

attended this storm, whose dimensions, wind velocities, and slow movement entitle it to be classed in a category somewhere between the waterspout and the hurricane, but distinct from the ordinary tornado.

of the low area *B* of the North Atlantic series.

after which

V.—On the 4th, a. m., the winds, as reported from the eastern portion of the Gulf of Mexico, indicated the presence of a cyclonic whirl. By the 5th, p. m., its presence east of Port Eads was clearly indicated, and by the 6th, p. m., the northerly wind of 34 miles at that point indicated its near approach. The progress of the whirl seems to have been nearly due north; it passed a little to the west of Pensacola about midday of the 7th, and then moved slowly westward, disappearing on the 9th in southern Mississippi. Very heavy rain

XII.—This was a tropical hurricane which passed westward between Dominica and Guadeloupe. What little is known of its earlier history is given in the chapter on "North Atlantic Storms." The center passed over the southern portion of San Domingo and Haiti and along the southern coast of Cuba, finally crossing that island and emerging between Habana and Matanzas on the morning of the 24th; it passed northward between Key West and Tortugas, a little east of Titusville, on the 26th, a. m., between Savannah and Charles-

ton on the 27th, a. m., near Morehead City, N. C., on the 28th, a. m., and had, by the 30th, p. m., reached a position approximately N. 39°, W. 70°. A full account of this storm is given in "Special Storm Bulletin No. 2 of 1894," showing that its path was fully announced and predicted by the official dispatches and warnings of the Weather Bureau.

In connection with this hurricane the following signals were ordered: Washington, 23d, 11.20 a. m., northeast storm signal at Key West; 11.20 a. m., information signals from Punta Gorda to Galveston; 9.40 p. m., northeast storm signals at Cedar Keys, Punta Gorda, Jupiter, and Tampa; 9.40 p. m., information signals from Jacksonville to Charleston. 24th, 9.48 a. m., northeast storm signals at Port Eads, Mobile, Pensacola, Jacksonville and section; 12.15 p. m., information signals from Wilmington to Newport News; 12.15 p. m., northeast storm signals at New Orleans, Savannah and section, and Charleston; 10.30 p. m., information signals at Galveston; 10.50 p. m., northeast storm signals at Wilmington and section. 25th, 7.30 a. m., northeast storm signals changed to southwest at Key West; 9.55 a. m., northeast storm signals at Morehead City, Washington, Norfolk and section, Newport News, and West Point; 2.00 p. m., northeast storm signals at Mobile, Pensacola, New Orleans, and Port Eads; 3.48 p. m., information signals from Baltimore to New York; 9.45 p. m., southeast storm signal at Jupiter; 9.45 p. m., southwest storm signal at Punta Gorda. 26th, 9.10 a. m., northeast storm signals from Delaware Breakwater to Boston; 9.10 a. m., northeast storm signal at Baltimore; 2.40 p. m., northeast storm signals changed to northwest at Jacksonville and section; 2.40 p. m., northeast storm signals changed to northwest from Savannah to Charleston. 27th, 9.30 a. m., southeast storm signals at Morehead City, Washington, Norfolk and section, Newport News, and West Point; 9.43 a. m., northeast storm signals changed to southeast at Wilmington and section. 28th, 8.00 a. m., northwest storm signal changed to information at Charleston. 29th, 10.10 p. m., northeast storm signals at Atlantic City, Sandy Hook, New York, and Narragansett section.

The reports from Tampa show that the hurricane center passed northward some distance to the east of Tampa, where the maximum wind during any five minutes was 43 miles per hour, with one minute puffs of 60 miles. The lowest barometer was 29.48, at 8 p. m., of the 25th. The observer, Mr. Considine, states that this hurricane center passed nearer to that station than any other hurricane since 1846. The rainfall during fifty-four hours, ending at 8 a. m. of the 26th, was 13.78 inches.

At Titusville the rainfall during forty-eight hours, while under the influence of the passing storm, was 7.72 inches; the range of temperature during the 25th and 26th was but 1.5°. A wind of from 48 to 60 miles an hour from the northeast began about 8 a. m., of the 25th, and continued until midnight.

At Jacksonville the northeast gale, beginning at midnight, reached a maximum of 48 miles at 10.40 a. m. of the 26th; the total rainfall during the storm was 11.11 inches.

On the 30th, while the storm center was south of Rhode Island and east of New Jersey, the northeast gale that prevailed all day at Narragansett Pier, with high tide and very heavy surf, was considered to be the most severe of the season at that place as well as along the entire coast of Long Island to the west and of New England and Nova Scotia to the east. At St. Johns, N. F., a heavy gale was also prevailing at that time, but this belonged to the storm *M* of the Atlantic series and not to this present hurricane center, although the newspaper paragraphs frequently confuse these storms.

Mr. Boyer, Weather Bureau Observer at Key West, reports as follows:

September 22, thunderstorm from 5.20 to 5.50 p. m. The storm moved

from northeast toward southwest. The squally character of the rain during the thunderstorm was the first symptom indicative of cyclonic influence. This squally tendency, peculiar to tropical storms, can not be mistaken by those who have experienced and noted them. 23d, day opened partly cloudy, cirrus clouds moving from the south; wind increasing from fresh to brisk and becoming squally. Toward midday the cirrus clouds thickened, producing solar halo; northeast storm signal hoisted at 12.30. During the afternoon lower clouds thickened, wind increased to high northeast squalls of wind and rain from 4.45 to 5.45 p. m.; at 10 p. m. wind northeast 44 miles, with rain squalls; barometer slowly falling. 24th, barometer falling more rapidly, with high northeast wind, until 1.45 a. m.; at 7.50 a. m., heavy squall of 48 miles per hour.

From this time on the hourly observations were as follows: 8 a. m., 29.80, NE., 42 miles, light rain; 9 a. m., 29.80, NE., 43, light rain squall; 10 a. m., 29.78, NE., 48, light rain squalls, scud from east-northeast; 11 a. m., 29.77, NE., 42, light rain squalls; noon, 29.74, NE., 40, heavy rain squalls; 1 p. m., 29.70, NE., 40, heavy rain; 2 p. m., 29.66, E., 37, light rain squalls; 3 p. m., 29.60, NE., 52, heavy rain; the violent wind began at 2.27; 4 p. m., 29.56, NE., 44, heavy rain; 5 p. m., 29.48, NE., 58, heavy rain; 6 p. m., 29.46, NE., 56, violent squalls of 72 miles; 7 p. m., 29.43, NE., 42, squalls of 60 miles; 8 p. m., 29.38, NE., 35, light rain; 9 p. m., 29.35, E., 33, less violent squalls; 10 p. m., 29.32, SE., 18, light; 11 p. m., 29.31, ESE., 20, light rain; midnight, 29.27, E., 20, light rain; thunder, with sharp lightning, began at midnight.

25th, 1 a. m., 29.25, E., 18, scud from ESE., thunder ceased at 12.40; 2 a. m., 29.20, SE., 9, light rain; 3 a. m., 29.18, SE., 10; 4 a. m., 29.16, SSE., 16; 5 a. m., 29.13, S., 24; 6 a. m., 29.10, SSW, 30, wind suddenly increased to 38 miles at 5.40; 7 a. m., 29.13, SW., 24, NE. signals changed to SW., cirro-stratus moving from WNW.; 8 a. m., 29.13, SW., 28. The rainfall was 5.85 inches from noon of the 24th to this present 8 a. m.; 9 a. m., 29.11, SW., 50, squalls of great violence, impossible to go on the roof, barometer pumping violently; 10 a. m., 29.19, SW., 40, violent squalls; between 8.30 and 9.30 a. m., there were violent and sudden fluctuations of about 0.1 of an inch in the barometer; 11 a. m., 29.20, SW., 70; violent gusts and heavy rains; the maximum velocity of the hurricane occurred at 11.20 a. m., with a terrific squall recording 87 miles in five minutes and an extreme of 104 miles per hour during one minute; noon, 29.28, SW., 42, heavy rain; 1 p. m., 29.35, SW., 60, violent gusts and heavy rains; 2 p. m., 29.38, WSW., 44; 3 p. m., 29.41, W., 43; 5 p. m., 29.48, W., 38; 6.50 p. m., 29.51, W., 36; 8 p. m., 29.56, W., 30.

On the morning of the 26th the winds and clouds were moving from the west, with occasional wind and rain squalls. During the day a permanent bank of stratus and cumulo-stratus remained visible in the northwest; the rainfall from 8 a. m. of the 25th to 8 a. m. of the 26th was 1.91 inch. The gulf water did not back up with the southwest winds and flood the city as was the case in the hurricane of October 19, 1876. The barograph curve of the 25th shows three minima similar to those at Mauritius, April 29, 1892; but not so well defined as those. The three readings were: 6 a. m., 29.10; 9 a. m., 29.11; 11.30 a. m., 29.15. A study of the wind velocities will show that each of these readings was recorded immediately after a strong squall when the wind was on the lull. At 5 a. m. of the 25th the wind was S., 24; at 5.40 it had increased to 38, after which it began to moderate; the first minimum reading was registered at 6 a. m., and by 7.15 a. m. the wind had subsided to 18; at 7.45 p. m. the wind changed to southwest, increasing in force. The second minimum, 29.11, occurred at 9 a. m., immediately after a violent squall of 65 miles, at 8.50 a. m.; by 9.05 a. m. the velocity had fallen to 48. The third minimum, 29.15, occurred at 11.30 a. m., immediately after the terrific gust of 104 miles at 11.20 a. m. The very marked lull in the wind force from 9 p. m. of the 24th to 5 a. m. of the 25th indicates the very close proximity of the vortex. The hypothesis that special depressions of very limited extent were developed at or near the vortex seems the most tenable one, as heavy squalls or gusts are thus produced to fill up the depression. The leaves of trees and plants were much affected by the hurricane winds, particularly on the southwest side, as if scorched by fire.

Mr. E. R. Demain, Weather Bureau Observer, Jacksonville, Fla., October 2, 1894, writes as follows:

Captain Moorhouse, of the three-masted British schooner *Coniston*, reports as follows: I left Tortugas (Keys) on the morning of the 22d, that was Saturday. Sunday morning I saw the barometer was going down. The first heavy squall struck me at 3 o'clock, 23d, from about east-northeast. It kept blowing worse and the wind continued east-northeast till 4 o'clock Monday afternoon (24th). I noticed about 4 o'clock that the wind suddenly went to east by south. Though I was on the east of the center, I steered west and so ran till 11 o'clock, when I struck the calm in the center of the storm. The storm was moving very slowly, about 10 miles an hour. At 2 a. m. Tuesday (25th) the wind was very heavy from west-southwest and continued so till 5 p. m. Tuesday, when the weather was clearing.

I must have been a little west of Key West. I judge I ran 50 miles back before I struck the calm; must have been somewhere west of Tortugas. Judge the storm was traveling north-northwest when it passed me. Never saw such rain; it was something terrible and continued till after the storm broke up; had very heavy rain squalls till after 12 at night. On the commencement of the storm we had a little lightning, but no thunder. I never heard any thunder in the five hurricanes which I have experienced. It was

the heaviest storm I was ever in. I think that the wind blew fully 120 miles per hour.

Mr. Fred. W. Ramsden, of the British Consulate, Santiago de Cuba, October 15, 1894, writes as follows:

From telegrams I received from the Windward Islands and from San Domingo and Haiti, and from my own observations here, I have reason to believe that the track of the center was as follows: It passed between the islands of Dominica and Guadeloupe about 1 p. m. on the 20th of September; was 150 miles southwest of San Juan de Puerto at 7 a. m. of the 21st; passed almost over and just to the south of the city of San Domingo about 2 a. m. on the 22d; then a little to the north of Port au Prince about midday of the 22d, and south of St. Nicolas Mole the same afternoon, reaching the city of Santiago de Cuba at half past 12 a. m. of the 23d. (Here we had very strong north and north-northwest winds up to that hour, when it became almost calm, veering to the northeast and east, commencing suddenly again to blow violently at 3 a. m. from the southeast.) After passing here its course was just south of Cienfuegos, having begun to slow down for curving at midday of the 23d before reaching that meridian, and, I believe, it then passed up between Habana and Matanzas on the 24th, and thence to Key West, etc.

Mr. Rafael Junquera, Weather Bureau Observer at Santiago de Cuba, writes as follows, November 14, 1894:

September 20, about 1 p. m., the center passed between Dominica and Guadeloupe; at 7 a. m. of the 21st it was southwest of Puerto Rico; on the 22d, at 2 a. m., it entered the mainland at San Domingo to the south of the capital, ransacking this country and Haiti; it passed south of St. Nicolas Mole on the afternoon of the 22d, and the center of the storm area reached Santiago by 12.30 a. m. of the 23d. The storm track became very irregular as soon as it reached the mainland of San Domingo and Haiti, and I believe that the mountains of San Domingo and Haiti changed its course to the south.

The cloud movements in the vicinity of this station showed perfectly well that the storm track would travel to the south of this station. I consider that the northern border of the storm vortex passed very near to this city and that the section of the vortical calms passed to the north of Cape Cruz.

At Merida, Yucatan, Signor Felix Gomez made the following record, which is translated by Mr. Symons from the monthly bulletin for September, 1894, published by the Central Magnetic-Meteorologic Observatory of Mexico, to which institution Mr. Gomez sent a storm warning by telegraph:

On Saturday, September 22, at 4.40 p. m., we observed in the northeast many scattered clouds of a cumulo-nimbus type coming rapidly at a low altitude. This was the first indication which led me to surmise that a storm existed in the southeast, and I immediately began to watch the wind and the barometer; the wind was east-northeast, and the mean pressure for the day was 29.93 inches.

On Sunday, 23d, the sky was occasionally overcast; there were light northerly squalls; the vane pointed steadily to east-northeast until the afternoon, when it went to north-northeast, and the pressure fell to 29.92 inches.

On Monday, 24th, the sky continued overcast at intervals; there were light squalls; the vane kept north-northeast until the afternoon, when it went to north-northwest, and the pressure fell to 29.87 inches.

On Tuesday, 25th, the wind was variable between northwest and west-northwest, and the sky clear; the barometer fell to 29.84 inches, and in the afternoon the wind backed to west-southwest.

On Wednesday, 26th, the wind went round to southwest and the barometer rose to 29.86 inches, and a drizzle gave 0.05 inch of rain.

Though the indications of the barometer were very slight, the aspect of the sky and the backing of the wind showed that Merida was on the western skirt

of a cyclone, therefore we reported to the observatory on the 23d and subsequent days that a depression existed to our east.

*B.* This hurricane was apparently formed in the southern portion of the low area attending the preceding storm *A*, and must have been central on the 7th, a. m., at about N. 35°, W. 45°; on the 8th, N. 43°, W. 42°; 9th, N. 49°, W. 40°; 10th, N. 60°, W. 20°, and rapidly expanded over the Atlantic to the northward; on the 11th pressure was very low at about N. 70°, E. 10°, and also in Labrador and Alberta, so that an extensive area of low pressure must have prevailed throughout the entire intermediate region. On the 12th area *B* was central in Lapland, after which it moved southeastward, and on the 14th disappeared in eastern Russia. During the 8th and 9th, while this area was turning from its north to its northeast course, low pressures and hurricane winds near its center were reported by the steamships *Rotterdam*, *Spree*, *Tris*, *Othello* (which reported pressure 27.99), *Queen's More*, *Peninsula*, *Ocean*, *Charlois*, *Brazilian*, *Manheim*, *Burgermeister*, *Taurie*, and *Christine*.

*G.* This is the same as low area No. XII, or the West Indian hurricane of the U. S. series. The first reports of its existence thus far received are those of the 20th, when it passed westward between Guadeloupe and Dominica at N. 15.5°, W. 62°. The pressure had diminished steadily in these islands from 30.03 on the 15th to 29.93 on the 19th, and doubtless the whirlwind was at that time forming far to the east and advancing slowly westward. From the reports that have been received relating to the 20th and subsequent dates the following extracts are taken:

Capt. A. Delanoe, of the steamship *Ville de Tanger*, left Pointe a Pitre for St. Pierre, Martinique, at 9 a. m., 20th; barometer between 758 and 759, weather squally, wind varying from east to northeast, with a little rain. At 12.30 p. m., when four nautical miles northeast of the northern part of San Domingo, the barometer rapidly fell to 753, terrific wind, very high sea, continuous rain. At Port de France, 4 a. m., 22d, the sky was covered with heavy clouds, squalls of little violence, the sea calm, with slight rain.

From Prof. T. Scherer, Port au Prince, Haiti:

During the 21st the barometer fell from 760.1 at 7 a. m. to 758.2 at 9 p. m. with slight rain and feeble southeast wind. On the 22d, at 8 a. m., the wind changed rapidly from east-southeast to west-northwest, and at 9 a. m. was varying between southwest and north-northwest. The lowest barometer occurred between 10 and 11 a. m., and was 755.3, after allowing for the regular diurnal variation; at this time the wind was west-southwest, and the rain ceased; at noon the wind had returned to east-southeast and gradually increased from 4 meters to its normal value at 9 p. m. of 9 meters per second. The cyclone passed over San Domingo during the night, between 11 p. m. of the 21st and 5 a. m. of the 22d; the lowest barometer was 738. More than 500 houses were destroyed and 2 churches. Nearly all the roofs were carried away. The palaces and the principal edifices were unroofed. A part of the fortress fell down. The crops were very generally injured throughout the northern part of the island. At Puerto Plata the tempest raged from 1 to 3 a. m., September 22. At Cape Haitien it was thought that the cyclone was passing by at noon; the barometer had fallen 15 mm. since the preceding day; the sea had overthrown the St. Nicolas Mole. By reason of the general disturbance of the telegraphic work many important points as to the destruction by the storm remain unsettled. The barometric minimum at Port au Prince seemed to occur between 10 and 11 a. m., apparently following the general movement. At the Island of St. Thomas the lowest barometric readings were: September 20, 9.40 p. m., 29.83. 21st, 1.50 a. m., 29.82; 3.55 a. m., 29.82; 5.40 a. m., 29.84; 6.30 a. m., 29.86. Strong puffs of wind and rain all night, mostly from southeast to southwest; a little lightning early in the night. At Martinique, September 20, 2 p. m., barometer 29.7 and wind varying from west to northwest. At Guadeloupe, 2 p. m., barometer 29.89, wind varying from east to northeast. At St. Croix and St. Kitts strong gale from the south and east during the night of the 20th-21st. At Antigua during the 20th a moderate southeast gale. In Cuba the center of the hurricane passed west of Cienfuegos about midday of the 24th, and passed between Habana and Matanzas that same afternoon.

The path of this cyclonic whirl lay to the southward of but in close proximity to, the highlands and mountains of San Domingo and Cuba, and in accordance with the analogy of vortex whirls moving in the neighborhood of large obstacles, these highlands may have had a slight influence in causing the general track of the storm center to have deviated slightly toward them, but this influence must have been almost inappreciable as the mass of air in motion in the regions above the highlands was too large to have been much affected by them. On the other hand, the local phenomena of wind and pressure experienced at any point near the earth's surface must have been largely influenced by the presence of these highlands, and this doubtless accounts for the comparatively slight diminutions of pressure observed at our West Indian stations in comparison with those noted in

previous hurricanes and, in fact, with those observed in the present hurricane as soon as it left Cuba. The northward path from Cuba into Florida and along the south Atlantic coast presents another illustration of the ease with which the hurricane develops on the ocean or the immediate coast and the difficulty with which it penetrates the interior of the continent. The present whirl appears to have grown in size very slowly and also to have moved quite slowly during its whole path not only in the West Indies, but also after reaching the south Atlantic States. On the 30th, noon, it was southeast of New Jersey, and the rest of its career belongs to October.

IV.—This was a hurricane which first became severe at Weather Bureau stations on the 7th, but by means of a few reports from Central American and West Indian stations the earlier history of this depression may be traced from its beginning on the 1st in the southern portion of the Caribbean Sea off the northern coast of Colombia, South America. On that date an area of high pressure was moving rapidly south-

ward over the United States and Cuba, and pressure was falling in the States of Nicaragua and Panama. By the 2d, a. m., the surrounding winds indicated a whirl central a little east of Roncador reef. This whirl moved northeastward, passing midway between Cuba on the right hand and Nicaragua, Honduras, and Yucatan on the left hand. Shut in by these land areas it apparently did not grow in size, but may have been as intense at the center as it was in the subsequent part of its path.

The general depression within which this area occupied the southern portion was at first a continuation of that which also contained the hurricane designated as No. XII in the September REVIEW, but subsequently this hurricane in the Caribbean Sea entered the region of low pressure whose northern portion was occupied by low No. I of the present month. On the 5th as low No. I passed rapidly eastward over Newfoundland the present hurricane was moving slowly northward through the eastern portion of the Gulf of Mexico, and was fed on its western side by high area No. II which was then central in Kansas and Missouri. As this high area moved rapidly eastward the hurricane entered the general depression containing low No. V which was central on the 7th in Minnesota. During the 8th and 9th the centers of these two low pressures rapidly approached each other; No. V went rapidly eastward toward Newfoundland while No. IV went rapidly northeastward over Florida and Georgia. Meanwhile a third low area (No. VII) had advanced from British Columbia southeastward, and by the 10th, a. m., was central over Lake Superior when No. IV was central off the coast of New Jersey and No. V was central in Newfoundland. These three centers thus formed the vertices of a triangle whose three sides were about twenty degrees in length. From this point onward, the record seems to show that low No. VII rapidly dwindled away while Nos. IV and V passed on to the Atlantic Ocean.

The following reports from Weather Bureau stations show the times of beginning and ending of this storm:

Mobile, Ala., rain began 7th, 8.45 p. m., with high wind, and continued until 8th, 5.45 p. m.

Fort Morgan, Ala., 7th, 8 a. m., 29.85, east to northeast 22 miles, high tide and heavy sea; 4 p. m., rain began; 8 p. m., 29.75, east-northeast 32 miles. 8th, 8 a. m., 29.43, northeast 53 miles, light rain, tide water 5 feet above ordinary high tide, very heavy sea; 10 a. m., 29.35, 60 miles northeast; 11.55 a. m., 29.30, 60 miles; 2 p. m., 29.24, wind 62.4; 3 p. m., 29.34; 6.30 p. m., 29.38, wind 79.2, lightening up in the northwest and clouds moving rapidly from north to south; 8 p. m., 29.46; 10 p. m., 29.54. 9th, 8 a. m., 29.68, wind north 20 miles.

Pensacola, Fla., 8th, rain continued from early morning and ended 8.15 p. m., with heavy northeast gales until late in the afternoon. The tide was higher than ever before.

Lake City, Fla., 8th, a heavy east storm occurred all day, which increased after dark to 40 or 50 miles with heavy rain; the storm increased in intensity until daylight of the 9th, when the wind was about 80 miles an hour with heavy rain.

Jacksonville, Fla., rain began at 10.40 p. m., 8th, with high wind and rapidly falling barometer. The early morning of the 9th the storm increased in violence; a maximum velocity of 62 miles southeast occurred at 5.45 a. m., being the highest velocity ever registered at this office. The rain ended at 9.30 a. m.

Charleston, S. C., 9th, rain continued all day, with high wind with a maximum velocity of 48 miles southeast. All shipping remained in port.

Charlotte, N. C., 9th, rain continued all day, ending at 7 p. m., the total amount being 3.80 inches. High wind prevailed during the day; maximum velocity 30 miles.

New York, N. Y., rain began 9th, 11 p. m., became heavy

the morning of the 10th and ended at 12.45 p. m. It is roughly estimated that at least \$1,000,000 worth of property was saved by the timely warnings.

Block Island, R. I., 10th, a severe storm set in at 12.45 a. m., accompanied by heavy rain, and increased in energy to a maximum velocity of 84 miles; storm ended at 9.25 p. m.

Narragansett Pier, R. I., 10th, rain began during the early morning, with a terrific northeast gale, the storm being the worst in several years.

Woods Holl, Mass., 10th, heavy rain began at 3.30 a. m., and continued until 11 p. m.; a severe gale blew from the northeast from 5 a. m., veering to east and southwest, with a maximum velocity of 60 miles per hour from the southwest. Owing to the timely warning given of the storm but few disasters were reported.

Boston, Mass., 10th, rain began about 3 a. m. and continued until 4.20 p. m., with high wind, reaching a maximum velocity of 49 miles east at 10 a. m. The timely warnings of the Bureau kept many vessels in port.

Portland, Me., 10th, rain began at 8.30 a. m. and continued until 8.12 p. m., with high wind. The storm was one of the severest that has ever occurred at this station.

In connection with this low area the following signals were ordered: 5th, 12.30 p. m., southeast, Key West. 6th, 10.55 p. m., northeast, Port Eads. 7th, 10.30 a. m., northeast, New Orleans to Tampa; 3.30 p. m., northeast, Galveston; 10.10 p. m., northeast, Jacksonville and section to Norfolk; 10.15 p. m., continue northeast, Port Eads; 10.20 p. m., continue information at Key West. 8th, 11 a. m., change to southeast at Tampa; 10.50 p. m., continue signals at Port Eads, Punta Gorda, Jacksonville to Norfolk. 9th, 8 a. m., southeast, Savannah and section; 10.50 a. m., northeast, Baltimore to Nantucket; 11 a. m., information, Portland and Eastport; 2 p. m., northeast, Boston and section; 4.40 p. m., southwest, Wilmington; 4 p. m., northwest, Savannah and section; 10.55 p. m., continue signals Morehead to West Point; information, Portland and Eastport. 10th, 9.50 a. m., northeast, Eastport and Portland; 9.50 a. m., change to northwest, Breakwater to New York; continue signals from New Haven to Woods Holl; 11.30 a. m., northeast signals at Oswego and section and Rochester; 8 p. m., northwest, New London. 11th, 10.30 a. m., information, Lake Ontario, Eastport, and Portland; 8.30 p. m., southwest, New York. For list of special warnings and other information, see Storm Bulletin No. 3 of 1894.



XII.—This was a West Indian hurricane whose history belongs to that of the North Atlantic storms, except only for the fact that on the 12th, and especially on the 16th, when its position and motion were as yet very imperfectly known, it was necessary to mention its existence in the general summary of weather conditions and to exhibit signals at Weather Bureau stations on the Atlantic coast as follows: 16th, 2 p. m., information, from Key West to Cedar Keys; 4 p. m., northeast at Cedar Keys, Tampa, Key West, Punta Gorda, Jupiter; 3.30 p. m., information at Jacksonville and section. 17th, 10.30 a. m., change to information at Cedar Keys, Tampa, Punta Gorda, and Jupiter.

XIV.—This was a West Indian hurricane whose details belong in great part to the storms of the North Atlantic Ocean; it was first located on the 22d at about N. 23°, W. 63°, from which position it moved eastward until, on the 25th, a. m., it was at about N. 26°, W. 76°, being then north of the Bahamas; its path now turned to the northeast at a considerable distance from the Atlantic coast until, on the 31st, it was central in N. 53°, W. 27°.

In connection with this hurricane, the following signals were ordered: 21st, 3 p. m., northeast, Norfolk section; 23d, 2.20 p. m., storm northwest, 2.50 p. m., from Key West to Jacksonville and section; information, at 2.50 p. m., from Savannah to Hatteras; 8 p. m., change to northeast at Jupiter; 10.20 a. m., information signals, Lake Pepin, Duluth, and Ashland section. 24th, 2.10 p. m., continue signals from Key West to Charleston, and from Wilmington to Hatteras; 2.40 p. m., information signals at Norfolk and section (except Hatteras) and Newport News; 9.50 p. m., southeast at Narragansett, Woods Holl and section; information at Boston and section. 25th, 10.50 a. m., change to information from Jacksonville to Key West; 1.50 p. m., northeast, Boston and section; 2.40 p. m., northeast at Sandy Hook, New Haven, New London, and Newport section; 10.05 p. m., continue northeast, Woods Holl and Narragansett section; 10.35 p. m., information signals at Eastport and Portland. 26th, 10.50 a. m., storm northeast at Portland and Eastport; 3 p. m., continue Boston and section. 29th, 9.55 a. m., northeast, Narragansett and Woods Holl section and Newport section. 30th, 10.30 p. m., northeast, Woods Holl, Henry, and Newport section; information at Sandy Hook. 31st, 10 p. m., southwest, Portland; southeast, Eastport; southwest, Boston and section; change to southwest, Woods Holl, Narragansett, and Newport section.

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## NORTH ATLANTIC METEOROLOGY.

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

The low pressure that prevailed at the center of this hurricane and the intense violence of the winds over a very small region near the center are well shown by the following extracts from the log book of the *Johann Ludwig*, Captain Jespersen, which arrived at Pensacola in a disabled condition on the morning of the 14th:

October 6, 8 a. m., N.  $28^{\circ} 45'$ , W.  $86^{\circ} 25'$ , wind NE. 10, barometer 29.96; 8 p. m., N.  $28^{\circ} 38'$ , W.  $86^{\circ} 35'$ , wind E. to NE. 11, barometer 29.94. 7th, 8 a. m., N.  $28^{\circ} 22'$ , W.  $86^{\circ} 58'$ , wind E. to NE. 11, barometer 29.86; 8 p. m., N.  $28^{\circ} 15'$ , W.  $87^{\circ} 25'$ , wind E. 12, barometer 29.54. 8th, a. m., N.  $28^{\circ} 10'$ , W.  $88^{\circ} 13'$ , wind E. 12, barometer 28.38; 8 p. m., N.  $28^{\circ} 03'$ , W.  $87^{\circ} 55'$ , wind NW. 10, barometer 29.50.

From 8.30 a. m. to 10 a. m. of the 8th, nearly calm. Intensely disturbed sea. At 10 a. m. of the 8th, wind shifted to north and barometer began to rise rapidly. The strongest wind occurred about 2 p. m. of the 8th. At 6.30 a. m., of the 8th, rigging was cut away to save vessel from capsizing. The sea was full of foam; and the sea, air, and clouds had seemingly merged into one. After sundown of the 8th to the morning of the 9th, wind moderating from northwest; clear, settled weather by night of the 9th.

C. This was central on the 1st at N.  $50^{\circ}$ , W.  $38^{\circ}$ , as a severe hurricane center. It moved slowly northeastward, but was joined on the 3d by areas *A* and *D*, forming a resulting oval depression and whirl that occupied the greater part of the Atlantic between Cape Breton and Ireland, but which broke up on the 6th in N.  $55^{\circ}$ , W.  $25^{\circ}$ . Among the vessels that experienced this hurricane were the *Pomeranian*, *Washington*, and *Buenos Ayrean* on the 1st; *Barbedian*, *Braunschweig*, *Tancarville*, and *Unionen* on the 2d; *Veendam*, *Washington*, *Sachem*, *Saale*, *Barbedian*, and *Othello* on the 3d; *Hungaria*, *Scandinavian*, *State of Nebraska*, *Braunschweig*, and *Micmac* on the 4th.

B. This was the hurricane referred to as No. IV of the U. S. series. It appears to have begun on the 1st off the coast of Panama and Colombia, and passed northeastward between Cuba and Yucatan on the 6th, northward through the eastern portion of the Gulf of Mexico on the 7th and 8th, and northeast on the south Atlantic and mid-Atlantic coasts on the 9th and 10th. On the latter date it joined with low No. VII of the U. S. series, and on the 12th these were central over Newfoundland. On the 13th these united with low area *F* of the North Atlantic series, and the resulting depression broke up by the 16th. When passing through the Gulf, this hurricane was encountered by the *Cayo Romano* and the *Johann Ludwig* on the 8th in about N.  $27^{\circ} 50'$ , W.  $87^{\circ} 45'$ ; by the *Stephen Bishop* and *Acme* on the 9th. When passing over the Atlantic, this hurricane was encountered by the *Allah* and the *Ben. Nevis* on the 13th, by the *Tauric* and *Elmville* on the 14th, and by the *Anvers* on the 15th.

G. This was the hurricane No. XII of the U. S. series. On the 10th pressure had begun to fall, and the winds had begun to show a cyclonic whirl off the coast of Venezuela west of Trinidad. This whirl moved slowly northward, and on the 12th, noon, was near Martinique, approximately central at N. 15°, W. 63°. It was at this time undoubtedly of small dimensions.

At Port au Prince, Haiti, the observer noted low pressure on the 14th, noon, which continued until the 18th, noon, with clear weather, light winds, and no rain.

Mr. Jos. Ridgway, Jr., observer at St. Thomas, sends the following account of the weather attending the hurricane:

On the 13th, evening, it was reported here that there was a hurricane to the southwest of Barbados, but the daily weather reports did not indicate anything so serious, though it had been quite plain some days that there was an evident barometric depression which indicated heavy rain (not unusual at this season), but nothing more. However, late at night (13th) and early morning we had wind strong from east to southeast, then south and southwest, with torrents of rain. Beginning on the night of the 12th, the rainfall here varied in different localities of the island from 70 to 100 lines (9 to 12 inches). Strange to say, at St. Croix there were but 30 lines. Judging from damage reported, wind must have blown at St. Lucia with hurricane force. Information from Vieuxfort (south side) reports great damage to property in that district, many factories being wrecked, the English church also being destroyed, and the cane crop totally gone at Calderac and Deunery. The fields were quite submerged, and the sugar and cocoa crops of this island are considered to be entirely destroyed. Serious landslips and all roads blocked.

By the 14th, noon, the center had passed to the north of St. Thomas, and had become the southern whirl in a depression that stretched northward to the St. Lawrence and included in its northern portion the low area No. IX of the U. S. series. According to the reports of the steamship *Herschel*, which left Santa Lucia at 1 p. m. of the 12th for New York, she was in the center of this whirl on the 16th, from 10 a. m. to 8 p. m., during which period the barometer was always below 28.20 and was lowest, 27.50, at 4 p. m. This low pressure is one of the lowest on record at sea level. The location was about N. 25° 40' and W. 66° 35'. The hurricane winds and blinding rain that accompanied this center were of the severest type. At Bermuda, on the 16th, at 7 a. m., the barometer was 30.13, wind northeast, force 6, with indications of the approaching hurricane. On the 17th, 7 a. m., the barometer was 29.94, southeast, force 3, with heavy surf from the south; at noon, 29.47, southeast, force 7; at 2 p. m., 29.45, northeast, force 9; at 4 p. m., 29.68, northeast, force 7, with a surf from the southeast, whence we infer that the storm center passed on the eastern side of Bermuda. On the 18th, noon, it was apparently central at N. 34°, W. 60°, and was now the southern portion of a depression that extended northward beyond Labrador and included the low area No. XI of the U. S. series. As usual in such cases, the southern whirl now began to rapidly die out and had disappeared on the 20th, while the northern center expanded and continued. Among the vessels experiencing this hurricane were the *San Giorgio* and the steamship *Herschel* on the 16th. The reports from numerous stations in Cuba on the 13th, 14th, 16th, and 17th show that the low pressure throughout the island and the gusty, rainy weather induced considerable anxiety lest another hurricane similar to that of September was about to visit the island, and telegrams of information were widely distributed both by the authorities of Cuba and the United States.

Mr. Rafael Junquera, observer at St. Jago de Cuba, communicates the following extracts from the log book of the captain of the Spanish steamer *Antinog y Menendez* coming from Manzanillo to that port; the steamer had to go into Niquero, a small port on the other side of Cape Cruz, to protect herself from the storm:

Left Manzanillo for St. Jago de Cuba at 10.30 a. m., October 17, 1894; barometer, 29.93; thermometer, 79. 2 p. m., barometer, 29.85; thermometer, 80; wind moderate from northeast, sky cloudy, drizzling. 3 p. m., barometer, 29.80; thermometer, 80; wind fresh from southeast with violent gusts and torrential rain; lower clouds moving with moderate velocity from east-

southeast, cumulus clouds from south-southwest. 4.30 p. m., barometer, 29.79; thermometer, 77. 5.30 p. m., barometer, 29.70; thermometer, 77. 6 p. m., minimum barometer, 29.67; thermometer, 78; anchored at Niquero; wind strong from southeast and much rain; the gusts of wind were very violent, inclining to southerly; lower clouds moved with great velocity from southeast, cumulus from southwest. 8 p. m., barometer, 29.74; thermometer, 79; wind weak from second and third quadrants; continuous rain; lower clouds moving at intervals with great velocity. 10 p. m., barometer, 29.70; thermometer, 79. At midnight the wind changed to the southwest; rain. 3 a. m., wind became weaker from first quadrant; mist. 2 p. m., wind southeast and south; squalls. 8 p. m., wind south-southwest followed by rain. 3 a. m., October 19, rain ceased, weather improving; barometer rising very slowly.

The schooner *B. Frank Nealley*, on her route from New York to Puerto Rico, passed near the vortex of this storm in N. 30°, W. 71° on the 26th, at 3 a. m., when she had a north-northwest gale of about 70 miles, with the barometer 29.30, the wind having veered 8 points in twelve hours. The vessel was at one time probably within 100 miles of the center of the storm.

H. This was the hurricane low No. XIV of the United States series. On the 20th the circulation of the winds indicated the presence of a disturbance north of the Windward Islands, central at about N. 20°, W. 60°; this moved slowly westward and by the 22d was at N. 23°, W. 64°, and by the 24th, at N. 26°, W. 74°, at which time it was turning toward the north and northwest, and by the 26th, noon, it was central at N. 36°, W. 68°. The northeasterly course of this storm was very rapid, being central on the 28th at N. 46°, W. 46°; on the 29th, N. 49°, W. 40°; here its rapid progress ceased, being central on the 30th at N. 48°, W. 34°; 31st, N. 50°, W. 30°. On this latter date this area had approached the low area described under *I* as resulting from the breaking up of the area *I G* and which was then near the coast of Great Britain. Among the many vessels that encountered this storm were the following: *La Flandre*, *Manitoba*, *Francisco*, and *Spain*, all of which report pressure below 28.8 on the 28th; *Massachusetts*, *American*, *Donau*, and *Maryland*, which report the lowest pressure, 28.2, on the 29th; *Amsterdam* on the 30th.