanied with heavy rain squalls lasting twelve hours; lowest barometer 29.85 (758.2).

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6.—Vessel reports of the 17th indicated the presence of a cyclonic centre to the westward of Jamaica; moving slowly north the depression is traced to the south coast of Cuba, in W. 79°, by the 18th, whence it passed north over that island by the 19th. During the 20th and 21st the centre of depression advanced eastward to the seventy-first meridian, after which it disappeared. The passage of this depression was chiefly characterized by heavy rain, although the wind was heavy, in gusts, and barometric pressure 29.60 (751.8) was reported on the 18th.

VII.—This low area was the only depression which passed within the limits of observation during the month that proved to be dangerous to all classes of vessels. Its first appearance

and subsequent course entitle it to be placed among that class of storms known as West Indies' cyclones.

The following report of Mr. A. P. Goodman, mate of bark "Florence," of Boston, located at Barbadoes during the time it prevailed in that vicinity, will illustrate its severity:

July 20th.—During the last two days we have had light squally weather, with rain showers and very close, sultry weather and a falling glass. At 4 a. m., Greenwich time, 20th of July, the weather commenced to threaten, the glass having fallen to 29.64. We put out extra ropes and lines and made all secure for a blow; at 6 a. m. blowing heavy, with squalls of rain and a sea rolling in from the sse.; 7.30, wind increasing in the squalls; 8.30, in a terrific squall we parted all our lines and drove over to the other side of the Creek, doing considerable damage; about the same time we saw distress signals out to the Roads, and when daylight broke it was something terrific to look at, there being no less two barks, one barkentine, one brigantine, one two-masted schooner, one small steamer, and two condemned vessels on the shore; one bark and barkentine completely broken up; the sea was like a mountain on the shore.

The path pursued by this cyclone, as determined by a number of vessels' logs, reports, and observations received from vessels sailing on the Gulf of Mexico, the Caribbean Sea, and vicinity, appears to have been a little south of Barbadoes on the 20th, moving east. It then moved eastward over the central portion of the Caribbean Sea just north of N. 15° to W. 85°, then northwest over the extreme eastern portion of Yucatan to about N. 25°. At about the latter point its path seems to have been northerly for a few degrees and then changed to northeast. It arrived on the coast of western Florida on the morning of the 27th, with a minimum pressure of 29.60 and a wind-velocity of fifty-four miles per hour or more. After reaching the coast of Florida its course con-

tinued northeast to the vicinity of Augusta, Ga., then westward, arriving in northern Mississippi on the evening of the 31st, where it finally disappeared early in August. Its progress through the Caribbean Sea and the Gulf of Mexico appears to have been between fifteen and twenty miles per hour, and was accompanied by destructive winds and heavy rainfall. Reports of a number of vessels wrecked have been received from the western Florida and northern Cuban coasts.

The progress of the cyclone after leaving the Gulf of Mexico was reduced to about ten miles per hour. Its violence also appears to have been slightly reduced, judging from the following maximum wind-velocities, in miles per hour: Cedar Keys, Fla., 54; Pensacola, Fla., 36; Jacksonville, Fla., 36; Savannah, Ga., 36; Augusta, Ga., 20; Atlanta, Ga., 30; Mobile, Ala., 26. The rainfall was very heavy in Florida, Georgia, and eastern Alabama. The following are the total amounts, in inches, reported during the time the influence of the cyclone prevailed: Jacksonville, Fla., 3.50; Titusville, Fla., 4.54; Cedar Keys, Fla., 8.00; Pensacola, Fla., 1.34; Montgomery, Ala., 3.57; Atlanta, Ga., 8.93, and Augusta, Ga., 6.02. This heavy rainfall, in connection with the high winds and swollen rivers, was very destructive to the growing crops and public highways.

Through the kindness of Padre B. Viñes, S. J., Director of the Magnetic and Meteorological Observatory, Belen College, Havana, Cuba, the Chief Signal Officer was kept informed by telegraph of the progress of the cyclone before it reached the coast of the United States, and timely warning was given to the shipping on the Gulf and south Atlantic coasts, both by cautionary wind signals and special storm messages.

NORTH ATLANTIC STORMS DURING AUGUST, 1887.

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

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

Of the nine depressions traced, three originated in the tropics; five advanced eastward over Newfoundland; and one left the American coast in about N. 38°. Three storms traversed the ocean from coast to coast, of which two passed eastward from the Gulf of Saint Lawrence, and one moved from the West Indies along the course of the Gulf Stream to the sixtieth meridian, and thence advanced northeast to the northward of the fifty-fifth parallel.

The depressions presented the usual characteristics of August north Atlantic storms, and, as a rule, exhibited a marked loss of energy after passing to the eastward of the thirtieth meridian. The tropical cyclones which advanced toward the Florida coast north of the West Indies, and subsequently moved northeast parallel with the American coast, were of the energetic and destructive type of storms peculiar to that region during August, and while they probably equaled in strength the tropical storms traced for corresponding months of previous years their destructive features were less apparent, owing to the course of their paths being too far to the northward to occasion disastrous winds or rains over the larger and more important West India Islands. These cyclones, more particularly the one traced as number 8, exhibited a great loss of energy during the periods occupied by their northward curve off the Florida coast, and, although their strength was augmented during their subsequent passage along the Gulf Stream, their influence along the Atlantic coast of the United States was not so severely felt on land as during the prevalence of storms of this class in previous years. The storm which is given a probable track westward over the Caribbean Sea was of slight energy.

The depressions traced over mid-ocean were rather evenly distributed throughout the month, and were, as a rule, accompanied by disturbances of pronounced strength. Over the ocean east of the twentieth meridian the weather was generally fine, while during the first half of the month settled weather prevailed off the American coast south of the forty-fifth parallel. The barometer continued relatively high in the vicinity of the Azores during the entire month, the fluctuations observed being incidental to the passage of cyclonic areas to the northward of the forty-fifth parallel.

2.—The presence of this depression to the southward of San Domingo was indicated by vessel reports of the 5th, whence it apparently moved eastward over the Caribbean Sea into the Gulf of Mexico by the 8th, accompanied by rain and fresh gales. Its course subsequent to the 7th cannot be determined, owing to an absence of reports. Capt. A. P. Goodman, of the bark "Florence," reports, relative to this depression, as follows: "5th, 4.30 a. m., Greenwich time, in East Harbor, Caicos Islands, threatening weather, barometer 29.61 (752.1) and falling; 7.30 a. m., wind and sea rising rapidly; 8.30 a. m., barometer 29.57 (751.1), wind a hard gale, with heavy squalls and rain and high sea from se.; 10 a. m., a very heavy se. squall of wind and rain, barometer 29.55 (750.6), gale at its height; 11.30 a. m., barometer rising and wind moderating."

5.—This depression apparently originated to the eastward of the Windward Islands and moved northwestward to about N. 22°, W. 63° by the 16th; moving slightly north of west, the depression was central on the 19th off the east coast of southern Florida, whence it circled northward and followed the course of the Gulf Stream until the 23d, on which date it was central in N. 50°, W. 31°. During the next five days the storm-centre pursued a diversified course over mid-ocean in the vicinity of the fifty-fifth parallel, and on the 29th had apparently moved westward and united with depression number 8 which had advanced from the westward. During the passage of this storm along the coast of the United States it was attended by hurricanes of exceptional violence; on the 22d, when central southeast of Newfoundland, a marked rise in central pressure and a considerable loss of energy were shown; with its advance over mid-ocean, however, the depression acquired great energy and was accompanied by barometric pressure ranging below 29.00 (736.6) and gales of hurricane force throughout the remainder of its course.

The following special reports have been rendered relative to disturbances encountered during the passage of this depression: Capt. J. Wilder, of the s. s. "City of San Antonio," reports a hurricane on the 19th and 20th; wind veered from ese. to sw.; lowest barometer, 28.56 (725.4), at 1.45 a. m. of the 20th, in N. 33° 48', W. 76° 36'. Capt. Frank Stevens, of the s. s. "Mantattan," reports: "20th, 9 a. m., off se. point of Hatteras Shoal, weather very threatening; barometer falling fast from 29.94 (760.5); wind from e.; turned ship around and ran to the northward as long as I possibly could for the heavy quartering sea. 11 a. m., hove-to on starboard tack, head to the eastward. 1 p. m. to 3.30 p. m., storm very severe, the wind at times estimated ninety to one hundred miles per hour, for it would flatten the sea down, and make it all foam; the air was thick with spray; during lulls a tremendous sea would arise; barometer at 1 p. m., 29.13 (739.9), wind se. 3.30 p. m.,

barometer commenced to rise, and wind veered to s. and sw., and commenced to moderate, when it hauled to nw. and cleared off. I had no warning of this storm until it was on me, for when I turned to run from it the barometer had been stationary at 29.94 (760.5) all night, the first part of the night being clear and starlit."

Capt. Robert Mount, of the steam schooner "Louis Bucki," reports: "A hurricane on the 19th and 20th; lowest barometer, 29.00 (736.6), at 3 a. m. of the 20th, in N. 34° 25', W. 76° 50', wind set in from se. to e., and steadily increased from 11 p. m. of the 19th to 3 a. m. of the 20th; after a lull of fifteen minutes wind suddenly shifted to wnw., blowing squally and hard, then moderated gradually. At 10 a. m. of the 19th, thirty minutes before any serious increase in wind, I experienced three huge seas, resembling what are described as tidal waves, each one sweeping the decks and doing considerable damage. The cyclone appeared to be travelling nne., and, considering our position at the commencement (about five miles to windward of Cape Lookout), I was unable to avoid the centre, which passed right over us. My barometer fell at the rate of two-tenths of an inch per hour, and rose as rapidly."

Capt. L. Dexter, of the s. s. "City of Para," reports: "20th, noon, in N. 23° 40', W. 74° 16', wind fresh from wnw., cloudy and threatening weather, heavy ne. swell, barometer 29.75 (755.6), I suppose we are in the sw. quadrant of a cyclone; I steered n. by e. $\frac{1}{2}$ e. forty-four miles until 4 p. m., when barometer stood at 29.60 (751.8), with a wnw. gale; slowed engine lowest possible speed, heading nne., took in all sail; 8 p. m., barometer 29.51 (749.5), hard wsw. gale with squalls and rain, increased speed to six miles per hour, making nne. course; midnight, barometer 29.41 (747.0), increasing sw. wind, squally, steering n., eleven miles per hour. 21st, 4 a. m., barometer 29.35 (745.5), hard s. gale, squally with blinding rain; 8 a. m., barometer 29.51 (749.5), very hard sse. gale, terrific squalls, blinding rain, heavy sea, ship running before it; noon, barometer 29.67 (753.6), wind se., moderate, weather clearing in ne.; wind continued se. and barometer rose rapidly." This vessel evidently entered the southwest quadrant of depression number 5 during the night of the 19-20th, and during the 20th and 21st was within the area of depression number 8.

Capt. C. L. Rigby, of the s. s. "Wyoming," reports: "21st, noon, Greenwich time, in N. 43° 32', W. 59° 08', barometer 29.79 (756.7), air 66°, light variable winds mostly southerly, with rain, wind backing to eastward; 4 p. m., in N. 43° 17', W. 60° 16', strong ese. wind, with heavy rain, wind veering to sw., barometer 29.70 (754.4), air 69°; 6.10 p. m., wind fell light and veered round by w. to nw. and ne., and increased to hurricane force with a very heavy sw. sea; 7.30 p. m., in N. 43° 02', W. 60° 50', barometer 29.05 (737.9), air 65°, still blowing the same, with heavy rain and a very heavy confused sea; 8 p. m., wind moderating and backing to nw., barometer 29.16 (740.7), air 62°; midnight, in N. 42° 46', W. 61° 36', strong nw. breeze and clearing weather, barometer 29.72 (754.9), air 67°."

Capt. W. Rea, of the s. s. "Bassano," reports a whole gale on the 20th and 21st; wind backed from sw. to se. and n.; lowest barometer, 29.35 (745.5), at 1.30 a. m. of the 21st, in N. 40° 35', W. 68° 04'. The gale was accompanied by very heavy rain, terrific thunder and lightning, and a confused sea. Capt. A. G. Braes, of the s. s. "State of Nebraska," reports a hurricane of short duration on the 21st; wind backed from se. to nne.; lowest barometer, 29.21 (741.9), at noon, in N. 42° 33', W. 62° 04'. Third Officer G. E. Doyle, of the s. s. "British Prince," Capt. S. Nowell, commanding, reports a hurricane on the 20th and 21st; wind backed from s. by e. to se. by s., and shifted suddenly to nw. by n.; lowest barometer, 29.09 (738.9), at 11.30 p. m., in N. 39° 54', W. 69° 20'. Capt. W. Topser, of the s. s. "Rhein," reports a ssw. to wnw. storm on the 21st; lowest barometer in N. 40° 05', W. 66° 20'. Capt. G. D. Spicer, of the sp. "Charles S. Whitney," reports a hurricane on the 21st and 22d; wind veered from sse. to nw.; lowest barometer, 29.39 (746.5), at 4 a. m. of the 22d, in N. 42° 15', W. 52° 50'.

Capt. R. T. Jones, of the s. s. "Galileo," reports: "22d, in N. 42° 22', W. 51° 19', at noon; 3.30 a. m., a strong gale from sw., with high, rough sea; 7.30 a. m., shifted to w., barometer 29.44 (747.8); 11 a. m., shifted to nw., barometer 29.58 (751.3), and gradually decreased into strong breeze." Second Officer Allan Call, of the s. s. "Ohio," Capt. P. R. W. Sargent, commanding, reports: "22d, 10 a. m., in N. 45° 00', W. 41° 30', wind s., increasing and hauling to westward; 4 p. m., wind falling light; 6 p. m., wind increasing from nw., barometer 29.57 (751.1); 7 p. m., blowing a hurricane, barometer 29.08 (738.6); 7.30 p. m., moderating, strong gale." Capt. W. Tyson, of the s. s. "Holland," reports a fresh gale on the 22d; wind backed from se. to n.; lowest barometer, 29.12 (739.6), at 11.44 a. m., in N. 47° 10', W. 41° 30'. Capt. J. H. Stiefel, of the s. s. "Europa," reports a fresh gale on the 22d and 23d; wind backed from ne. to nw.; lowest barometer, 29.20 (741.7), at 11.09 a. m., in N. 48° 23', W. 38° 09'.

Capt. W. McMickan, of the s. s. "Umbria," reports a hurricane on the 23d and 24th; wind backed from se. to e. and nw.; lowest barometer, 28.85 (732.8), at 1 p. m. of the 23d, in N. 49° 40', W. 31° 40'. Capt. S. Brooks of the s. s. "Arizona," reports: "23d, noon, Greenwich time, in N. 50° 51', W. 26° 30', barometer 29.34 (745.2), wind s., moderate gale, barometer falling very rapidly and wind backing to se.; 9 p. m., in N. 50° 30', W. 30° 00', barometer 28.73 (729.7), wind had backed to nw. round by e. ne., and n., barometer began to rise, and a furious nw. gale prevailed till after midnight." Capt. T. L. Evans, of the s. s. "Mineola," reports a hurricane on the 23d and 24th; wind veered from se. to w. and nne.; lowest barometer, 29.00 (736.6), at 8 p. m. of the 23d, in N. 51° 10', W. 30° 30'. Capt. W. Abbott, of the s. s. "Marengo," reports a whole gale on the 23d and 24th; wind veered from sw. to wnw.; lowest barometer, 28.74 (730.0), at 6 p. m. of the 23d, in N. 49° 18', W. 26° 33'.

Capt. W. Janes, of the s. s. "Oxford," reports a whole gale from the 23d to 27th; wind veered from se. to nw.; lowest barometer, 28.69 (728.7), at 2.30 p. m. of the 23d, in N. 50° 21', W. 30° 39'. Fourth Officer Lossius, of the s. s. "Britannic," Capt. H. Parsell, commanding, reports a gale on the 27th; wind veered from se. to wnw.; lowest barometer, 29.09 (738.9), in N. 51° 06', W. 23° 58'. Capt. W. Kuhlewein, of the s. s. "Gellert," reports a whole w. to nw. gale from the 27th to 29th; lowest barometer, 29.26 (743.2), at 5 a. m. of the 27th, in N. 49° 40', W. 23° 20'. Capt. W. Skjöldt, of the s. s. "Island," reports a fresh gale on the 26th and 27th; wind backed from sw. to e. and nw.; lowest barometer, 28.84 (732.5), at 9 a. m. of the 25th, in N. 56° 6', W. 26° 35'. Capt. W. J. Boggs, of the s. s. "Indiana," reports a strong gale on the 26th and 27th; wind veered from sw. to nw.; lowest barometer, 29.13 (739.9), at noon of the 26th, in N. 50° 52', W. 21° 05'.

Windward Islands was indicated by vessel reports of the 19th; by the 20th the centre of depression had moved west-north-west to about N. 22°, W. 66°, whence it is traced to N. 26°, W. 76° by the 21st. On this date south to west gales of hurricane force prevailed over the eastern portion of the Bahama Islands; in the vicinity of the thirtieth parallel fresh easterly gales were reported, while off the Florida coast strong northerly gales prevailed. During the 22d and 23d the storm-centre circled slowly northward, with a marked decrease in energy; by the 24th it had advanced to N. 32°, W. 76°, and during its northeast passage along the course of the Gulf Stream during the next two days it was attended by hurricanes of exceptional violence.

During the 26th and the early morning of the 27th the depression advanced northeast to the fiftieth parallel, its path being to the westward of the Banks of Newfoundland and touching the southeastern extremity of Newfoundland. This direction of movement was, presumably, occasioned by an area of relatively high barometric pressure which occupied the ocean to the southeastward of the Banks, whereby the depression was deflected to a more northerly course than that which it had previously held. During the 28th and 29th the centre of depression passed too far to the northward of the region of observation to permit of other than an approximate course being given to its path; by the 30th, however, its presence to the westward of the British Isles, in about N. 57°, was clearly shown, and its subsequent passage to the north of Scotland was indicated by reports of the 31st. This storm was remarkable both by reason of the extent of territory it traversed and on account of the great energy displayed throughout its entire course, the only period during which a diminution of strength was observable being on the 22d and 23d, during its re-curve over, and to the northward of, the Bahamas.

The general character of the disturbances which attended its passage is shown by the following special reports:

Mr. W. H. Carter, of the s. s. "Earnmoor," Capt. R. J. Grey, commanding, reports: "19th, 11 p. m., left Santiago with a light nw. breeze and hazy weather, barometer falling slowly and sky having every appearance of an approaching hurricane. 20th, weather fine, with light to fresh nw. and w. to sw. breeze and falling barometer. 21st, in N. 23° 35', W. 74° 16', at noon, at 6 a. m., fine and clear, fresh sw. breeze; 7.30 a. m., heavy squall of wind and rain from sw., lasting one hour, and a heavy northerly sea, falling barometer; 2.40 p. m., passed Watlings Island with a fresh and increasing southerly gale and a heavy sea, also a short n. sea and terrific squalls accompanied with rain. 22d, in N. 27° 06', W. 74° 20', a heavy gale and tremendous sea running, with torrents of rain, brought ship to the wind which was sse. at 4 a. m., with slowly rising barometer; 5 a. m., barometer again falling, se. gale and ssw. sea, with very unsteady barometer continued throughout the day. 23d, in N. 30° 44', W. 74° 36', at noon, fresh gale continued up to 4 p. m., then moderated; midnight, fresh gale again from ese., with falling barometer. 24th, in N. 33° 51', W. 74° 40', at noon, fresh gale, falling barometer, heavy sea; towards noon it blew a heavy gale from e. and ssw., with terrific squalls and rain; 4 p. m., hard gale and high sea, falling barometer, fresh gale continued up to midnight. 25th, in N. 36° 56', W. 74° 49', at noon, at 4 a. m. wind hauled to ne., with fresh gale and tremendous sea; noon, strong northerly gale and rising barometer, in p. m. the wind moderated."

Captain Legoe, of the s. s. "Pomona," reports: "20th, after leaving Cape Maysi, Cuba, wind came into the nw., moderate; wind freshened at night and sky looked very red; during night wind hauled to westward and freshened, with squalls and heavy rain. 21st, at Watlings Island, weather looked very dirty, and barometer continued falling; wind hauled to s. with terrific squalls and heavy rain; ship running before the wind and sea; at 5.30 p. m., hove the ship's head to the sea, barometer still falling; between 10 and 11 p. m., blew very hard, afterwards moderating. 22d, in N. 26° 44', W. 74° 11', took off crew of the wrecked schooner "Mary E. Douglass," which had

been caught in two hurricanes. 23d, in N. 30° 56', W. 74° 20', at noon, strong gale from se. and high sea with rain. 24th, in N. 34° 24', W. 74° 20', at noon, very squally, with rain and high seas. 25th, in N. 38° 04', W. 72° 00', at noon, at 5 a. m., wind changed to n. and blew a gale with very heavy sea."

Capt. Frank Stevens, of the s. s. "Manhattan," reports: "22d, 11 p. m., in N. 30° 0', W. 80° 40', very bad looking weather, and barometer falling rapidly, strong ene. gale and very heavy se. sea; hove-to head to the northward. 23d, 9.30 a. m., turned round and ran to southward, barometer 29.63 (752.6), wind inclined to back to northward; 11 p. m. hove-to head to eastward, hard wnw. gale, barometer 29.43 (747.5), very heavy ne. sea. 24th, 9 a. m., rising barometer, hard nw. gale. On the 23d, at sunset, the sky was full of 'mares-tails,' more than I ever saw before, and moving in all directions, the lower clouds from n.; the ones next above them from sw., then some from se., and some from ne."

Capt. Charles Brown, of the barkentine "Josephine," reports: "24th, barometer continued falling until 19 h. 30 m., in N. 38° 13', and W. 74° 40', to 29.65 (753.1), with light rain, and the wind gradually backed from se. to ne.; when it suddenly increased to force 8; the barometer then commenced to rise, and the wind gradually increased and backed to n. by w.; with increasing sea. 25th, 3 h. 15 m., sky commenced to clear, but the wind increased until 4 h. 58 m., when it blew heaviest from n. by w., force 10, with sea heavy from n. by w., after which it moderated gradually." First Officer J. C. Norton, of the s. s. Yemassee," Capt. S. C. Platt, commanding, reports: "24th, noon, in N. 37° 38', W. 74° 50', barometer 29.75 (755.6) and falling steadily, sea swell fast, long; and heavy, heavy clouds in e. and s.; 4 p. m., wind had backed to e., blowing in heavy gusts, with rain squalls; 8 p. m., wind ne., barometer 29.48 (748.8), hard gale; 11 p. m., barometer 29.27 (743.4), lowest, wind a hurricane. 25th, 2.40 a. m., Hatteras west, immense sea; during the day the barometer rose and wind backed to n. and nnw."

Capt. E. Wylie, of the s. s. "Catalonia," reports: "25-26th, between longitudes 58° and 68°, had very unsettled weather; wind attained force of a fresh gale, accompanied by a heavy electrical storm, balls of flame being on all extremities aloft; wind backed gradually from s. to e. and w. by n." Capt. W. McMickan, of the s. s. "Umbria," reports: "26th, in N. 42° 27', W. 59° 20', noon; 2 p. m., Greenwich time, barometer 29.80 (756.9), wind s., overcast and much rain, barometer falling rapidly, and wind increasing, with a high, confused sea; 3 p. m., wind se., and a tremendous sea running; wind fell very light; to all appearances in the centre of a cyclone; engines slowed; 5.30 p. m., barometer 28.65 (727.7); during a heavy squall of rain and wind the wind went to nnw. and blew with hurricane force for two hours and then gradually moderated to strong gale from nw., with high sea."

Captain Vogelgesang, of the s. s. "Rhaetia," reports a whole gale on the 26th; wind backed from nne. to w.; lowest barometer, 29.30 (744.2), at 7 a. m., in N. 41° 55', W. 65° 00'. Capt. E. Santelli, of the s. s. "La Gascogne," reports a hurricane on the 26th and 27th; wind backed from ese. to nw.; lowest barometer, 28.58 (725.9), at 1.30 p. m. of the 26th, in N. 42° 29', W. 62° 00'. Second Officer Call, of the s. s. "Ohio," Capt. P. R. W. Sargent, commanding, reports: "26th, 8 a. m., in N. 41° 28', W. 62° 02', encountered a hurricane from sse., barometer 29.51 (749.5); noon, barometer 28.20 (716.3), wind hauled to nw., and storm continued four hours, with very high sea." Capt. G. Evans, of the s. s. "Peconia," reports a hurricane on the 26th; wind backed from ssw. to e. and nw.; lowest barometer, 28.11 (714.0), at 7 a. m., in N. 39° 19', W. 64° 14'.

Capt. W. Tyson, of the s. s. "Holland," reports a hurricane on the 26th; wind backed from s. to n.; lowest barometer, 28.52 (724.4), at 9.53 a. m., in N. 42° 41', W. 61° 47'. Capt. W. G. Crockhart, of the s. s. "Devonia," reports a storm on the 26th; wind veered from sse. to nw.; lowest barometer, 28.44 (722.4), at 7.15 p. m., in N. 43° 37', W. 56° 24'. Capt. R. B. Stannard, of the s. s. "Crystal," reports a whole gale

on the 26th; wind backed from ne. to nw.; lowest barometer, 29.24 (742.7), at 11 a. m., in N. 42° 00', W. 64° 12'. Capt. E. H. Freeth, of the s. s. "British Princess," reports a hurricane on the 26th; wind veered from se. to w.; lowest barometer, 28.67 (728.2), at 1 p. m., in N. 43° 12', W. 60° 09'. Capt. S. Brooks, of the s. s. "Arizona," reports: "26th, 8 p. m., Greenwich time, in N. 45° 06', W. 53° 10', strong breeze from s., and fog, barometer 29.67 (753.6), and falling rapidly; 10 p. m., barometer 28.70 (729.0), wind a hurricane from sse., ship completely enveloped in spray; midnight, in N. 44° 50', W. 54° 00', barometer lowest, 28.50 (723.9), wind began hauling to westward, and barometer commenced to rise; wind settled down to hard wsw. gale, with tremendous high-breaking seas, and barometer continued to rise rapidly."

Capt. J. H. Stiefel, of the s. s. "Europa," reports a hurricane on the 26th; wind veered from sse. to w.; lowest barometer, 28.80 (731.5), at midnight, in N. 44° 10', W. 54° 40'. Capt. G. D. Spicer, of the sp. "Charles S. Whitney," reports a hurricane on the 26th; wind backed from sse. to nw.; lowest barometer, 28.40 (721.3), at 7 p. m., in N. 42° 30', W. 60° 30'. Capt. W. Pearce, of the s. s. "Italy," reports a heavy sw. to w. gale on the 27th; lowest barometer, 29.01 (736.8), at 1 a. m., in N. 45° 00', W. 50° 30'. First Officer Lossius, of the s. s. "Britannic," Capt. H. Parsell, commanding, reports a strong gale from the 28th to the 30th; lowest barometer, 29.44 (747.8), on the 29th, in N. 48° 40', W. 38° 30'.

Capt. G. de Kersabiec, of the s. s. "La Normandie," reports a whole wsw. to nw. gale from the 29th to 31st; lowest barometer, 29.22 (742.2), at 6 a. m. of the 30th, in N. 50° 15', W. 24° 30'. Capt. G. Stenger, of the s. s. "Leerdam," reports a whole wsw. to wnw. gale on the 29th and 30th; lowest barometer, 29.50 (749.3), at 10 a. m. of the 29th, in N. 48° 05', W. 36° 03'. Capt. H. Christoffers, of the s. s. "Aller," reports a whole sw. to wnw. gale from the 28th to 30th; lowest barometer, 29.33 (745.0), at 4 p. m. of the 29th, in N. 49° 13', W. 35° 29'. Capt. W. Skjodt, of the s. s. "Island," reports a whole gale on the 28th and 29th; wind veered from s. to nw.; lowest barometer, 29.09 (738.9), at 7 a. m. of the 28th, in N. 52° 06', W. 41° 20'.

9.—This depression was central on the 19th over the Gulf of Saint Lawrence, and by the 20th had moved eastward to N. 51°, W. 49°, with a fair display of energy; by the 21st the storm-centre had advanced to N. 52°, W. 32°, with moderate to fresh gales over a considerable area; by the 22d the centre of depression had passed northeast to about N. 58°, W. 25°, in which position barometric pressure ranging below 29.00 (736.6) was indicated; by the 23d the storm had disappeared to the northward of the region of observation.

VII.—This depression, whose path was almost wholly beyond the limits of observation, was first reported in a telegram to the Chief Signal Officer on the morning of the 16th as a cyclonic disturbance to the southwest of Cuba. Subsequent reports received from marine observers by mail showed, however, that it was first observed in N. $13^{\circ} 00'$, W. $57^{\circ} 00'$. (For additional data, in connection herewith, see description of north Atlantic storm number 5, given elsewhere in this REVIEW.) Twenty-four hours afterwards, with slightly increased energy, it was approximately central on the northeastern coast of Yucatan. The pressure at this time over the United States to the east and south of a line drawn diagonally from the western coast of Lake Superior to Yuma, Ariz., was above the normal, except in portions of the Gulf States and Florida, where the departures from the mean were but very slight. The maximum pressure, nearly .5 above the mean, was central northeast of the lower lakes, the gradients gradually decreasing to the south and west. Another high area had, also, but a few days previously moved off the coast into the north Atlantic, where the pressure was probably considerably above the mean near the coasts of the United States. The high pressure to its north apparently aided materially in determining the path of the cyclone, which approximately moved to the northwestward over the northern portion of the peninsula of Yucatan towards the southern coast of Texas.

By the courtesy of Padre B. Viñes, S. J., Director of the Magnetic and Meteorological Observatory at Belen College, Havana, Cuba, the Chief Signal Officer was notified of the presence of the cyclone in the vicinity of the West Indies, and its subsequent progress through the Gulf. Timely warnings were issued and the public fully apprised, both by the display of signals and the publication of special messages.

The disturbance continued to move slowly in the same general direction during the 17th, 18th, 19th, and 20th, attended by local rains in the Gulf and south Atlantic states, and by high local winds and gales from north to east on the Gulf coasts on the 19th and 20th. At the last report on the night of the 20th it was approximately central about one hundred miles to the east, and slightly to the north, of the mouth of the Rio Grande. The pressure at this time was above the normal over the entire country, except on the southern shore of Lake Superior, portions of northern California, Nevada, and Oregon,

where the variations from the mean were very slight, and in a narrow border along the coast of the west Gulf states and Rio Grande Valley, where the maximum depression below the normal, .18, then existed at Corpus Christi and Brownsville, Tex. Centres of high areas were in the north of the middle Atlantic states and northern Montana, averaging about .3 above the normal. Gradients were beginning to be close on the coasts of Texas. By the morning of the 21st the cyclone had apparently moved westward and slightly to the south and was approximately about fifty miles east of the mouth of the Rio Grande. The barometer at Brownsville, Tex., about twenty miles inland on the river, had fallen nearly .3, and read .38 below the reading reported from Rio Grande City, Tex., ninety miles westward. The gradients between were in consequence very marked, averaging about one-tenth of an inch in twenty-four miles. Heavy rain had fallen in the vicinity and still continued, and high winds and gales from north to east prevailed on the coasts of Texas, but had subsided on the Gulf coast eastward.

Within the next eight hours the barometer at Brownsville fell .52 as the cyclone approached the vicinity, the reading at the afternoon report being .84 below that at Rio Grande City. The gradients between were remarkably close, about .1 in eleven miles, while northward towards Corpus Christi, Tex., about one hundred and thirty-two miles distant, the average was about one-tenth of an inch in sixteen miles. Very heavy rain had fallen at Brownsville, 4.96 inches in the preceding eight hours, and still continued; the gale had also increased in fury, reaching a maximum of seventy-eight miles from the north at 1 p. m., and a current velocity of forty miles per hour was reported from the northwest. A high wind from the northeast still continued at Corpus Christi and a maximum velocity of forty-five miles was reported during the eight hours previous. At Key West, Fla., a maximum velocity of thirty miles had occurred during the previous eight hours, but the current velocity reported showed a subsidence below that considered as dangerous to navigation. Local rains generally light, except in the vicinity of Brownsville, where they were very excessive, had fallen both on the Gulf coasts and the eastern coast of Florida. The centre of the hurricane, about 4 p. m., was approximately a few miles to the southeast of Brownsville, moving slightly south of west. Soon afterwards the heavy rains changed to light and the barometer began to rise, but the gale still continued, with but slight abatement.

By the morning of the 22d the hurricane was approximately south, and a little to the east, of Rio Grande City, moving southwest into Mexico. Eight hours later it seemed to have advanced farther to the southward and westward beyond the limits of observation. During the 21st and on the morning of the 22d the gale materially damaged property, especially from Brownsville eastward on the Rio Grande to the coast, demolishing trees, fences, houses, etc., and at Point Isabel, Tex., tearing smaller craft from their moorings and carrying them into the Gulf. The greatest damage, however, was probably due to the heavy rains and the floods in the river and adjacent lowlands, which destroyed cattle and other live stock and materially injured cotton; sugar cane, and exposed products. While the damage that occurred was very extensive it would seem that first reports were materially exaggerated and, owing to the timely warnings given in advance and the precautions taken in consequence, the actual losses to property were very materially lessened. By the afternoon of the 22d the winds had subsided and the rains had generally ceased, though they still continued lightly at San Antonio and Rio Grande City, where they also ceased during the next eight hours. At Galveston, Tex., high winds prevailed during the 19th and 20th; a maximum velocity of forty miles per hour from the northeast was recorded during the forenoon of the latter date.

The Signal Service observer at Corpus Christi, Tex., reports as follows:

Brisk to high northerly winds prevailed on the 19th until 5 p. m., when the wind veered to northeast; it backed to north at 8.15 p. m., and attained its maximum velocity, thirty-three miles per hour from the north, at 9.17 p. m.

High northerly winds prevailed during the 20th, attaining a maximum velocity of thirty-six miles. During the early morning of the 21st heavy rain fell, and light to heavy rain continued until 9 p. m. on that date. The wind veered to northeast and attained a velocity of forty miles per hour at 1.10 a. m., backing to north at 6.30 a. m., and then veering to northeast it reached its maximum velocity of forty-five miles per hour at 12.25 p. m.; brisk to high winds continued during the remainder of the day. The water in Corpus Christi Bay rose about 2½ feet from the 19th to the 21st.

Serjeant A. B. Crane, Signal Corps, Brownsville, Tex., reports, concerning this storm, substantially as follows:

For several days prior to the 21st the winds which were light to fresh in force were from north to northeast; the temperature was slightly below the mean; fair weather prevailed, with cumulo-stratus clouds predominating; the barometer was below the normal, and fluctuated but slightly, until the night of the 20th, when it fell rapidly. The telegraphic advices received from the office of the Chief Signal Officer (through the observer at Corpus Christi, Tex.), regarding the movements of the cyclone were placed before the public, and had therefore warned the inhabitants of, and prepared them for, the approaching dangerous storm.

A light drizzling rain set in at 2.20 p. m. on the 20th and continued until 11 p. m., when the rain increased to "heavy" and subsequently to "very heavy." At 7 a. m. of the 21st the barometer read 29.45, wind ne., twenty-five miles per hour, and heavy rain. The barometer continued to fall steadily until at 1.45 p. m., when a minimum of 28.93 was reached; then the pressure seemed to fluctuate slightly, but by 2.15 p. m. had risen to 28.96; by 4 p. m. the barometer had again fallen to 28.93, but shortly afterwards began to rise rapidly.

The following table shows the readings of the barometer, with direction and velocity of the wind, at Brownsville during the storm:

Date.	Time. (75th meridian.)	Barometer (reduced to sea-level).	Wind.		Date.	Time. (75th meridian.)	Barometer (reduced to sea-level).	Wind.	
			Direction.	Velocity, miles per hour.				Direction.	Velocity, miles per hour.
		<i>Inches.</i>					<i>Inches.</i>		
20	10.00 p. m.	29.92	nw.	15	21	3.15 p. m.	28.95	nw.	36
21	7.00 a. m.	29.45	ne.	25	21	3.30 p. m.	28.94	nw.	36
21	1.00 p. m.	29.00	n.	78	21	4.00 p. m.	28.93	nw.	18
21	1.15 p. m.	28.97	n.	50	21	4.30 p. m.	28.94	nw.	12
21	1.30 p. m.	28.94	n.	40	21	5.00 p. m.	28.96	nw.	11
21	1.45 p. m.	28.93	nw.	53	21	5.30 p. m.	28.98	w.	9
21	2.00 p. m.	28.95	nw.	45	21	6.00 p. m.	29.03	w.	12
21	2.15 p. m.	28.96	nw.	40	21	10.00 p. m.	29.37	se.	24
21	2.30 p. m.	28.95	nw.	37	22	2.00 a. m.	29.74	s. and se.	60
21	2.45 p. m.	28.95	nw.	45	22	7.00 a. m.	29.74	se.	17
21	3.00 p. m.	28.95	nw.	38					

At Point Isabel, Tex. (situated about twenty-three miles northeast of Brownsville), the wind on the morning of the 21st blew from the northwest and north, shifting to the northeast and east and finally to the south, while at Brownsville, same time, the wind came from the northeast, backing to the northwest and west and finally to south. The maximum velocity attained at Brownsville was seventy-eight miles per hour at 1 p. m. (75th meridian time) of the 21st; afterwards the wind decreased in force until at 4.10 p. m., when a lull occurred, and to all appearances the storm seemed to be over; between 4.10 to 5 p. m. the wind became variable, swinging in all directions, and by 6.45 p. m. it had backed to the southwest and began blowing at a high rate, increasing in force to sixty miles per hour. The lull at Point Isabel began at 11 a. m., and lasted until about sunset.

At Brownsville, the wind of sixty miles, south and southeast, at 2 a. m. of the 22d caused more damage to the city and vicinity than did the higher velocity of seventy-eight miles, north, at 1 p. m. on the 21st. This the observer considers due to the fact that the inhabitants protect their homes and property against the "northers" and high northerly winds more so than against the south winds. Many fences, trees, and small houses, principally of Mexican construction, consisting of but the lighter building materials, were blown down, and the streets presented a picture of devastation.

The greatest damage reported occurred from the effects of the heavy rains and the flooding of the Rio Grande River. The river banks were overflowed and the flats and bottoms filled with water, although the streets were not flooded. The roads leading into Brownsville became impassable and up to this writing (October 8) their condition remains unchanged. At Point Isabel the sloop "Romp," the schooner "Mignonette," and the yacht "Maud B" were lost sight of and have not been heard from since. The "Mignonette" was a Government light-house boat, and had a crew of fourteen persons. Around and about Brownsville no great damage was sustained either to property real or personal, and this fact is largely due to the warnings issued by the Signal Service, as the inhabitants were busily engaged in nailing up their windows and fences, bracing their houses, and taking other precautions against damage, when the storm was reported as coming toward southwest Texas. The newspaper correspondents erroneously reported one million dollars damage. The reports were written on the day of the storm, when, to all appearances, that estimate seemed justifiable; but after the storm had passed and the actual damages estimated, it is found that \$10,000 will fully cover all losses to property. The United States military telegraph line was blown down in several

places and could have been easily repaired, but for the flooded condition of the country along the river by which the line runs.

The following table shows the rainfall, in inches, at Brownsville during the storm:

Date.	Time, 75th meridian.			Total.
	7 a. m.	3 p. m.	10 p. m.	
Sept. 20	0.00	0.00	0.02	0.02
21	1.60	4.96	1.94	8.50
22	1.88	0.38	0.00	2.26 10.78

Reports received from Santa Maria, Tex., twenty miles northwest of Brownsville, indicate that the winds and rains experienced there were about the same as at Brownsville.

Mr. Egan, of Point Isabel, furnishes, through the observer at Brownsville, the following record of observations taken during the storm:

Observations at Point Isabel.

Date.	Time. (75th meridian.)	Barometer.	Direction of wind.	Remarks.
		Inches.		
Sept. 20	7.10 p. m....	29.73	nw.	Water high; drizzling rain.
21	7.30 a. m....	29.12	nw.	Hurricane since 4 a. m.
21	9.50 a. m....	28.76	n.	Do.
21	10.45 a. m....	28.74	ne.	Wind weakening.
21	11.00 a. m....	28.74	ne.	Wind very light.
21	11.45 a. m....	28.77	ne. by e.	Do.
21	12.30 p. m....	28.79	e. by s.	
21	12.40 p. m....	28.82	se.	Wind fresh; water falling fast.
21	1.45 p. m....	28.98	se.	Wind fresh.
21	2.30 p. m....	28.98	se.	Do.
21	3.10 p. m....	29.00	se.	Do.
21	4.30 p. m....	29.12	se.	Do.
21	6.40 p. m....	29.27	se.	Do.
21	8.10 p. m....	29.40	se.	Do.
21	8.55 p. m....	29.44	se.	Do.
21	11.40 p. m....	29.56	se.	Wind fresh; stronger.
22	7.30 a. m....	29.76	s.	Wind moderate; very heavy rain.
22	8.30 a. m....	29.83	s.	Wind moderate.
22	11.00 a. m....	29.88	s.	Do.

NOTE.—Glass stands in ordinarily good weather with easterly winds at 30.00 inches; elevation above sea, eleven feet.

The Chicago "Times" of the 24th contained the following:

MATAMORAS, MEXICO, *September 23.*—The great storm of Wednesday (21st) night and yesterday morning did extensive damage in Matamoras and for twenty miles south of here and forty miles west along the Rio Grande. Telegraph wires were prostrated, preventing early accounts of the storm. The wind reached the velocity of a hurricane, blowing eighty-five miles an hour, as registered at the headquarters of the Mexican troops located here. The hurricane drove the sea into the mouth of the Rio Grande, causing it to overflow its bank on the Mexican side for a distance of nearly a hundred miles from its mouth.

The principal streets in Matamoras were submerged to a depth of three feet. Many old houses in the city collapsed and were carried away by the wind and flood. Notwithstanding the great destruction to property, no lives are yet known to have been lost, but many people were wounded by flying debris and falling houses. Narrow escapes from death are recounted by hundreds. The hurricane was so powerful that not a single metal roof remains in the city. They were all curled up like so much paper and hurled to the ground. All fences in the city and for miles surrounding have disappeared. In many instances not a single board is left on the ground—nothing but the naked posts. It is thought that every frame house in the city was moved more or less from its foundation or otherwise damaged.

During, and immediately following, the progress of the storm rescuing parties were organized and sent out to relieve people in the lagoon districts of the city, where the flood was dangerously deep. The rain poured down in blinding sheets for several hours, adding terror to the hurricane and the raging river. The government troops were all called out to assist the police in the work of rescue. The public school and government buildings are now crowded with refugees, whose homes have disappeared. Not less than a hundred small houses (jacals) were destroyed, while all of the larger buildings and residences are damaged. The Matamoras and Rio Grande Railroad sustained serious loss. Its track is swept away for many miles along the river, and its depots demolished. The federal and state authorities are feeding the homeless victims of the storm. Matamoras suffered much greater damage than Brownsville.

The following telegraphic warnings concerning this storm were issued from the office of the Chief Signal Officer:

WASHINGTON CITY, *September 16, 1887*—12.40 p. m.

Secretary Maritime Exchange, New York City; observers at New Orleans, Mobile, Cedar Keys, Key West, Galveston, Pensacola, Corpus Christi:

The following has been received from Havana, Cuba, this morning: "Storm-

centre southwest of station; cyclonic disturbance; additional information will be given later."

CRAIG.

WASHINGTON CITY, *September 16, 1887*—6 p. m.

Secretary Maritime Exchange, New York City; observers at New Orleans, Mobile, Cedar Keys, Key West, Galveston, Pensacola, Corpus Christi:

Afternoon special from Havana, Cuba, reports the cyclonic disturbance as central southwest of that station, and probably moving westward with slightly increasing energy.

CRAIG.

WASHINGTON CITY, *September 18, 1887*—5.40 p. m.

Secretary Maritime Exchange, New York City, and to Collector of Customs, Appalachicola, Fla.:

The cyclone reported Saturday (17th) as moving into the Gulf is apparently approaching the central and western Gulf coasts. Northeasterly gales are indicated, except on southern Texas coast, with rain.

CRAIG.

WASHINGTON CITY, *September 20, 1887*—10 a. m.

Secretary Maritime Exchange, New York City:

The cyclone is central off the western Gulf coast. Easterly gales have occurred from Galveston to Pensacola.

CRAIG.

WASHINGTON CITY, *September 21, 1887*—10.20 a. m.

Secretary Maritime Exchange, New York City: observers, Key West, Cedar Keys, Pensacola, Mobile, New Orleans, Galveston, and Corpus Christi.

Cyclone has moved northwestward to Texas coast.

CRAIG.

The Acting Chief Signal Officer desires to express his indebtedness to the Rev. Benito Viñes, S. J., of the Belen College Meteorological Observatory, Havana, Cuba, for the timely information furnished this office of the passage of the above-described storm over the region of the West Indies.

2.—This depression was central on the 1st in about N. 29°, W. 55°, whence it had apparently advanced from the tropics; by the 2d the storm-centre had moved northeast to the thirty-third parallel, in about W. 58°, from which position it circled northward to the Banks of Newfoundland by the 3d; by the 4th the depression had passed rapidly northeast to N. 52°, W. 30°, and by the 5th to N. 56°, W. 23°; during the next twenty-four hours the depression pursued an east-southeast course to the Irish coast, and by the 7th had advanced eastward beyond the region of observation. This depression was attended by disturbances of marked violence throughout its course, as is indicated by the following special reports:

Captain Shaw, of the ship "Inflexible," reports: "1st, in N. 33° 34', W. 56° 00', at noon, wind freshening and barometer falling; wind backed to ese. and then to e., blowing stiff breeze; heavy se. seas; 10 p. m., barometer falling rapidly; sea ese., with long roll; the sun rose and set like a ball of fire. 2d, 1 a. m., barometer falling, wind increased to a gale, and backing to ne.; 4 a. m., wind backing, barometer falling; rain and terrific squalls; the sea one mass of foam; 10 a. m., moderating, wind nw.; barometer rising; position at noon, N. 32° 21', W. 60° 10'." Capt. O. Olsen, of the bark "Hermon," reports: "2d, in N. 43° 10', W. 51° 29', at noon, s. and sse. wind and rapidly falling barometer. 3d, in N. 42° 2', W. 53° 48', at noon, wind drawing to ne., with heavy rain; 4 a. m., wind n., force 10; very heavy ssw. sea; barometer commenced to rise and wind moderated and drew to wnw."

Capt. C. W. Möller, of the s. s. "Geiser," reports: "1st, 7 a. m., in N. 43° 26', W. 59° 22', entered a fog bank, which continued without any clearings until the 3d, when it was dispersed by a cyclone which passed to the southward of the 'Geiser.' 3d, 8 a. m. (in N. 45° 50', W. 49° 45'), barometer 29.53 (750.0); wind s. by e., 5; dense fog. 10 a. m., barometer 29.39 (746.5); wind sse, 6; heavy rain. Noon (in N. 46° 20', W. 48° 58'), barometer 29.29 (744.0); wind se., 6; heavy rain. 1 p. m., wind ese, 7; heavy rain. 1.30 p. m., wind e. by n., 7; heavy rain. 2 p. m., wind ne. by e., 7; heavy rain. 3 p. m., wind ne., 9; heavy rain. 4 p. m. (in N. 46° 46', W. 48° 14'), barometer 28.86 (733.0); wind ne. by n., 9; heavy rain. 4.30 p. m., barometer 28.86 (733.5); wind nne., 10; rain moderating. 5 p. m., barometer 28.92 (734.5); wind nne., 10. 6 p. m., barometer 28.96 (735.5); wind n. by e., hurricane. 7 p. m., barometer 29.06 (730.0); wind n. by w., 10. After this the clouds broke and barometer rose rapidly and the wind settled into an ordinary gale from nw. by n. that continued two days, with a heavy sea."

Capt. J. J. Brarens, of the s. s. "DeRuyter," reports a hurricane on the 3d; wind backed from se. to e., ne., and nw.; lowest barometer, 29.10 (739.1), at 7.40 a. m., in N. 41° 16', W. 54° 54'. Capt. E. Smit, of the s. s. "Pieter de Coninck," reports a storm on the 3d; wind veered from sse. to sw.; lowest barometer, 28.48 (723.4), at 3 p. m., in N. 44° 48', W. 48° 08'. Capt. G. W. Koch, of the s. s. "Taormina," reports a hurricane on the 3d; wind veered from se. to nw.; lowest barometer, 28.44 (722.4), at 5.15 p. m., in N. 43° 48', W. 48° 17'. The s. s. "City of Rome" encountered a whole w. to nw. gale on the 4th; lowest barometer, 29.08 (738.6), at noon, in N. 50° 37', W. 35° 11'. On the 5th and 6th the depression was accompanied by heavy gales east of the thirty-fifth meridian.

5.—This depression is given a probable track from east of the Windward Islands to Yucatan, the period embraced by its passage over the Caribbean Sea including the 11th and the 17th. During the latter date the storm moved northwest over Yucatan into the Gulf of Mexico, and advanced to the mouth of the Rio Grande River by the 21st. Owing to the limited number of reports received from the region traversed by this depression, its charted track over the Caribbean Sea is only approximately correct, and accurate data relative to its intensity cannot be given. With its advance over the Gulf of Mexico, however, it was accompanied by gales of hurricane force.

7.—This depression was of tropical origin, and moved northward in the vicinity of the fifty-fifth meridian during the 15th and 16th, attended by storms of hurricane force. During the 17th the centre of depression passed east of north over the Banks of Newfoundland, and during the 18th moved north of the fiftieth parallel and beyond the region of observation. The following special reports indicate the character of the disturbances occasioned by this cyclone during its passage over the Grand Banks:

Capt. N. Maass, of the s. s. "Marsala," reports a strong gale on the 16th and 17th; wind veered from se. to nw.; lowest barometer, 29.02 (737.1), at 9 p. m. of the 17th, in N. 45° 26', W. 50° 54'. The gale was accompanied by heavy rain, and fog prevailed until the passage of the storm-centre. Mr. J. Higgins, observer at Saint John's, N. F., reports: "strong ne. gale, with heavy rain, commenced on afternoon of the 17th; at 11 p. m. barometer fell to 29.31 (744.5); gale increased and continued till the morning of the 18th, when it veered to nw. and moderated." This gale caused considerable damage to shipping along the Newfoundland coast, and the Banks fishing fleet suffered severely.

X.—The low area which had for several days been indicated as in the Gulf of Mexico, beyond the limits of observation of adjacent coast stations, was on the morning of the 29th approximately located off the southwestern coast of Florida, about two hundred miles to the northwest of Key West. Local rains had been frequent in the Rio Grande Valley, Gulf States, and Florida since the 24th. A high area was now advancing southward near the Mississippi. Crossing the Florida Peninsula during the next eight hours the centre of the disturbance trended more to the northward and, moving approximately parallel with the coast and at a comparatively short distance from it, progressed northeastward. The rains in the Gulf ceased after its advance into the Atlantic, but extended northeastward along the coast as the disturbance moved in that direction. It apparently increased in energy during translation and was accompanied by heavy gales, especially on the coasts of North Carolina and Virginia. In the vicinity of Norfolk, Va., the storm seems to have been especially severe on the 31st and to have caused much general damage. At the last report of the month the depression was apparently central off the coasts of Delaware and Maryland. Its energy was perhaps at its maximum when off the Virginia coast on the afternoon of the 31st. The pressure at that time at Norfolk was .56 below the normal, but was probably much less nearer the centre.

Observers in North Carolina and Virginia make the following reports regarding this storm:

Hatteras, N. C.: a storm began 4.05 a. m. and ended 2.20 p. m. on the 31st; a maximum velocity of fifty-four miles per hour from the north was recorded at 4.22 a. m.

Kitty Hawk, N. C.: rainy and brisk northerly winds becoming high, with a maximum velocity of sixty miles per hour, at 10.15 p. m. on the

30th. A severe rain and wind storm prevailed until 2 p. m. on the 31st, and for seven hours, from 4 until 11 a. m., the wind velocities averaged over sixty miles an hour; at 10 a. m. the storm attained its greatest force, the wind then reaching a velocity of seventy miles per hour. Considering the severity of the storm, very little damage was done in this vicinity.

Lenoir, N. C.: light rain prevailed at 8 a. m. on the 30th, it was accompanied by hail for a short time in the afternoon, and a few flakes of snow fell.

Raleigh, N. C.: a heavy rain storm began during the night of the 30-31st and continued until 1.10 p. m., when hail fell for about ten minutes. It again turned to heavy rain and was accompanied by snow from 6.30 to 8.30 p. m., when heavy rain set in anew and ended at 10 p. m., 4.18 inches of rain and melted snow having fallen during the prevalence of the storm.

Chicamacomico, N. C.: a heavy gale from the east, accompanied by a few claps of thunder, prevailed during the early morning of the 31st. The storm prostrated several telegraph poles on Body Island and south of Little Kinna-keet, cutting off telegraphic communication.

Cape Henry, Va.: a violent wind, rain, and sand storm prevailed during the day of the 31st. During the storm four schooners were driven ashore at different points between this place and Dam Rock, Va., and many vessels around the capes are still in danger; two lives are reported to have been lost. The wires between this point and Norfolk are in trouble and communication cut off.

Norfolk, Va.: a northerly gale prevailed throughout the day of the 31st, attaining a maximum velocity of forty miles per hour from the northeast. The gale is said to have been of longer duration and caused more damage than any storm since the memorable August gale in 1879. A number of vessels were blown ashore and became total wrecks. The captain and one man of the schooner "Manantico" were drowned. On account of heavy rains and high tides, much merchandise has been damaged or destroyed by water.

9th, between N. 25° 10', W. 74° 8' and N. 28° 00', W. 74° 15'; at 4.50 a. m., Greenwich time, a fresh gale commenced, with heavy rain and a rough sea from e.; gale continued till 7 p. m., when it moderated; lowest barometer, 29.59 (751.6), 9 a. m."

3.—This depression is traced from the Caribbean Sea westward along the twentieth parallel over Yucatan and the southern portion of the Gulf of Mexico during the 6th, 7th, and 8th, its path being determined, approximately, by a limited number of vessel reports. While the cyclonic nature of this storm is well defined by charted reports, its course was too far to the southward to accurately determine its strength.

4.—The presence of this depression over the Caribbean Sea was shown by reports of the 8th; by the 9th the storm-centre had apparently moved westward to about N. 19°, W. 71°, and on the morning of the 10th it had moved northwest over the western extremity of Cuba, whence it passed slowly westward over the Gulf of Mexico. The path of this storm subsequent to the 11th cannot be determined, owing to an absence of reports from the region east of the position it occupied on that date. The following reports show the general character of the disturbances which attended its passage:

"Havana, 10th, barometer 29.89 (759.2); wind se., eleven miles; cloudy weather; $\frac{4}{10}$ cirro-stratus clouds moving from the sw.; storm-centre west of station." Captain McKay, of the s. s. "Alvena," reports: "8th between Cape Maysi, Cuba, and Castle Island, at 4.57 a. m., Greenwich mean time; at 8.12 a. m., barometer 29.63 (752.6), and falling rapidly; 9.27 a. m., barometer lowest, 29.36 (745.7), after which it commenced to rise. The weather during this time was heavy and threatening, with wild-looking clouds from n. to s. and around to w.; at the last-mentioned hour the clouds parted in east to north and the greater portion remained in the south, but no rain fell.

recurved northeastward. The following reports indicate the character of the disturbances which attended its passage:

"The corvette 'Nalon,' from Belize to Cienfuegos; 10th, in N. $19^{\circ} 50'$, W. $75^{\circ} 20'$, heavy sea from ese.; in southeast quadrant heavy clouds, which caused violent gusts of wind and rain; wind oscillated from ese. to se. and barometer fell slowly. 11th, in a. m., wind hard from ese., heavy clouds and violent gusts of rain and wind; in p. m. barometer fell considerably, to 29.33 (705.0) at 6 p. m., weather dark, and rain continuous; 8 p. m., terrible rolling sea from ese. to ssw.; during the night continuous rain and violent gusts; barometer fell to 29.21 (742.0). 12th, in a. m., rain continued, with hurricane from se. to s., the sea a boiling mass, and so it continued to the end of the day's run, in N. $20^{\circ} 45'$, W. $77^{\circ} 0'$, with barometer steady at 29.21 (742.0); in afternoon much rain and wind, sea more moderate; 6 p. m., weather cleared somewhat, and barometer rose slightly; during night violent gusts from s. and ssw. 12th, noon, in N. $20^{\circ} 50'$, W. $76^{\circ} 30'$, barometer rising slowly to 29.29 (744.0), hard gusts. 13th, hard sw. gusts at long intervals; sea from ese., and diminishing; barometer rising."

Havana, 12th, 9 a. m., barometer 29.74 (755.4), e., light rain, 10 miles, storm-centre sse. of station; 3 p. m., barometer 29.64 (752.8), e., heavy rain, 20 miles, storm-centre south of station. Havana, 13th, barometer 29.69 (754.1), e., light rain, 25 miles. Cienfuegos, 12th, 3 p. m., barometer 29.70 (754.4), se., heavy rain, violent gusts. Havana, 14th, 6 a. m., barometer 29.70 (754.4), se., cloudy, 19 miles, storm-centre sw. of station, moving west. Trinidad. Santa Cruz, violent gusts from se., light rain; sea swell sse. Capt. James Bolger, of the s. s. "Neuces," reports a strong gale from the 13th to the 15th; wind veered from nne. to ene.; lowest barometer, 29.73 (755.1), at 12 noon of the 14th, in N. $24^{\circ} 50'$, W. $85^{\circ} 3'$. After the gale the wind continued to blow from ese., accompanied by heavy rain squalls to Key West. Capt. P. H. Hanlon, of the s. s. "Mascotte," reports a whole gale on the 14th and 15th; wind veered from ne. to se.; lowest barometer, 29.68 (753.9), at 1 a. m. of the 15th, in N. $25^{\circ} 30'$, W. $82^{\circ} 20'$. Captain Jørgensen, of the bark "Adele Sabina," reports a storm on the 19th and 20th; wind veered from ese. to wnw.; lowest barometer, 29.35 (745.5), at 1 p. m. of the 19th, in N. $30^{\circ} 08'$, W. $87^{\circ} 10'$. Capt. John Stewart, of the bark "Gettysburg," reports a storm on the 19th; wind veered from se. to w.; lowest barometer, 29.38 (746.2), at 11 a. m., in N. $29^{\circ} 55'$, W. $87^{\circ} 10'$.

8.—This depression first appeared east of Bermuda on the 12th, whence it had apparently advanced from eastward of the Windward Islands; by the 13th the storm-centre had moved rapidly north-northeast and united with depression number 9 on the northeast edge of the Banks of Newfoundland, without evidence of marked energy.

9.—This storm passed southeast from the northern extremity of Newfoundland and united with number 9, as above stated; subsequent to the morning of the 13th the depression advanced rapidly east-southeast and united with number 5 in the vicinity of the Azores, without a special display of strength.

13.—The path of this depression is approximately located to the northward of the West Indies on the 29th and 30th, a scarcity of reports from that region rendering an accurate location of its centre on those dates impracticable. The following reports show that this depression possessed considerable energy: Captain Evans, of the s. s. "Claribel," reports: "28th, passed Fortune Island, with wind increasing to heavy gale, high sea, and frequent rain squalls. Gale continued from northward and westward, blowing with hurricane force at times until the 29th, in N. 24°, W. 74°, at noon, when wind shifted into ne., with very heavy cross-sea. 30th, in N. 26°, W. 74°, at noon, no abatement in either wind or sea, the latter being more to the northward, with heavy rain and wind squalls; towards midnight encountered three distinct seas, running from n., ne., and nw., those from the n. and ne. being dangerously high." Captain Schütte, of the ship "Fidelio," reports a strong n. by e. gale on the 30th; barometer lowest at 11 p. m., when in N. 35°, W. 68°.

NORTH ATLANTIC STORMS FOR DECEMBER, 1887.

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

The paths of the depressions that appeared over the north Atlantic Ocean during December, 1887, have been determined from international simultaneous observations by captains of ocean steamships and sailing vessels, received through the co-operation of the the Hydrographic Office, Navy Department, and the "New York Herald Weather Service."

Thirteen depressions are traced, of which seven advanced eastward from Newfoundland or the Grand Banks; one occupied the ocean between the British Isles and Iceland during the 1st and 2d; two originated to the westward of the Azores; two moved northwest from the region east of the Windward Islands, and one is given an approximate westward track over the Caribbean Sea. With the exception of numbers 1, 9, and 11 the depressions pursued normal paths.

In December, 1886, ten depressions were traced, of which five passed eastward from Newfoundland; four developed over the ocean south of Nova Scotia; one first appeared over mid-ocean in about N. 55°, and one moved eastward in the vicinity of the Azores. The severest weather of the month attended the passage of a depression from south of Nova Scotia to the British Isles from the 2d to the 8th, inclusive. During the 7th and 8th storms of almost unprecedented violence raged over Great Britain, and the fall in the barometer was reported as having been unparalleled. At Orme's Head a minimum of 27.45 (697.2) was observed, while at Liverpool the barometer fell to 27.48 (698.0). During the second and third decades of the month the weather was seasonable.

In December, 1887, the depressions traced north of the fortieth parallel corresponded closely in number with the December average, and the disturbances which attended their passage were of normal intensity. In the vicinity of the West India Islands, and over the ocean south and southeast of Bermuda, there was an unusual prevalence of cyclonic disturbances during the early part of the month, occasioning loss of life and great damage to property, more particularly at the Island of Hayti. During the first decade of the month stormy weather prevailed over the entire ocean east of the seventieth meridian, and the barometric fluctuations were frequent and marked.

During the second decade severe gales continued along the trans-Atlantic tracks, and off the middle Atlantic and New England coasts. During the third decade the region of greatest storm frequency extended from the American coast north of the thirty-fifth parallel to the twentieth meridian. Compared with the corresponding month of previous years, December, 1887, did not present abnormal meteorological features over the Atlantic in the middle and northern latitudes, while over the southern part of the ocean the severe storms of the first decade constituted a noteworthy departure from the usual winter weather in that region.

In the following descriptions of the depressions traced, positions are given in degrees latitude and longitude, except in cases where twenty-five to thirty-five minutes are cited, when they are shown in degrees and half degrees:

1.—This storm was a continuation of depression number 13 traced for November, 1887, and was central December 1st about seven degrees south-southeast from Bermuda, with heavy gales over the West India Islands and northward to Nova Scotia. By the 2d the storm-centre had moved slowly northwest, and at 12 noon, Greenwich time, was located about five degrees south of Bermuda. During this date hard north to northeast gales continued west of the sixty-fifth meridian. By the 3d the depression had slowly recurved north and northeast, and during the succeeding twenty-four hours advanced east-northeast to about N. 33°, W. 56°. The chart of the 5th shows that, subsequent to 12 noon, Greenwich time, of the 4th, the centre of depression recurved to the northwest, which fact is attributed to the presence on those dates of an area of high barometer over the ocean to the east and northeast of its position, whereby it was deflected from a normal northeasterly course. During the following four days the depression pursued a somewhat rapid normal course to the British Isles and disappeared over the North Sea after the 10th, accompanied throughout by gales attaining hurricane force. The following reports relative to this storm have been rendered: Bermuda, a heavy ne. to n. gale prevailed during the 2d and 3d. Captain Mollieu, of the s. s. "Marseille," reports: "3d, in N. 29°

6.—This depression is given a probable westerly track over the Carribbean Sea from the 7th to the 12th, inclusive, after which it apparently passed over Central America into the Pacific Ocean. During the 7th and 8th a heavy "norther," evidently occasioned by this depression, swept over the West Indies, causing much damage to shipping.