

Movements of centers of areas of high and low pressure.

| Number. | First observed. | | | Last observed. | | | Path. | | Average velocities. | |
|------------------------|-----------------|---------|----------|----------------|---------|----------|---------|-----------|---------------------|---------|
| | Date. | Lat. N. | Long. W. | Date. | Lat. N. | Long. W. | Length. | Duration. | Daily. | Hourly. |
| High areas. | | | | | | | | | | |
| I..... | 1, a. m. | 50 | 86 | 6, a. m. | 39 | 79 | 1,410 | 5.0 | 282 | 11.8 |
| II..... | 6, a. m. | 49 | 87 | 9, p. m. | 33 | 79 | 2,040 | 3.5 | 583 | 24.3 |
| III..... | 7, p. m. | 39 | 125 | 12, p. m. | 41 | 68 | 3,420 | 5.0 | 684 | 28.5 |
| IV..... | 10, p. m. | 46 | 123 | 17, p. m. | 26 | 82 | 4,320 | 7.0 | 617 | 25.7 |
| V..... | 13, a. m. | 38 | 125 | 18, a. m. | 33 | 100 | 2,820 | 5.0 | 564 | 23.5 |
| VI..... | 18, a. m. | 52 | 117 | 23, a. m. | 44 | 59 | 3,360 | 5.0 | 672 | 28.0 |
| VII..... | 21, a. m. | 43 | 110 | 24, a. m. | 30 | 92 | 1,440 | 3.0 | 480 | 20.0 |
| VIII..... | 22, a. m. | 47 | 121 | 24, a. m. | 44 | 111 | 720 | 2.0 | 360 | 15.0 |
| IX..... | 25, a. m. | 51 | 109 | 30, p. m. | 36 | 78 | 2,460 | 5.5 | 447 | 18.6 |
| Total..... | | | | | | | 21,990 | 41.0 | 4,689 | |
| Mean of 9 tracks..... | | | | | | | 2,443 | | 521 | 21.7 |
| Mean of 41 days..... | | | | | | | | | 536 | 22.3 |
| Low areas. | | | | | | | | | | |
| I..... | 1, a. m. | 52 | 117 | 4, a. m. | 53 | 101 | 1,140 | 3.0 | 380 | 15.8 |
| II..... | 4, p. m. | 54 | 108 | 11, a. m. | 48 | 53 | 3,900 | 6.5 | 600 | 25.0 |
| III..... | 10, p. m. | 24 | 83 | 14, a. m. | 34 | 99 | 1,260 | 3.5 | 360 | 15.0 |
| IV..... | 10, p. m. | 51 | 117 | 14, a. m. | 47 | 59 | 2,760 | 3.5 | 789 | 32.9 |
| V..... | 12, a. m. | 51 | 124 | 18, a. m. | 49 | 53 | 3,600 | 6.0 | 600 | 25.0 |
| VI..... | 16, p. m. | 54 | 114 | 21, a. m. | 48 | 64 | 3,480 | 4.5 | 773 | 32.2 |
| VII..... | 18, p. m. | 47 | 125 | 21, a. m. | 50 | 89 | 1,740 | 2.5 | 696 | 29.0 |
| VIII..... | 20, a. m. | 23 | 85 | 25, a. m. | 48 | 59 | 2,580 | 5.0 | 516 | 21.5 |
| IX..... | 23, p. m. | 55 | 111 | 27, a. m. | 49 | 57 | 2,580 | 3.5 | 737 | 30.7 |
| X..... | 26, a. m. | 53 | 121 | 30, p. m. | 52 | 70 | 3,060 | 4.5 | 680 | 28.3 |
| XI*..... | 27, a. m. | 25 | 86 | 30, p. m. | 28 | 86 | 600 | 3.5 | 171 | 7.1 |
| Total..... | | | | | | | 26,100 | 42.5 | 6,131 | |
| Mean of 10 tracks..... | | | | | | | 2,610 | | 613 | 25.5 |
| Mean of 42.5 days..... | | | | | | | | | 614 | 25.6 |

* Not used in final summary.

LOWS.

For the first time this season the conditions have been favorable for West India storms. The first of these, No. III, began to the north of Cuba on the 10th, p. m., though there had been a slight disturbance forming for several days previously. The storm traveled very slowly (15 miles per hour) a little to the north of west and finally disappeared in Texas morning of 14th. The lowest pressure noted was 29.58 off Galveston, p. m. of 12th. The heaviest rain in twenty-four hours was 1.12 inch at Mobile, p. m. of 12th, showing a rather remarkable deficiency, and possibly one reason for the rapid dissipation of the storm on reaching the land. The highest wind of the storm was at Port Eads, 72 miles per hour, northeast, a. m. of 12th, and the next highest was 42 miles at New Orleans, a. m. and p. m. of 12th. Another Gulf storm, No. VIII, began with a disturbance in the southeast Gulf before the 20th. Its motion was rather slow (21.5 miles) to a point a little east of north, reaching the Gulf of St. Lawrence, a. m. of 25th. The lowest pressure noted was 29.62 off Savannah, a. m. of 22d. Phenomenal rains attended this storm on the west Florida Coast and off the south Atlantic Coast, except in south Florida. Tampa reported 6.56 inches in twenty-four hours, a. m. of 21st; Jacksonville, 5.40 inches, p. m. of 21st; Savannah, 2.78 inches, a. m. of 22d, and Charleston, 1.48 inch, same date. Jupiter (170 miles from Tampa) had only 0.01 of an inch of rain, and the same amount fell at Key West. The highest wind was 50 miles per hour at Charleston, a. m. of 22d. In both of these storms all shipping and Gulf and south Atlantic ports received ample warning of high winds.

The third Gulf storm was first noted as a slight disturbance off west Cuba, a. m. of the 25th, the pressure at Habana having fallen off 0.10 in twenty-four hours. This disturbed condition practically continued in the east and southeast Gulf throughout the storm. Light rains were experienced. The highest wind, 48 miles northeast, was noted at Port Eads, a. m. of the 30th.

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STORM WARNINGS AND WEATHER FORECASTS.

By Lieut. Col. H. H. C. DUNWOODY, Supervising Forecast Official.

Under this head it is proposed to make note of all extreme and injurious weather conditions occurring during the month, and the warnings of the same issued by the Bureau, with instances, as far as reported by observers or the press, in which these warnings were of special public benefit. The signals displayed by the Weather Bureau will be referred to as "information," "storm," "hurricane," "cold wave," and "norther," respectively.

SEVERE STORMS.

The following report on the work of October has been prepared by Mr. H. E. Williams, Chief of Forecast Division:

Storm of October 19-21.—Two tropical storms for which hurricane signals were ordered occurred during October, viz, 19-21 and 23-26. The first was noted on the evening of the 19th as a slight depression east of Florida. It moved rapidly northeast toward the North Carolina coast, and on the morning of the 20th was central south of Hatteras, causing northeast winds of 34 and 26 miles at Hatteras and Henry, respectively. During the day it moved slowly northeast, increasing in intensity, and on the night of the 20th was apparently central off the east North Carolina coast, maximum velocities of 44 south and 60 northeast, occurring at Hatteras and Henry, respectively. Storm southeast signals were hoisted by the observer at Hatteras at 6 a. m. of the 20th, and at 10 a. m. the Central Office ordered storm northeast at Henry, Norfolk,

and in Hampton Roads, and information signals from Breakwater to Nantucket. At 12:10 p. m. these latter were changed to storm northeast, and the same extended to Boston and section. Special reports of the development and progress of the storm were received during the day, and at 11:55 a. m. the observer at Norfolk was warned that the storm was likely to be very severe, and directed to notify all vessels that it would be dangerous to leave port. At 1 p. m. hurricane signals were ordered from Hatteras to Boston section, with the warning that the winds would probably reach hurricane velocity off the south New England and middle Atlantic coasts, and that it was dangerous for vessels to leave port. At 10 p. m. information signals were hoisted at Portland and Eastport, with the warning of severe east gales on the south New England coast Thursday morning (21st), and that winds would be likely to be brisk to high off the north New England coast Thursday. On the morning of the 21st the storm was central off the southeast New England coast, whence it passed during the day northeast beyond the region of observation. Northeast winds of 36 miles at Atlantic City, 38 at New York, 56 at Block Island, and 44 at Nantucket occurred during the night of the 20th and morning of the 21st.

Storm of October 23-26.—The second storm was first observed on the evening of the 23d, the p. m. synopsis of that date stating that "there are some indications of a depression to the east of Florida." Information signals had been ordered during the

afternoon for increasing northeast winds from Hatteras to Atlantic City, and at 10 p. m. storm northeast were hoisted at Hatteras and Henry, with warning of a possible depression southeast of Hatteras. During the night of the 23d the storm moved northward toward the North Carolina coast, causing northeast winds of 48 and 34 miles, respectively, at Hatteras and Henry. At 10:30 a. m. of the 24th storm northeast signals were ordered from Norfolk to Cape Cod section, and information at Baltimore and Boston, with warning that the storm to the south of Hatteras, moving slowly to the east of north, would probably cause dangerous northeast gales on the middle Atlantic and south New England coasts during the night.

Special noon observations of the 24th showed the storm to be increasing in energy, and at 2 p. m. hurricane signals were ordered from Hatteras to Cape Cod section, storm northeast at Boston and section, and information at Portland and Eastport, with warnings from Hatteras to Boston that winds would probably reach hurricane velocity from the North Carolina to the southeastern New England Coast, and that it was unsafe for vessels to leave port. The warning to Norfolk predicted that the evening tide would be higher than that of the morning in that vicinity. At 9:30 p. m. the signals at Boston and section were changed to hurricane, and at Portland and Eastport to storm northeast, and the official at Boston directed to use all available means to distribute the information. At 9:50 p. m. an additional message was sent to the observers at New York and Philadelphia, directing them to use all available means to warn shipping and other interests of the approaching storm. The storm continued to move slowly northward during the day and night of the 24th, and on the morning of Monday, the 25th, it was central as a storm of great energy near the Virginia coast, the barometer reading 29.32 at Norfolk.

Winds of 64 miles north at Cape Henry, 56 north at Hatteras, and 43 northeast at Atlantic City occurred during the day, and 48 northwest at Hatteras, 38 north at Norfolk, 52 northeast at Atlantic City, and 48 northeast at Block Island during the night of the 24th. At 10:50 a. m. of the 25th the officials at Boston, New York, Philadelphia, and Nantucket were again directed to use all available means to distribute warnings of the storm and to notify postmasters in their vicinity that the storm would cause winds of hurricane velocity near the coast Monday night and Tuesday.

During the 25th the storm moved to the southeast, a very unusual and unexpected direction of movement for a storm of this character, and the barometer rose at the center of the disturbance. Northeast winds of 48 miles at Cape Henry, 42 at Atlantic City and Block Island, and 40 at New York occurred during the 25th.

At 10:50 p. m. of the 25th signals were changed to storm northeast from Hatteras to Cape Cod Section, and observers notified that conditions were less threatening, although strong northeast gales were probable off the south New England and middle Atlantic coasts. During the night of the 25th the storm decreased in energy, remaining central near Hatteras, where it gradually disappeared, some effects of its presence continuing until the morning of the 27th.

COMMENTS OF THE DAILY PRESS.

It is impracticable, from the nature of the case, to obtain accurate estimate of the benefits derived from the warnings of these storms issued by the Bureau, but the reports received indicate that they were very great, particularly those in connection with the storm of the 23d-26th, which from New York south to Hatteras was the most violent and destructive that had occurred for years. Danger warnings and special telegraphic bulletins were displayed at all ports from twelve to twenty-four hours in advance of the hurricane, and the information widely disseminated by means of the telephone,

telegraph, and signal rockets at night, and, as a result, few disasters to shipping occurred. Between 800 and 900 vessels were reported to have remained in port at harbors on the Atlantic Coast as a result of the signals.

A report from the Weather Bureau official at Norfolk states:

Practically all shipping tied up on Sunday and remained at their docks until Wednesday. The ocean liners which did not go out on account of the warnings were: Boston steamer, Providence steamer, New York steamer, and Philadelphia steamer. In addition to the regular schedule steamers, there were 20 tramp steamers, 16 of which were loaded with cotton and other merchandise from this port and other southern ports that had put in here for bunker coal; also 105 coastwise vessels, the majority loaded with lumber and coal; all received protection through the warnings of the Weather Bureau.

It is difficult to estimate the value of maritime property in this vicinity which was protected by the warnings, though it is in excess of \$7,000,000 and 1,000 persons. It is estimated that \$550,000 worth of cotton and other merchandise was saved from damage by high tides. Much damage to fish industries is reported from the coast district. Three wrecks were reported from the coast between Cape Henry and Hatteras.

At 10:30 p. m. of the 26th the German steamer *Polaria*, with a cargo of cotton-seed meal, cotton, and coffee, stranded off Cape Henry. The observer at that station notified the wrecking company at Norfolk at 10:35 p. m., and tugs were on the way to the assistance of the stranded vessel inside of two hours, and were alongside of her at daylight.

The great value, in the public estimation, of the work done by the Bureau in connection with these storms is shown by the following extracts from the public press in relation to the warnings issued, viz:

Norfolk Virginian, October 26.—That the loss of life and property has not been greater is due largely to the magnificent service of the Weather Bureau, whose hurricane signals were generally heeded. The Department also gave out valuable information regarding tides, enabling those who had the forethought to move their goods in stores along the river out of reach of the water. * * * Weather Observer Gray and his efficient staff not only earned their salaries several times over during the storm, but saved many thousand dollars' worth of property, and, perhaps, many lives, by vigilance and untiring effort to warn shipping and merchants.

Norfolk Landmark, October 26.—Farmer Gray and his assistants, from the conditions, at once recognized the possibility of danger to shipping due to the high winds, which originated off Hatteras, and which were slowly but surely traveling the coast line, notified transportation companies, and their prompt action very probably saved many lives. Knowing the direction of the wind and its effect upon the tides, all merchants in the lower part of the city who could be reached were warned, and thus considerable property was saved. * * * Because of the promptness of the weather officials in warning shipping, no serious results have as yet been reported to vessels.

Norfolk Daily Pilot, October 27.—Had it not been for the promptness of the local weather bureau, the loss here would probably have reached many millions instead of a few thousand dollars. The work of the wire from Norfolk to Hatteras has also been invaluable.

Baltimore American, October 26.—Undoubtedly the damage is large, but it would have been much larger had not the warnings of the Weather Bureau given the mariners notice of the coming of the storm.

Philadelphia North American, October 27.—The Weather Bureau at Washington has once more rendered valuable service to the shipping interests of the nation by its accurate forecast of the severe gale which swept along the Atlantic Coast on Monday. That more ships were not wrecked and more lives lost must be placed entirely to the credit of the timely warnings issued from the Weather Bureau, and we may once more congratulate ourselves upon having such an efficient corps of experts, always on the lookout for dangers from the elements.

Philadelphia Press, October 26.—If important shipping escaped the storm, it was largely due to the timely warning of the Weather Bureau, which has been watching the progress of the hurricane since it first touched the Florida coast last week.

New York Times, October 25.—A hurricane is raging off the Atlantic Coast, and mariners were warned yesterday not to go to sea. Chief Moore of the Weather Bureau at Washington sent out orders for the display of hurricane signals at the Delaware Breakwater, Reedy Island, Cape May, Sandy Hook, New York, Montauk Point, Newport, Narragansett, Woods Hole, and Cape Cod. The order was accompanied by a notice that a severe storm was central near Cape Hatteras, moving northeast, and likely to cause wind of hurricane velocity along the coast. The chief followed this with another urgent notice at 11 o'clock last night.

"Use all available means," he wired, "to inform shipping and other interests of approaching storm, which will cause winds of hurricane velocity on the coast."

New York Journal, October 25.—Big Hurricane Due. Weather Office issues Two Warnings to Shipping—Raging about Hatteras. "Use all available means to inform shipping and other interests of approaching storm which will cause winds of hurricane velocity on the coast."—Bulletin from the Chief of the Weather Bureau at 11 o'clock last night.

Wild weather was sweeping from the south last night. Within a few hours yesterday Chief Moore of the Weather Bureau at Washington issued two warning bulletins, the second more urgent than the first.

The very word "hurricane," coming from an official, a scientific source, is enough to give pause to those who go down to the sea in ships, and the news from Atlantic City, printed below, shows that the dreaded visitant or one of its kindred was hard upon New York last night.

Here is Chief Moore's first bulletin:

"Hoist hurricane signals at 2 p. m. at Breakwater, Reedy Island, Cape May, Sandy Hook, New York, Montauk Point, Newport section, Narragansett section, Woods Hole section, and Cape Cod section. Severe storm center near Cape Hatteras, moving northeast, likely to cause wind of hurricane velocity along the coast to-night."

The second bulletin from Washington is quoted at the head of this article.

New York Mail and Express, October 25.—The blow, according to the weather cracks, extends all along the coast from Cape Hatteras to Maine. The surf is cutting up great capers everywhere along this extensive stretch of strand, and telegraphic reports furnish particulars of considerable damage to board walks and even beach cottages. The Weather Bureau has instructed all its branches between the points mentioned to warn all vessels not to leave port. Monday is generally a slow sailing day, but the caution exercised the attention of not a few mariners. Several coastwise schooners cleared Sandy Hook outward bound shortly after daylight, but when their skippers subsequently saw the great carnival of green and white water outside, and the cautionary signals flying at the observatory at the Hook, they decided to return to the lower bay to give old Æolus a chance to tire out.

New York Tribune, October 26.—The Washington Weather Bureau early yesterday morning had hurricane signals hoisted along the Atlantic Coast from Florida to Maine, and as a consequence vessels intending to sail remained in port. At no time during the day did the wind in this harbor exceed 40 miles, but the steamers *Fluminense*, of the Red Cross Line, for Barbadoes, and the Clyde liner *Comanche*, for Charleston, the only passenger vessels scheduled to sail from here yesterday, refrained from venturing to sea. Some half dozen square riggers and schooners desirous of leaving port also remained at anchor in the roadstead about Liberty Island. There were anchored off Thompkinsville, Staten Island, five United States cruisers of the White Squadron, which arrived here on Sunday, and altogether the harbor presented a thoroughly stormbound appearance.