

statement will be found in "

statement seems excessive. Probably \$100,000 would be nearer the true figures. Strong winds were also reported at Eufaula, Ala., and Winston, N. C.

7th.—A severe windstorm began on the west Florida coast on the morning of the 7th, increasing in force as the day advanced. The maximum velocity of the wind at Pensacola (72 miles per hour from the southeast) was reached at 11.45 a. m. Much damage was done in that city. About 35 houses were unroofed, and there was a general destruction of signs, awnings, telegraph and telephone wires, smokestacks, windmills, etc. The greatest destruction, however, occurred in the harbor, and on the water front. Nine fishing smacks were sunk; one brig dragged her anchor and was washed ashore; two barks were badly damaged and a number of smaller craft wrecked and sunk. The property loss has been estimated as high as \$400,000 in Pensacola alone, but that

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## CLIMATOLOGY OF THE MONTH.

The principal storms of the month were the two hurricanes that passed northward along the Atlantic Coast on the 5-10th and 28-30th.

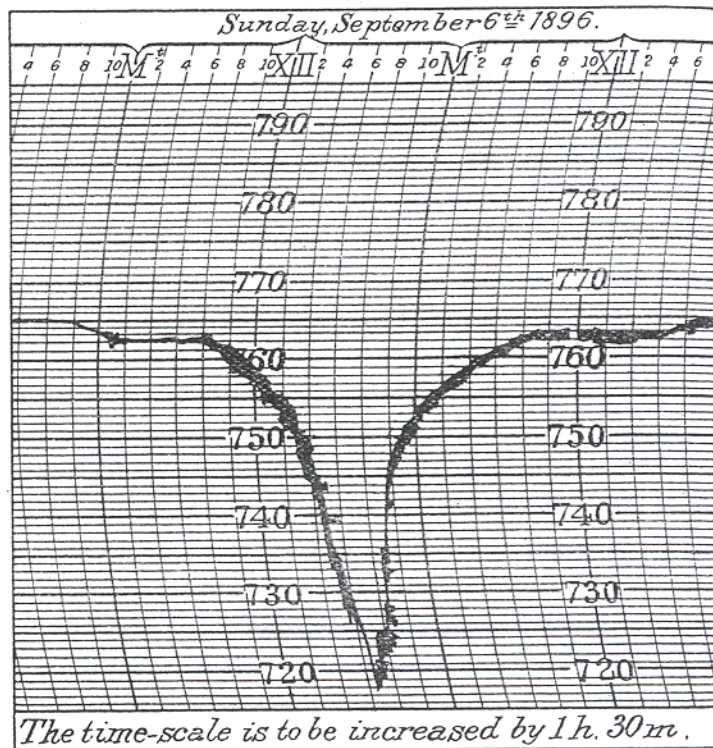
No. IV was a well developed West India hurricane which,

however, only touched the country on the southeast point of New England. One of the ocean steamers that was caught in this storm has forwarded a barograph sheet showing the central depression on the 6th, when a reading of 28.50 inches was reached. This sheet is reproduced on a later page. On the morning of the 5th a report was received from Nassau, Bahama Islands, stating that a disturbance was forming near there. Its path was just half way between Bermuda and North Carolina. No effects from this storm were felt on the Atlantic Coast till the afternoon of the 7th when the observer at Hatteras hoisted his northeast signal. On the morning of the 8th the wind reached 34 miles at Hatteras, and at night the maximum wind was 36 miles at that station. At 9.30 p. m. of the 8th storm northeast signals were hoisted from New York City along the southern New England coast. By 1 p. m. of the 9th the storm had advanced sufficiently to warrant hurricane signals from Montauk Point, Long Island, to Portland, Me. During the afternoon of the 9th a maximum wind of 76 miles was reached at Block Island, which was the highest reported at any land station. On the a. m. of the 10th the storm had lost some energy, and by night it was almost entirely replaced by a high area over Nova Scotia.

ing in the harbors along the coast sailing and steam vessels valued in the aggregate at over \$7,000,000, some of which might have been lost but for the warning. On board these vessels there were about 1,750 sailors and passengers. A full description of the damage wrought by the storm in Florida and along the south Atlantic Coast will be found under severe storms.

The most notable storm of the month was reported near the northwest edge of Cuba p. m. of 26th. An area of high pressure remained nearly stationary off the middle Atlantic Coast for two days and this prevented a rapid development of the storm. By a. m. of 28th the wind had shifted to southeast at Key West, showing that the storm had moved to the southwest coast of Florida. By a. m. of the 29th it had moved to southeast Georgia, increasing rapidly in intensity. By 8 p. m. of the 29th the storm had moved with great rapidity and was central over Lynchburg, Va., which station reported a barometer reading of 29.30 inches. About three hours later occurred the severest storm or "wind-rush" ever experienced in Washington, D. C., a description of which will be found elsewhere. On the a. m. of the 30th the storm had moved to Lower Michigan. Storm and hurricane signals were ordered along the Atlantic Coast in ample time, thus detain-

and Mr. Rouilliard says that time data should be increased by one hour and thirty minutes, probably, in order to get correct local mean time, or by one hour and thirty-one minutes to get seventy-fifth meridian time, or subtract three hours and twenty-nine minutes to get correct Greenwich time.



#### BAROGRAM NEAR A HURRICANE CENTER.

Mr. A. Rouilliard, engineer in charge on the S. S. *Francois Arago*, has kindly sent the Weather Bureau a photograph of the Richard barograph curve for the time when the steamer crossed the hurricane center northeast of the Bahama Banks on September 6; a similar copy was sent by Captain Tissier to the Hydrographic Office and is published on its Pilot Chart. Mr. Rouilliard says:

We have been right in the center of the hurricane and suffered considerable damage; two boats carried away, one man overboard, steam steering gear and hand steering gear both broken. In order to get out of the center we had to make our rudder fast with blocks and ropes in such a way that the helm was hard on port, this to keep the wind on the starboard bow, steering only with the engine which we kept more or less slow.

The following diagram, showing the barometric pressure during the 6th, apparently has its original time scale adjusted to the local time of some meridian a little to the eastward

The first signs of a hurricane appear on the barometric sheet by the rapid fall beginning at 10 p. m. September 5, and the vessel had completely left the influence of the hurricane by 10 a. m. September 7. The position of the center of the hurricane at 9 p. m. September 6 was latitude  $28^{\circ} 50'$  north, longitude  $77^{\circ} 0'$  west of Paris, or  $74^{\circ} 40'$  west of Greenwich, at which time the center was about 220 nautical miles distant from the vessel; this location is based upon an estimate of the position of the steamer at noon of September 7. The lowest pressure was recorded at 6.30 p. m. of the 6th, viz, 717.3 mm. (28.24), which must, therefore, have been very near the center of the hurricane. Nothing is stated as to the corrections to the barograph at this pressure. If we assume that the navigator was sailing northward, while the hurricane center was moving toward the northeast, we find that the vessel was in the southeast quadrant of the storm and approaching the center up to 6 p. m. of the 6th, and that after 8 p. m. it was in the northwest quadrant and receding from the center. This explains the fact that the accompanying barogram shows a somewhat more rapid fall in the course of the eight or ten hours preceding the center than during the same interval of time after the center had passed.



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## CLIMATOLOGY OF THE MONTH.

### GENERAL CHARACTERISTICS.

The principal storm of the month was the hurricane that moved slowly northward from the West Indies on the 9th to the coast of New England on the 15th, but which was not felt severely at any interior land stations. Another interesting storm passed from the west Gulf States on October 23, rapidly northeastward, attended by general rain.

The West India hurricane of October 9th to 17th was IV on Chart I. Its ocean path has been mapped by the Hydrographic Office. From the 13th to 16th this storm remained almost stationary off the middle Atlantic Coast. The highest winds were reported as follows: Cape Henry, 60 miles, p. m. of 10th and 11th. Block Island, 68, p. m., 11th; 73, a. m., 12th; 80, p. m., 12th. Boston, 52, p. m., 12th.

NOTES CONCERNING THE WEST INDIA HURRICANE OF  
SEPTEMBER 29-30, 1896.

By A. J. HENRY, Chief of Division of Records and Meteorological Data (dated  
November 10).

[CONTINUED FROM THE SEPTEMBER REVIEW.]

As stated in the September REVIEW (page 317 of this volume), the violence of the storm of the above date was not uniform throughout its entire course. There seems to have been two distinct periods of unusual violence separated by a period during the afternoon of the 29th when the winds exhibited but little destructive power.

Evidences of unusually violent winds were observed on every hand throughout the storm's course in the States of Florida and Georgia. In the counties of Levy, Alachua, Lafayette, Suwannee, Columbia, Bradford, and Baker, Fla., the destruction of pine timber was enormous, the monetary loss from that source alone being estimated at \$1,500,000. During the early part of the storm the trees were torn up by the roots, but as the force of the wind increased they were broken and twisted off and thrown forward in a confused mass.

At Jacksonville, a little south and east of the storm's path, the self-registers show the maximum wind velocity, 70 miles per hour, to have occurred coincidentally with the minimum of pressure. Violent winds continued for an hour and a half after the occurrence of the barometric minimum. The average velocity during the continuance of the storm, or from 9.10 a. m. to 12 noon, was 52 miles per hour, rising during a portion of the time to 63 miles, which velocity was maintained continuously for an hour.

The self-registers at Savannah indicate quite clearly that that city was in or very near the center of the storm's path. The barograph curve is exceedingly interesting. It is of the V-type characteristic of thunderstorms and tornadoes. The fall was quite slow at first but increased rapidly as the center of the disturbance approached. The fall from noon to 12.45 p. m. was .45 inch, almost all of which had been recovered by 2 p. m. Unfortunately the electrical recording apparatus of the anemometer was disabled at about 12.15 p. m., and the highest velocity can not therefore be obtained. The average velocity during the 28 minutes the recording apparatus failed to register was 75 miles per hour, a velocity

somewhat greater than at Jacksonville. The duration of the storm at Savannah was about 2 hours, and the average velocity during that time was 55 miles per hour.

The storm passed to the westward of Charleston, and though the wind at that station attained a velocity of 62 miles per hour for five minutes, but little damage was done. A velocity of 50 miles per hour prevailed continuously from 1.10 to 2.10 p. m., and an average hourly velocity of 44 miles prevailed from 12.45 to 3.30 p. m. The total fall in pressure amounted to but .4 inch, all of which had been recovered by 7 o'clock p. m.

North of Charleston the storm winds appeared to diminish in strength. There are no Weather Bureau stations directly in the path pursued by the storm between Charleston and Richmond, although it must have passed within 30 or 40 miles of the Weather Bureau station at Raleigh. The wind register at the last-named place showed a maximum velocity of only 26 miles, and the greatest hourly velocity was but 23 miles. At Charlotte, about 120 miles west-southwest, the maximum velocity was also 26 miles. Here a gust preceded the storm proper by about an hour, the wind in the interval being almost calm. The greatest hourly velocity at Charlotte was 20 miles.

A maximum velocity of 34 miles per hour was recorded at Lynchburg, Va., another station on the western side of the storm's path, and the greatest hourly velocity was 26 miles. At Norfolk on the eastern side, and at about the same distance from the storm center, a maximum velocity of 38 miles was registered ten minutes later than the time of maximum velocity at Lynchburg. While the maximum velocity at Norfolk was but slightly greater than at Lynchburg, the velocity of the wind on the average for the six hours ending midnight of the 29th was exactly twice as great as at Lynchburg. No safe conclusion can be drawn from this fact, however, since the ratio of the wind velocity at Lynchburg to that of Norfolk is about as the numbers 4 to 10.

The storm center evidently passed slightly to the westward of Washington. The wind gradually increased in violence, reaching a maximum velocity of 66 miles per hour for five minutes at 11.15 p. m., and maintaining an average velocity of 56 miles from 10.40 p. m. to 11.40 p. m. The wind was remarkable for this locality both on account of its duration and the high velocity attained. The trees in the city and suburbs suffered greatly, although in sheltered places little damage was done. At the Dalecarlia Reservoir (a sheet of

water a little less than an eighth of a mile wide) the effect of the increased velocity of the wind, caused by passing over a water surface, is plainly seen. The north bank of the reservoir is lined with a grove of pine trees about 6 inches in diameter. Probably 80 per cent of the trees on the northern edge of the reservoir were broken off 10 to 15 feet above ground, while the destruction at some distance inland from the water was not more than about 5 per cent.

The wind at Baltimore, 40 miles east-northeast of Washington, was less violent than at the last-named place, the maximum velocity for five minutes being but 36 miles per hour.

At Harrisburg, Pa., the winds were even more violent for a short period than at Washington. The maximum velocity of 72 miles per hour occurred at 1.10 a. m., two hours, lacking five minutes, later than at Washington. This would give the storm a rate of progression of over 50 miles per hour, somewhat greater than the average velocity over the entire course.

The greatest average hourly velocity at Harrisburg was 47 miles for one hour and 45 miles for two hours.

Instrumental records of wind velocity between Harrisburg and Lake Ontario are wanting, but from reports of damages by wind at intermediate points it is inferred that there was a decided lull in the violence of the storm while passing through northern Pennsylvania and central New York, followed by a renewal of activity in Cayuga and Cortland counties, New York. It passed thence to the St. Lawrence Valley as an ordinary rain and wind storm.

Comparison of the relative wind velocities on the two sides of the hurricane can not well be made. The number of self-registering wind instruments in the storm's path was quite small, and moreover there is considerable uncertainty regarding the exact position of the area of lowest pressure. Local differences of anemometer exposure also prevent comparison of wind velocities except under the most favorable circumstances. The maximum velocities recorded near the center of the storm as at Jacksonville, Savannah, Washington, and Harrisburg were the highest ever known.

It may also be interesting to note that though the storm passed northward through nearly 15° of latitude its easting was but 3.5°. The general course of West India hurricanes after passing the lower latitudes is northeasterly. In the present case the pressure distribution to the eastward seemed to give the storm a more northerly direction of motion.