

Two disturbances of tropical origin reached our southern coasts during the first decade of the month. The first of these appeared in the vicinity of Barbados on the 2d, passed thence north of west over the Caribbean Sea to the Yucatan Channel by the night of the 7th, and reached the Texas coast on the 10th. This disturbance had the character of a large shallow depression, rather than that of a well-defined hurricane. Reports show that high winds were encountered northwest of Barbados on the 2d, and that severe wind and rain storms occurred along the south coast of Haiti on the 4th. Rough weather was also reported off the south coast of Cuba during the 8th. Passing from the Yucatan Channel the center of disturbance reached the Texas coast on the 10th, where the earlier signs of its approach were of an alarming character. Beginning on the 9th, Texas coast interests were fully informed by the Weather Bureau relative to the advance of the disturbance over the Gulf, and on the 10th the Bureau was able to issue advices that allayed the fears of the people.

The second storm referred to appeared over the eastern Caribbean Sea on the 6th, passed on a northwest course south of Porto Rico on the 7th, causing a wind velocity of 56 miles an hour at San Juan, skirted the eastern Bahamas on the 8th and 9th, arrived off the North Carolina coast on the 10th, and acquired marked intensity during the night of the 10th, when a maximum velocity of 64 miles an hour was reported at Hatteras, N. C. After the morning of the 11th the storm diminished rapidly in energy. Timely and accurate advices were telegraphed all points in the West Indies and on our southern coasts which lay in the path of these disturbances.

The tracks of the disturbances referred to are shown in part on Chart II.

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FORECASTS AND WARNINGS.

By Prof. E. B. GARRIOTT, in charge of Forecast Division.

The first month of the season of tropical storms passed without the occurrence of gales of hurricane force at any of the islands of the Greater or Lesser Antilles. The most important storm of the month first appeared as a feeble disturbance in the subtropical region north of Cuba on the morning of the 9th. By the morning of the 10th this disturbance had advanced to the extreme southern part of the Florida Peninsula, with an apparent slight increase in energy. At that time the following advisory message was sent to all Florida stations, and also to Savannah and Charleston:

Disturbance of moderate strength central off southeast Florida coast. May cause squalls dangerous to small sailing craft along Florida coast and over western Bahamas.

During the next twenty-four hours the center of disturbance moved slowly northwestward to the Florida coast south of Tampa, and on the morning of the 11th, the following advisory message was sent to Gulf and south Atlantic stations from New Orleans to Charleston:

Disturbance of slight extent central this morning off the west Florida coast; evidently moving northwestward; may cause severe squalls this afternoon and to-night on the west Florida coast.

By the morning of the 12th the center of the disturbance had advanced to a position over the eastern part of the Gulf of Mexico, with an apparent increase in energy, and coast stations from New Orleans to Jacksonville were again advised of the position and character of the storm. The regular morning and special reports of the 13th showed the advance of the storm toward the mouth of the Mississippi, and at 8 a. m. a wind velocity of 48 miles an hour from the northeast was reported at Port Eads. On that date southeast storm warnings were ordered on the west Florida, Alabama, Mississippi, and Louisiana coasts, and the following message was telegraphed to west Florida and Alabama ports:

Storm center apparently approaching the mouth of the Mississippi. Considered dangerous for vessels bound for middle and west Gulf ports.

Stations on the Louisiana and Mississippi coasts were notified that the storm was increasing in intensity, and would probably cause brisk to high northerly winds the day and night of the 13th.

At 8 a. m. of the 14th Port Eads reported a current wind velocity of 60 miles an hour from the southeast, with a maximum velocity during the preceding twelve hours of 72 miles

an hour from the southeast. Storm warnings were continued along the middle Gulf coast, vessels were again advised that it would be unsafe to leave port, and railroad and other interests were notified that a severe storm and high water were indicated. By the morning of the 15th there was every evidence that the storm possessed hurricane force. Stations on the west Florida and Alabama coasts were informed that the storm would be very severe and dangerous for any class of vessels. The forecast official at New Orleans was authorized to order, at his discretion, hurricane warnings on the Gulf coast from the mouth of the Mississippi westward, and was directed to notify, by all available means, points in Louisiana and Mississippi that severe gales and heavy rain would occur during the next twenty-four hours. Similar advices were also telegraphed throughout Alabama. During the next twenty-four hours the center of disturbance crossed the coast line somewhat to the west of the mouth of the Mississippi, and advanced thence northward over east central Mississippi, where it was central at 8 a. m. of the 16th.

After passing into the interior, the storm showed a rapid decrease in strength. At New Orleans the barometer fell to a minimum of 29.41 inches at 9 a. m. of the 15th, and the maximum wind velocity recorded on that day was 49 miles an hour from the northeast, at 9:35 a. m. At Mobile the storm was most severe from 5:15 to 6:30 p. m. of the 15th, and the wind attained its greatest velocity, 60 miles an hour from the southeast, at 5:50 p. m., with an extreme velocity of 78 miles an hour. Between the hours of 5 and 7 p. m., the wind velocity averaged from 50 to 60 miles an hour. From a short distance west of the mouth of the Mississippi River to a point somewhat to the east of Pensacola, Fla., the storm was very destructive. The forecast official at New Orleans reports that the estimated damage to property on the Louisiana coast amounted to more than \$1,000,000, exclusive of the damage to growing crops. The official in charge at Mobile reports that, according to the estimate of the secretary of the Chamber of Commerce, the value of property saved by the warnings of the Weather Bureau aggregates several millions of dollars.

A detailed description of this storm will be found in the following reports submitted by the Weather Bureau officials at New Orleans and Mobile.

Report by Dr. Isaac M. Cline, Forecast Official, New Orleans, La.:

The 8 a. m. weather map of August 12, 1901, showed a general barometric depression over the Gulf States, and there were conditions along the Gulf coast which indicated that a storm was probably developing in the central Gulf. Attention was called to this in the general forecast at 8 a. m., August 12, and shipping interests were advised to be on the alert.

1 p. m. special observations were called for on this date, but they revealed no material change since morning in the conditions. Some tugs and barges were, however, advised not to go into the Gulf, and the advice was heeded. At 8 p. m. the lowest barometer was 29.82 at Galveston.

The 8 a. m. reports of August 13 showed a storm developing in the central Gulf off the mouth of the Mississippi River, and the following was issued and distributed:

"Storm northeast, 9 a. m., stations along the Louisiana and Mississippi coasts. Disturbance in the Gulf off the mouth of the Mississippi River, increasing in intensity; will probably cause brisk to high northerly winds to-day and to-night."

Several tugs with fleets of barges were held in the basin on the advice of the Weather Bureau. The New Orleans agent of a steamship line, running to Tampico, Mexico, after consulting the Weather Bureau officials over the telephone, wired his correspondent at the latter place to hold his vessel until further notice from the Weather Bureau.

By 8 p. m. the storm had developed considerable intensity. The wind at Port Eads was blowing 48 miles an hour from the northeast. No report was received from Port Eads on the morning of the 14th. The following warning was issued and distributed:

"Continue storm northeast, 9 a. m., along Louisiana and Mississippi coasts; disturbance central in Gulf, off Louisiana coast, moving north; will cause high winds, shifting to west."

All the railroads running into southeast Louisiana and southern Mis-

issippi were requested by telephone to send notice to their agents in these districts that a severe storm and high water were indicated and to be on the alert and prepare for the same. The officials of the companies distributed the information promptly.

By 8 p. m. August 14 the storm had spread into the west Gulf, with the barometer reading 29.66 inches both at Galveston and New Orleans. Notwithstanding the barometric gradients to the westward were slight, storm northeast signals were ordered at Galveston and Sabine Pass, Texas.

At 8 a. m. August 15 the report showed a well-defined hurricane in the Gulf off the coast of Louisiana, and moving slowly toward the northwest. The following warning was issued:

"Continue storm northeast along the Louisiana and Mississippi coasts; storm increasing in severity and moving northward; high northeast to east winds and high water will continue to-day and probably to-night; the tide has risen 7.4 feet in 48 hours."

The following was received from Washington, 10.53 a. m.
"At your discretion order hurricane warnings on the Gulf coast from Mississippi westward; storm undoubtedly of great intensity and will strike the coast between the mouth of the Mississippi River and Galveston."
GARRIOTT."

It was my desire to wait until receipt of 1 p. m. specials, which had been called for, before issuing a hurricane warning for the east Texas coast, but I learned that all the telegraph wires east had gone down, and that only one or two wires north and west remained. On account of the threatening conditions and the probability of all wires going down and making it impossible to get warnings out, I issued a warning at once for the territory between the mouth of the Mississippi River and Galveston, as follows:

"Hoist hurricane signals 11 a. m. along Louisiana and east Texas coasts; storm off the Louisiana coast undoubtedly of great intensity and moving northwest; will probably strike the coast between the mouth of the Mississippi River and Galveston, causing hurricane winds from an easterly direct on on the Louisiana coast and northerly on the east Texas coast."

This warning was supplemented by the following advisory message sent to Galveston:

"Only high north winds indicated for east Texas coast, which will give low water at Galveston."

This was also given to the press so as to allay the fear of those interested in Galveston who would probably read of the storm in the Gulf.

The storm blew with great fury along the immediate coast of Mississippi and Louisiana, commencing on the afternoon of the 13th and continuing through the 14th and 15th. The high wind was not felt at New Orleans until the afternoon of the 14th.

The following are the essential features of the weather at New Orleans on the 14th and 15th:

August 14.—Cloudy, damp, cool, and windy weather; 10 strato-cumulus from northeast at 8 a. m.; 6 alto-stratus from west and 4 cumulus from northeast at 1 p. m.; 10 cumulus from northeast at 4 p. m. and 10 strato-cumulus from northeast at 8 p. m. At 8 a. m. the barometer reading was 29.703; at 1 p. m., 29.720; at 4 p. m., 29.671; at 8 p. m., 29.653, and at midnight, 29.650, which was the lowest reading for the day. The wind blew steadily from the northeast throughout the entire day; at 8 a. m. the velocity was 9 miles an hour; at 1 p. m. and 4 p. m., 20 miles; at 6:40 p. m., 32 miles, and at 8 p. m., 24 miles. Highest velocity for the day, 32 miles an hour. Light showers occurred from 1 to 5:55 a. m., 7 to 7:40 a. m., 8:26 to 9:15 a. m., 10:20 to 11:40 a. m., 12:40 to 2:40 p. m., 5:10 to 5:20 p. m., 6:05 to 7:55 p. m., and from 9:05 p. m. till past midnight. Total rainfall for the day, 0.78 inch. The Mississippi River at this point rose 1.9 foot in the twenty-four hours ending at 8 a. m., and to a stage of 5.9 feet, and two hours later had risen to 7.1 feet, due to the backing of the water, and continued to rise.

August 15.—Wet and stormy morning and forenoon; cool, overcast, and stormy in the afternoon till about 5:45 p. m., when the sun broke through the clouds in the northwest; the evening was cool, partly cloudy, damp, and comparatively quiet. Clouds: 8 a. m., 10 strato-cumulus from northeast; 1 p. m., 10 strato-cumulus from north; 4 p. m., 10 nimbus from northwest; 8 p. m., few cirro stratus from southwest and 9 strato-cumulus from northwest. At 8 a. m. the barometer reading was 29.431 inches, having fallen steadily all the morning; at 9 a. m. it was 29.410, the lowest recorded during this storm; after this it began to rise; at 1 p. m. it was 29.461; at 4 p. m., 29.516; at 8 p. m., 29.566, and at midnight, 29.650. The wind blew steadily from the northeast from early morning till about 10 a. m., then it backed to north with occasional gusts from northeast till about 11:55 a. m., when it backed to northwest for a few minutes; from this time till about 3:45 p. m. the wind blew mostly from north-northwest, and during the remainder of the day from northwest with decreasing energy. From 12:01 to 8 a. m. the wind velocity was from 20 to 35 miles an hour from northeast; at 9:35 a. m. there was a severe squall, during which the wind reached a velocity of 49 miles an hour from northeast; this was the highest velocity recorded for the day; at 1 p. m. the wind was 40 miles from north; at 4 p. m. it was only 24 miles from northwest; at 8 p. m., 15 miles from northwest, and at midnight 8 miles west.

To-day's windstorm is the severest experienced in this city since

1870 with one exception, August 19, 1888, when the wind blew at the rate of 60 miles an hour from the east. The rain that began at 9:05 p. m. yesterday ended at 7:30 o'clock this morning; light showers occurred from 8:26 to 9 a. m., 11:15 a. m. to 12:40 p. m., and 2 to 5 p. m. Total for the day, 0.59 inch. The Mississippi this morning stood at a stage of 11.4 feet, a rise of 5.5 feet in the past twenty-four hours; soon after noon the river began to fall, and after 4 p. m. it fell rapidly.

During August 13 and up to the afternoon of the 14th the storm moved northward. At 8 a. m. of the 14th the wind at Port Eads had changed by the way of the east to southeast, with a maximum velocity of 72 miles an hour. This, with other reports, showed that the storm had moved to the westward of that place. The 8 a. m. reports of the 15th showed the storm moving toward the northwest. During the evening of the 15th the storm changed its course from northwest toward the northeast. The center of the storm appears to have struck the coast of Louisiana to the west of the mouth of the Mississippi River, as forecast in the hurricane warning. It then moved toward the northeast over southeastern Louisiana, the center probably passing between New Orleans and Port Eads, across southern Mississippi into Alabama, and thence northward up the Mississippi Valley.

EXTENT OF DAMAGE.

Much damage and loss of life was reported. It is estimated that the damage to property on the Louisiana coast will amount to more than \$1,000,000, exclusive of the damage to growing crops, which can not be estimated.

The greatest damage in the vicinity of New Orleans occurred at Milneburg and Bucktown, on the shores of Lake Pontchartrain. The West End suffered serious damage. The Old Basin overflowed its banks and inundated a large section of the city, causing much damage, especially in the vicinity of Tremé market, where the streets were covered with water from 1 to 3 feet deep. The Orleans levee board and the city authorities, acting upon information given out by the Weather Bureau, had a force of 500 men at work strengthening the canal levees. By noon of the 15th the water in the basin began to recede, and by sundown it had ceased to flow over its banks.

All the towns south and southeast of New Orleans suffered seriously; also all towns along the Mississippi coast. Only 10 persons are known to have perished, but more lives no doubt were lost. Railroads east and north suffered serious damage. Mail communication with the East was cut off on the night of the 13th and has not yet been restored, August 17.

The warnings issued by the Bureau, well in advance of the hurricane, and the advice that conditions were very threatening, are credited with saving many lives and a vast amount of property, as the following editorial from the Daily States of August 15 indicates:

"SERIOUS DAMAGE PROBABLE."

"The severe storm which has been raging over the Gulf coast of the Southwest during the past two days is quite likely to furnish a chapter of unpleasant reading when all the reports have been made up. The continued force of the wind and wave has resulted in producing a serious situation all down the lower coast, where the water has been backed up even higher than was the case in the great Chenier Caminada disaster, which occurred in October, 1893, and destroyed so many lives. It is greatly feared that the loss of life among the fishermen and others who make their temporary habitation on the low-lying coast and the adjacent islands will be considerable.

"Fortunately, the splendid service of the Weather Bureau, by the timely notice it sent out of the approaching storm, gave many an opportunity to secure protection, and the consequent disaster will be much smaller than would have been the case had the storm broken upon the coast without warning. Communication with many important points is difficult, owing to the fact that the wires are prostrated, but if the storm has prevailed over the principal sugar and rice districts with anything like the same force that characterized its passage over the coast sections the damage to the crops must be considerable.

"The rice crop throughout Louisiana and Texas is just in that condition where the ripening grain will cause the stalks to succumb to heavy winds, and it is feared that the loss resulting will be considerable. The sugar-cane and cotton crops will probably come out better than the rice, by reason of the fact that these crops have not reached that advanced stage of ripeness where the injury done would be irreparable. The chief damage to be apprehended is to life and shipping on the coast and in the Gulf and to the great rice crops of Louisiana and Texas.

"It is sincerely to be hoped that the early and accurate warning given by the Weather Bureau enabled most of those exposed to seek places of safety, which appears to have been the case from reports brought in by several who were on the lower coast at the beginning of the storm."

The Times-Democrat of August 15, 1901, published the following regarding action taken as a result of the warnings:

"High winds prevailed along the coast yesterday afternoon and last night, and the warning sounded by the New Orleans Weather Bureau office was amply justified.

"The advice which Forecast Official Cline gave the owners of vessels of various kinds to keep in port was heeded, and this fact probably tended to minimize the damage resulting from the high wind.

"The timely warning sent out by the Weather Bureau officials yesterday saved many of the vessels from the storm. The Weather Bureau office here early yesterday notified all points all along the Louisiana and Mississippi coast to advise ship owners not to send their vessels to sea. This warning was heeded, for about twelve steamers were stopped at the Head of the Passes and cast anchor, and will remain in the river until the storm has passed over.

"At 4:30 o'clock the Weather Bureau reported the storm to be increasing. The last information received was that the wind was sweeping off the Passes at the rate of 48 miles an hour. It had increased greatly in velocity, and was growing greater in its force all the time.

"The storm was reported to the Weather Bureau officials as being centered south and central of the Passes. It was moving slowly northward

"It is by far the worst storm of the season," said Captain Ward, of the steamer *Lawrence*, last night, "and I am afraid the worst is yet to come. So far as I have been able to learn there are no boats out on the lake, as the warning came in time."

The Picayune of August 17, 1901, says:

"The merchants along the river front took advantage of the timely warnings of the Weather Bureau, and got their goods up on platforms above high-water mark; so that, comparatively speaking, the damage to stocks of merchandise is small."

The Picayune of the same date, in publishing a sketch of the warnings issued by the Weather Bureau in connection with this storm, says:

"The lesson to be drawn from the above story should be one of confidence on the part of the people in the great and important work done by the Weather Bureau. The uses made of the daily forecasts are so numerous and well known as to call for no remark; but the value to the manifold business interests of the country of the publication of the weather data and the dissemination of the warnings of exceptionally severe and injurious weather conditions should be as fully appreciated as it deserves. Warnings of storms and hurricanes, issued for the benefit of marine interests, are most important and pecuniarily valuable."

The Daily Item of August 17, 1901, makes the following editorial comment:

"The Weather Bureau, by the timely notice it sent out of the approaching storm, gave many an opportunity to secure protection, and the consequent disaster was much smaller than would have been the case had the storm broken upon the coast without warning."

Supplementary report by Mr. H. F. Alciatore, temporarily in charge, New Orleans, La.:

I have the honor to submit the following additional report on the effects of the hurricane of August 13-16, 1901, at the mouth of the Mississippi River, based on mail advices and telegraphic reports from our displayman at Port Eads and Pilottown, La.:

At 8 p. m., August 13, 1901, the barometer at Port Eads was 29.66 inches, and the wind was blowing from the northeast at the rate of 48 miles per hour. Later in the evening the wind increased in force and the telegraph and telephone lines were prostrated and have remained down ever since. At 8 p. m., August 14, a report was filed at the telegraph office by the displayman but was never sent, the line being down. This report showed that the barometer was 29.50 inches, wind from southeast, 60 miles per hour, and that some time during the day the wind had reached a maximum velocity of 72 miles per hour from the northeast.

During the night of the 14th and morning of the 15th the anemometer cups were blown away and the anemometer support knocked down, from which it would appear that a hurricane velocity in excess of that reported in the 8 p. m. observation of the 14th must have occurred. The instrument shelter was washed away. The flagstaff was broken by the wind and fell to the ground. The office building (a small cabin Carre) weathered the storm, but the papers and records therein were soaked with water.

At Pilottown, La., about 12 miles up the river, the storm was equally severe. The large and substantial "lookout" tower from which storm flags were displayed was blown down (probably on the night of the 14th) and completely wrecked. The outhouse in which our displayman was accustomed to sleep was blown down and rapidly filled with water, the tide having risen about four feet in about ten minutes, and property belonging to the Weather Bureau was ruined. The storm-warning lanterns, property of the Bureau, are however, reported to be in good condition. The displayman reports that "it blew a hurricane here (Pilottown) for twenty-four hours from northeast to east-southeast.

Report by Mr. William M. Dudley, official in c¹ Mobile, Ala.:

One of the most interesting storms in the meteorological history of this section occurred Thursday, August 15, 1901. On Sunday morning, the 11th, the following advisory message was received from the Central Office, and furnished the public:

"Storm warning at 10:15 a. m., disturbance of slight extent central this morning off the west Florida coast, evidently moving northward. May cause severe wind squalls this afternoon and to-night on the west Florida coast."

During Monday, August 12, fresh southerly winds prevailed, with light thunder squalls from the southeast during the afternoon. The following message was received from the Central Office at 3:10 p. m.:

"Advisory 3 p. m., disturbance over eastern Gulf. No evidence of marked energy as yet, but may develop, causing squalls dangerous to small sailing craft in east and middle Gulf."

This information was given out and published by the afternoon press.

On Tuesday, August 13, the storm was central in the middle Gulf, south of Port Eads, La., and at 10:45 a. m., the following message was received from the Central Office:

"Advisory, storm central south of Port Eads, increasing in intensity; will probably move up the Mississippi Valley, and may cause brisk easterly to southeasterly winds on the west Florida, Alabama, and Mississippi coasts."

This information was printed on the morning weather map, sent out over the telephone, and published by the afternoon press. The conditions becoming more threatening as the day advanced the Central Office sent out the following information, received here at 2:10 p. m.:

"Southeast storm warning 2 p. m., Mobile, Pensacola, storm center apparently approaching the mouth of the Mississippi. Considered dangerous for vessels bound for middle and west Gulf ports."

The warning was hoisted at once, and the information given to the public by bulletins, and through the afternoon papers. Several ship captains were advised not to sail.

Light rain began at 11 p. m., of the 13th, and ended at 12:30 a. m. of the 14th; began again at 7:40 a. m., and ended at 7:42 a. m.; amount at 8 a. m., 0.02 inch. A rainbow was observed in the west at 7:40 a. m. Fresh to brisk southeast winds during the night, increased to high during the morning of the 14th, and with the incoming of the tide backed the water of the bay into the river. By noon the water had come awash of the top of the wharfs along the city front, causing some apprehension to business houses located thereon. The office was crowded with people and the telephone rang continually. The southeast wind increased, attaining a maximum velocity of 42 miles per hour at 12:55 p. m., attended by heavy rainfall. Brisk southeast winds prevailed after 1:45 p. m., with showers at intervals, varying from light to heavy. The following message was received from the Central Office at 3:23 p. m.:

"Continue southeast storm warning 3 p. m. Storm central near mouth of Mississippi, apparently moving northward. Unsafe for vessels to leave for west Gulf points this evening or to-night."

This information was distributed by telephone and bulletins. Rain ended at 6 p. m., the amount to 8 p. m. being 0.40 inch. Cloudy and threatening weather all the evening, and fresh to brisk southeast winds to midnight.

On the 15th light rain began at 12:50 a. m. and continued in showers varying from light to heavy through the night, with wind in gusts, varying from fresh to brisk; amount of rain at 8 a. m., 1.67 inch. The day opened stormy and threatening, with high southeast winds after 6 a. m., which attained a maximum velocity of 36 miles per hour at 7:05 a. m.; decidedly cooler, the maximum temperature for the day being 76° and the minimum 74°. There was a slight lull in the wind from 7:30 to 8:40 a. m., when it increased suddenly, attaining a maximum velocity of 41 miles southeast at 8:42 a. m.; it continued high southeast to noon. The barometer fell all the forenoon, and read 29.74 inches at 8 a. m. and 29.65 at noon. The following readings were made during the afternoon, all readings being reduced to sea level: 3 p. m., 29.60; 3:30 p. m., 29.54; 4 p. m., 29.50; 4:30 p. m., 29.47; 5 p. m., 29.42; 5:30 p. m., 29.38; 6 p. m., 29.34; 6:30 p. m., 29.32; 7 p. m., 29.32; 7:30 p. m., 29.32; 8 p. m., 29.32, and 9 p. m., 29.33 inches. All telegraph wires were working badly, and our circuit reports were not received until 11 a. m. On the weather map the following advice was given the public:

"A storm of severity shows on this morning's chart in the vicinity of New Orleans, La. High southeast winds will prevail throughout the day, causing continued high water on the river front at Mobile, Ala., and it is deemed advisable for persons holding perishable goods to move them to a place of safety, as the full intensity of the storm has not been felt, and every indication shows that in its movement it will cause dangerous gales along the coast."

The office was crowded with representatives of business houses on the river front, the telephone rang continually, and merchants prepared to elevate goods on the river front.

The following advisory message was received from the Central Office at 11:20 a. m.:

"Center of Gulf storm approaching coast between mouth of Mississippi and Galveston. Storm becoming very severe. Dangerous for vessels of any class to sail westward to-day."

Information was issued by the afternoon press, to those seeking at the office and over the telephone, to vessels on the river

front, and to interested persons in general. At 1 p. m. the following was telegraphed to Washington:

"Water over wharf, and three blocks up in the city. Everyone previously warned to move goods."

An effort was made to get information from Fort Morgan, Ala., 30 miles down the bay, on the Gulf, but the wire had been down since early in the morning.

An order from the Central Office to continue southeast storm warning at 3 p. m. was received at 2:30 p. m.:

"Continue southeast storm warning 3 p. m. Hurricane warnings were ordered this morning on Louisiana and east Texas coasts. Storm apparently increasing in intensity. Violent southeast gales will shift to-night to southerly and southwest on Mississippi, Alabama, and northwest Florida coasts."

This information was distributed by the afternoon papers and by bulletin and telephone. Many persons were in the office waiting for advices regarding the storm, and as a result of this warning additional precautions were taken for the removal of goods to higher elevations. It was impossible to send this warning and the advisory message previously received to Biloxi, Scranton, and Fort Morgan, our subdisplay stations, as all wires were down to points west and south of Mobile.

The rain became heavy at 11 a. m., increased with the wind at 3 p. m., and continued until 7 p. m., when the wind shifted to south; total fall from 8 a. m. to 8 p. m., 3.79 inches. Rainfall for twenty-four hours ending 8 p. m. 16th, 5.44 inches; total from the beginning of the storm, 5.84 inches.

The barometer fell at the rate of .05 inch per hour until 6 p. m., and then continued stationary to 8:30 p. m., when the wind shifted to southwest. The barometer then rose rapidly, and watchmen on the river front were informed that the danger had passed.

The wind continued brisk to high southeasterly throughout the afternoon, increased in force after 4 p. m. and continued high until 7 p. m. The storm was most severe from 5:15 to 6:30 p. m., and the time of highest velocity was 5:50 p. m., when a maximum of 60 miles southeast occurred, with an extreme velocity of 78 miles. The wind velocity averaged from 50 to 60 miles an hour between 5 and 7 p. m. After the wind changed to southerly at 7 p. m. it showed a gradual decrease to 22 miles southwest at midnight.

The greatest source of damage feared from the storm was the backing of water into the river, and this continued during the 14th and 15th. The water had been awash of the wharfs from 12 m. to 1 p. m. of the 14th. At 10 a. m. on the 15th it began to come over the wharf, and from this time on it came in very rapidly, rising at the rate of 1 foot an hour. By 1 p. m. it had come up into the streets three blocks above the river front. At 3:30 p. m. the water was 5 feet over the wharf and it continued to rise until 7 p. m., reaching to within half a block of the Government Building, which is located five blocks from the river front. Boats were going about this part of the city. The water began falling when the wind shifted to southerly at 7 p. m. and fell at a rate of about 1 foot an hour.

The height of the water did not equal by 1 foot the stage reached during the hurricane of October 2, 1893. During that memorable storm the water was 6 feet over the wharf, the maximum wind 72 miles southeast, with an extreme velocity of 80 miles, and the water reached the street car tracks on Royal street, one-fourth block farther up than during the recent storm.

During the storm business was suspended throughout the day; merchants everywhere gave heed to the warnings, and as soon as they were received began to move all perishable goods to a safe elevation.

People waded waist deep, directing the moving of goods. Merchants who came to this office late in the evening informed me that, owing to the Bureau's warnings, their losses would be slight.

The warnings issued by the Bureau during the approach of this storm constituted a chain of perfect links. The work of the Bureau was highly commended and appreciated by the community, and merchants do not hesitate to admit that, had they not been notified, their losses would have been incalculable.

The street cars stopped running at 3 p. m. Boats in the river went up to Twelve Mile Island to a safe anchorage. Everything in port was tied fast. No trains arrived during the 16th, and none left.

The office force remained on duty until 12 midnight, when all danger of the storm had passed.

The wind continued fresh from the southwest through the night, and on the morning of the 16th it had diminished to light, with clear and cool weather, in marked contrast with the conditions of the previous day.

The streets were littered with limbs of trees, and the river front was strewn several feet deep with drift wood. Immense saw logs three feet in diameter had floated up the street to within a half block of the Government Building, or four and one-half blocks above the river front.

The damage within the city was slight. The Bay Shell Road a mile below the city from Frascati to Monroe Park, and points below, was washed away entirely. A number of small craft, mostly private sailing yachts, were lost. Bath houses along the eastern shore of Mobile Bay, and along the Gulf coast between Mobile and New Orleans, were washed away. Most of the damage reported from these districts was

due to the high tides. No loss of life is reported, and vessels coming in later, while damaged to some extent as to rigging and sail, rode safely through the storm.

The captain of the steamship *Espana* reports that he first encountered the storm in the Gulf Monday, August 12, at 2:30 p. m., with wind 20 to 30 miles, which gradually increased through Tuesday and Wednesday, until a maximum was reached Thursday between 2 and 7 p. m., the barometer falling steadily all the while. The wind was estimated to be between 60 and 70 miles an hour from the southeast. The Gulf was very rough, and waves broke over the funnels. Between the hours of 2 and 7 p. m., Thursday, there was so much spray that it was impossible to see where the boat was going. The captain and the entire crew had remained on watch for three days and nights, and were in an exhausted condition when they reached port Friday morning.

The secretary of the Chamber of Commerce informed me that the amount saved by the warnings could not be estimated, but would aggregate several millions of dollars.

Aside from advices issued in connection with the middle Gulf coast storm, no special forecasts or warnings were required in the United States; neither were hurricane warnings ordered, nor were they needed, in the West Indies.

The forecast center for the west Gulf district was closed at Galveston, Tex., August 5, and opened at New Orleans, La., August 8, 1901.

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No. 9

FORECASTS AND WARNINGS.

By Prof. E. B. GARRIOTT, in charge of Forecast Division.

The most important tropical storm of the month appeared near the Island of St. Kitts on the 11th; moved thence westward over the north part of the Caribbean Sea from the 12th to the 15th, recurved over the Gulf of Mexico and reached the middle Gulf coast of the United States by the 17th, and passed from that section northeastward off the south Atlantic coast of the United States. While this disturbance was lacking in the energy of a hurricane it was attended by high winds and heavy rain throughout its course.

Several storms of marked strength for the season, visited the Great Lakes. The first of these crossed the upper lakes

during the 7th and 8th, causing some disasters to shipping in southern Lake Huron. The period from the 11th to the 17th was a stormy one in the Lake region, and shipping on Lakes Michigan and Huron suffered some damage. Unsettled weather also prevailed on the lakes from the 21st to the 25th. The first winter-type storm of the season appeared on the north Pacific coast during the evening of the 20th, causing severe gales at sea and continued rain. On the 20th and 21st rain warnings were issued to California fruit growers and railroads.

Timely and accurate warnings were issued in connection with all of the general storms which appeared in the United States and the West Indies.

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No. 11

FORECASTS AND WARNINGS.

By Prof. E. B. GARRIOTT, in charge of Forecast Division.

The month opened with a storm of tropical origin central north of Porto Rico. At 11:10 a. m. of the 1st the following message was telegraphed the Weather Bureau offices at Hamilton, Bermuda; New York, N. Y.; Philadelphia, Pa., and Boston, Mass.:

Severe disturbance moving northward east of Turks Island will probably pass near Bermuda Saturday.

The following article from The Bermuda Colonist, of November 6, 1901, verifies the accuracy of the advices furnished:

THE LATE STORM.

The hurricane that was predicted by the Washington Weather Bureau for Saturday, arrived on time and raged around the islands for twenty-four hours. All the incoming steamers were delayed, in consequence, and those that were southward bound, the New York mail steamer especially, experienced exceedingly heavy weather.

The growing crops throughout the colony have suffered somewhat and the storm damage to property has been considerable. The principal damage reported has been occasioned to government property about the islands in the Great Sound, where the prisoners of war are interned, and it is said that the preliminary estimate of the damage reaches the sum of £2,000.

Reports from the westward state that the contractors for the dock-yard extension works have also sustained some loss; a large boat used

for conveying laborers to and fro between the old Terror and the shore foundered and a large quantity of baulk timber got adrift.

Atlantic coast shipping interests were notified on the 2d that a severe tropical storm was moving northeast near Bermuda, and similar advices were cabled to London, England.

From the 2d to the 5th the storm center moved northeastward over mid ocean attended by gales of great violence. There is no evidence that this storm reached the European coast. It appeared rather to gradually lose intensity over mid ocean from the 6th until the 8th, when depressions appeared, respectively, over the North Sea and near the Azores. In the meantime a disturbance of moderate strength had moved eastward over the Canadian Maritime Provinces, and during the 9th, passed to the southeast of Newfoundland. It is possible that this depression is identical with the severe storm that moved eastward over the British Isles during the 12th and 13th, and passed thence over the continent.

North Atlantic shipping interests were kept fully advised regarding storms which visited the western part of the ocean, and forecasts of the wind and the weather for the first three days out of steamers sailing east from American ports were issued daily.

The following letter, dated November 15, 1901, addressed by the secretary of Lloyd's, London, to the Chief of the United States Weather Bureau at Washington, indicates the degree of interest that is being taken in the Weather Bureau warnings by representatives of the commercial and shipping interests of the North Atlantic.

I am instructed to express to you the best thanks of the Committee of Lloyd's for the forecasts of bad weather in the Atlantic with which you have been so good as to allow them to be favored, and I am desired to convey to you the congratulations of my Committee on the infallibility of the predictions that have been supplied by these forecasts.

The most important storm of the month along the Atlantic seaboard of the United States began the night of the 23d and continued during the 24th.

The following special bulletin, issued from Washington on the 25th, indicates the general character of this storm, and of the action taken to issue warnings in connection therewith:

The severe storm that visited the Middle Atlantic and New England coasts Saturday night and Sunday, and which continued on the New England coast Monday, was most severely felt from New York to Boston, where maximum wind velocities ranging from 60 to 66 miles an hour from the northeast were reported Sunday.

Timely warning was given by the Weather Bureau of the approach of this storm, and before 1 p. m. Saturday, coast and shipping interests from Maine to Florida had been informed regarding its position, character, and course, and storm warnings had been ordered from Hatteras to Eastport. Monday morning Lloyd's, London, were cabled from Washington that a severe storm would pass over Newfoundland Monday night, moving northeast.