TROPICAL DISTURBANCES OF AUGUST 1938 [1]

By I. R. TANNEHILL

[Marine Division, Weather Bureau, Washington, September 1938]

August 8–10.—The first clearly defined tropical disturbance of the 1938 season appeared on the morning of August 8 among the islands to the eastward of Puerto Rico. Early in the day, the Am. S. S. *West Isleta* experienced heavy squalls of hurricane intensity and rough, heavy sea and swell from the east-southeast. The ship was then near 21° N., 64° W.

During the 8th the center of the disturbance passed some distance to the northward of Tortola and caused some damage on the island of Anegada. The lowest barometer reading reported from Tortola was 29.58 inches at 1:44 p. m. (local time) of the 8th.

On the 9th and 10th squally conditions progressed rapidly west-northwestward, along the northern coasts of Haiti and Cuba, and into the Florida Straits. Its progressive movement probably exceeded 20 miles an hour. However, no definite cyclonic circulation was charted after the 8th. There are no reports to indicate that the disturbance was of more than moderate intensity at the time of its maximum development. Advisory messages were issued from San Juan on the 8th and from Jacksonville on the 9th and 10th.

August 9 to 14.—While the preceding squally condition was in progress on the 9th and 10th, a slight disturbance passed rapidly through the Windward Islands into the eastern Caribbean Sea. Advisory information was issued on those dates from the Weather Bureau forecast center at San Juan. It is not possible with reports at hand to trace the center of the disturbance with any assurance of accuracy beyond 14° N., 67° W., which was its approximate position at 7 p. m. (eastern standard time) of the 10th. However, its rapid progressive movement westward and the subsequent appearance of a rapidly moving tropical cyclone in the western Caribbean Sea on the 12th, indicates the probability that it continued to move west-northwestward on the 11th and is identical with the latter.

On the morning of August 12 a disturbance of marked intensity was centered near Grand Cayman Island, where shortly before 7 a. m. (eastern standard time) the wind reached a maximum velocity of 95 miles an hour from the east. Maintaining marked intensity, but with rather small diameter, the storm passed through the Yucatan Channel on the night of August 12–13, moved rapidly northwestward to the Central Gulf and thence north-northwestward into western Louisiana. Its average rate of progressive movement across the Gulf was 18 to 20 miles an hour. The storm passed inland over Cameron and Calcasieu Parishes, during the evening of the 14th with the center a short distance west of Lake Charles at about 8:30 p. m. (eastern standard time).

The report of the forecaster at New Orleans, R. A. Dyke, includes the following:

> Though the storm was without a deep center of low pressure, as far as known, and winds were rather weak on the left side, the winds to the right of the center showed considerable strength over the Gulf, a wind of force 11, or "storm," being reported by the steamship *John D. Archbold* at 9 a. m., eastern standard time, of the 14th, in latitude 27.1° N., and longitude 91.9° W.; and winds were estimated as of hurricane force at Grand Chenier near the coast of eastern Cameron Parish, La., about 7 p. m., of the 14th. At Lake Charles, La., 35 miles inland, with the disturbance decreasing in intensity, a southeast wind of 50 miles per hour was recorded between 8:00 and 8:30 p. m., with gusts up to 60 miles per hour; and the lowest pressure was 29.56 inches at 8:30 p. m. At Port Arthur, Texas, the lowest pressure was 29.73 inches at 8:20 p. m. and maximum wind velocities of 32 to 34 miles per hour from the east and southeast were recorded between 2:30 p. m. and 4:12 p. m.
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> The gales attending the storm drove in many sea birds, which were observed at the game preserve of Avery Island, Iberia Parish.
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> The movement of the storm favored increasing tides on the east coast of Texas on the 13th–14th and on the Louisiana coast on the 14th. The highest tides at various points follow: Galveston, 3.6 feet above mean low tide, at 6 to 7 p. m., on the 14th, or 2.8 feet above normal predicted tide; Sabine Pass, 7 p. m., 4.1, or 2.7 feet above normal predicted tide. Water was 4 to 5 feet above mean low tide on the coast of Cameron and Vermillion Parishes with lowlands flooded for depths of 1 to 4 feet. The storm caused a rise of about 2.5 feet in the Atchafalaya River at Morgan City, La., and tide slightly more than a foot above normal predicted tide at Grand Isle, La.
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> Torrential rainfall preceding and attending the passage of the storm caused extensive overflow of crops and detours or interruption of highway traffic for a considerable distance inland, between twenty and forty miles east of the path of the storm center, especially in Jefferson Davis Parish and neighboring localities.
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> Damage to buildings, wires, derricks, piers, and other property is estimated at $133,000; to crops, $110,000, principally to rice, but including considerable cotton damage from the heavy rains, and slight damage to sugarcane snapped off by the wind. Total losses are conservatively estimated at $243,000.
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> At 10:30 a. m. of the 15th, about 12 hours after the storm center had passed, a small tornado occurred at Kinder, Allen Parish, 28 miles northeast of Lake Charles, destroying a house and prostrating two barns, fences, and some trees, with damage of $2,000 reported.

Advisory warnings were issued from Jacksonville on the 11th and 14th. Storm warnings were hoisted on the

[1] Tracks of the tropical disturbances of August are shown on chart X.

coast of Louisiana and the east coast of Texas early in the morning of the 14th and hurricane warnings were ordered from Morgan City, La., to Point Bolivar, Tex., at 2 p. m. (eastern standard time).

August 23–28.—Vessel reports showed disturbed conditions in the central Caribbean Sea on the morning of August 23 with some evidence of cyclonic circulation central about 250 miles southeast of Jamaica. This disturbance moved west-northwestward across northern Yucatan, with rapidly increasing intensity, and reached the Mexican Coast between Tampico and Brownsville on the morning of August 28.

On crossing Yucatan the storm was of full hurricane intensity. The Am. S. S. *Agwistar* was in the center on the morning of the 26th, while anchored 7 miles north of Progreso. Winds of hurricane force were experienced from 4 a. m. to 7 a. m. (local time) but with a dead calm from 5:15 to 6:00 a. m. Lowest pressure was 28.92 inches during the calm. The highest wind was estimated at 90 miles an hour. The Nic. M. S. *Sama* also became involved in the hurricane on the 26th. The ship was very near the center at 4:00 a. m. of the 27th, at 22½° N., 93½° W., barometer 29.26 inches. According to estimates of the ship's officers, the highest wind was 90 miles an hour between 8 p. m. and midnight of the 26th.

As to the effects of this storm during its early history, Forecaster Norton at Jacksonville says:

> We have had no reports of damage, and since the storm did not seriously affect any land area in the Caribbean except the sparsely settled coastal section of northeastern Yucatan, it is believed that damage was relatively small. The paucity of ships' observations near the storm center made the problem of the forecaster somewhat difficult in charting the exact center of the storm and calculating its intensity, but this lack of ships' reports is indicative of the value of the advices to shipping, and no reports have been received of any ship having been damaged in the Caribbean.

Concerning the winds aloft during the progress of the disturbance, Forecaster Dyke of New Orleans makes the following comment:

> Upper winds during the movement of the storm were from the east over the Middle and West Gulf States except for a brief interruption in the morning of the 26th, when upper winds, 10,000 feet and higher, were from the southeast over Texas. Upper winds at Tampico were from the northeast until the storm approached near enough to deflect them to the north and northwest. Under the prevailing flow of air no turning to the right was to be expected.

The following is taken from the report of the official in charge of the Weather Bureau office at Brownsville, regarding the passage of the storm into Mexico and the damage resulting there:

> Reports from Capt. Durst, Pan American Airways pilot, through Mr. Ronning their meteorologist, and from local fishermen who apparently were in the northern portion of the storm track, the center apparently went inland in the vicinity of Boca Jesus Maria, and the width of path of damage on the beach was about 75 to 80 miles. The little village La Pesca on the beach in the same latitude as Soto La Marina appears to have had winds strong enough to blow their palm-thatched huts down or badly damage them. In Brownsville and vicinity fishermen, who happened to be on the beach or on an island some 20 miles north of Boca Jesus Maria, estimate the wind velocity around 75 to 80 miles per hour from northwest to north into the east. The center reached the coast line probably shortly after midnight Saturday.
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> Velocities in some of the squalls along this immediate coast, according to Brazos Coast Guard personnel, were estimated at about 45 miles per hour. The condition of the Gulf of Mexico along this immediate coast, however, was affected greatly, according to the Brazos Coast Guard personnel and reports from others at or near the beach at Del Mar, a resort on the beach a short distance south of Port Isabel, Texas. The water was very rough and swells occasionally swept entirely across Padre and Brazos islands in places, washing away a few inexpensive structures at Del Mar—the only damage as a result of the storm in the vicinity of which we have any knowledge.

Frequent advisory warnings were issued from Jacksonville on August 23, 24, and 25 and from New Orleans on August 26, 27, and 28. Northeast storm warnings were hoisted on the extreme southern Texas coast at 9:30 p. m. of the 26th. Hurricane winds were forecast for the extreme northeastern coast of Mexico.

HURRICANE OF SEPTEMBER 16 TO 22, 1938

By I. R. TANNEHILL

[Marine Division, Weather Bureau, Washington, October 1938]

This hurricane was first definitely located from radio reports on the evening of September 17, when it was centered approximately 500 miles northeast of the Leeward Islands, but mail reports now at hand show that it was centered at about 21° N., 53° W. late on the 16th. Its subsequent course is shown on chart IX. On September 21 the center passed over Long Island and into New England near New Haven. Loss of human life was placed at about 600; the total value of property destroyed in the affected areas has been conservatively estimated at a quarter to a third of a billion dollars.

TROPICAL STORMS IN NEW ENGLAND

Many storms of tropical origin have previously affected the New England States. Some of them have crossed the Gulf coast, approaching New England from the southwest, usually with diminishing force; in greater numbers, they have skirted the Atlantic coast with their centers over the ocean, causing gales along the seaboard; a few have retained hurricane force in their progress northward and have been destructive in the interior of the New England States.

Perhaps the earliest of the severe tropical storms of record in New England was that which occurred on August 15, 1635. A strong northeast wind with heavy rain began before daybreak, increased in violence and was accompanied by torrential rain. After the gale had continued 5 or 6 hours, it changed to northwest and gradually subsided. In the same month there was a hurricane, possibly the same one, between St. Kitts and Martinique, exact date unknown, and also a violent gale on the coast of Haiti. Of the New England storm of the 15th, Governor Bradford said: "None then living, either English or Indian, ever saw a storm equal to it." [1]

The "Great September Gale" of 1815 is probably the most noted of the early storms of New England. It was generally destructive in Rhode Island and in the central portion of Massachusetts. On the coast of Connecticut the high tides and hurricane winds destroyed many buildings, and numerous vessels were driven ashore. The storm set in from the northeast late on September 22 and reached its height shortly before noon of the following day. This hurricane came from the West Indies. It was recorded at St. Bartholomew on the 18th. Oliver Wendell Holmes was 6 years of age at the time of the storm and afterward immortalized it in his poem, "The September Gale."

Another noteworthy hurricane occurred in New England in 1821. Its course was traced by Redfield.[2] The center of this hurricane crossed the western part of Long Island and passed northward into Connecticut. Shortly afterward, in traveling over the area devastated by this storm, Redfield observed the directions in which the fallen trees were lying and discovered that the storm was a great whirlwind. However, he did not publish the first account of his observations until 1831.[3]

Other storms, probably all of tropical origin, which have seriously affected the New England States,[4] are summarized briefly as follows:

August 19, 1788.—A storm passed northward over eastern New York and western New England. There was considerable damage in Connecticut and western Massachusetts.

September 8, 1869.—This storm appears to have passed over eastern Connecticut, Rhode Island, and eastern Massachusetts with a path about 60 miles wide, then over the ocean to the Maine coast. Many vessels were driven ashore. There was much property damage in eastern Massachusetts and on the Maine coast.

October 23–24, 1878.—Center of the hurricane crossed eastern Pennsylvania and southeastern New York, then turned to the northeast and east across New England. Much damage was reported in New York City, Brooklyn, the Hudson Valley, and Long Island Sound. Several vessels were sunk along the Connecticut coast.

August 24, 1893.—A storm passed over New York City, then northeast across New England. It was severe in Connecticut and Rhode Island.

August 29, 1893.—A storm was severe from New York to the eastern New England coast.

September 16, 1903.—This storm was destructive in the Connecticut Valley; there was extensive damage to shipping on the coast.

From these accounts it appears that the hurricane of September 1938 is not unprecedented in violence in the New England area; but the great increase in population and property values since the early part of the 19th century

[1] Perley, Sydney. Historic storms of New England. Salem, 1891.

[2] Redfield, W. C. On three severe hurricanes of the Atlantic. New Haven. 1846.

[3] Redfield, W. C. Remarks on the prevailing storms of the Atlantic coast, of the North American States. The American Journal of Science and Arts. Vol. XX, pp. 17–51. New Haven. 1831.

[4] From notes furnished by J. M. Kirk, official in charge of the Weather Bureau Office, New Haven, Conn.

accounts for economic losses in the recent hurricane which are probably in excess of all previous hurricanes in that area combined. In fact, the destruction of property in the hurricane of September 1938 was considerably greater than that caused by any other single hurricane in the United States.

The approximate tracks of the centers of the hurricanes of 1815 and 1821 are shown in chart X. Open circles on the tracks indicate noon positions on the dates beside the circles. The track of the hurricane of 1821 is reproduced as it was traced by Redfield. After the hurricane of 1815, Noyes Darling, who lived in New York City, made a collection and abstract of all the newspaper accounts of it that came to his attention. In 1842 he published his collection [5] which contains sufficient information to determine the track of the storm center as it appears in chart X. The hurricane of 1821 moved with unusual rapidity throughout the known path. While the hurricane of 1815 did not move so rapidly in the early part of the track, its progressive motion on the day it entered New England was exceptionally rapid.

THE HURRICANE OF 1938 AT SEA

There was some evidence of cyclonic circulation central about 19° N., 37° W., on the morning of September 13, 1938, but the storm has not been definitely charted prior to the evening of September 16, when it appears to have become a fully developed hurricane. At about 9:30 p. m., ship's time, on September 16, the Brazilian S. S. *Alegrete* was near the center in approximately 21°12′ N., 52°46′ W., barometer 28.31 (uncorrected), wind force 12, shifting from east-northeast to east-southeast. Early on the morning of September 17, the Netherlands S. S. *Socrates* encountered the storm while near 21° N., 59° W., and had increasing winds, backing from east-northeast to northwest and then to west-southwest, lowest barometer 29.29 inches. The highest wind experienced was W–11 at 9:35 p. m., ship's time, in latitude 20°38′ N., longitude 59°17′ W.

During the 17th and 18th, the hurricane moved in a direction only slightly north of west, its progressive motion averaging more than 20 miles an hour. On the 19th and 20th the hurricane recurved, with somewhat slower movement, about 15 miles an hour, until the evening of the 20th when it turned more to the northward and began an increasingly rapid march which culminated in a progressive rate of about 50 miles an hour during the 21st.

Many vessels were heavily involved in the storm during the period from the 18th to 21st. Two vessels reporting by radio gave barometer readings below 28 inches, the British S. S. *Corrales*, 27.90 on the 18th and the British S. S. *Carinthia*, 27.85 on the 20th, but neither has rendered gale reports. A summary of gales, including barometer readings, from other vessels appears in the table accompanying the summary of North Atlantic weather elsewhere in this REVIEW.

It appears that central pressure was near or below 28.00 inches throughout the course of the storm at sea, beginning late on the 16th and continuing until the center moved inland near New Haven on the afternoon of the 21st.

THE HURRICANE IN COASTAL AREAS AND IN NEW ENGLAND

It was not until the early morning of September 21 that the hurricane approached any coastal or island area close enough to be felt seriously. At about 7:30 a. m., E. S. T. of that day, the center was about 75 miles east or slightly north of east from Cape Hatteras, where the barometer reading at that time was 29.30 and the wind velocity 50 miles an hour from the northwest. With the center approximately the same distance east of Atlantic City, at about 1 p. m., the hurricane caused a maximum wind velocity of 61 miles an hour from the west at 12:55 p. m., simultaneously with the lowest barometer reading, 28.99 inches. At Sandy Hook, the lowest reading was 28.71 inches, shortly after 2 p. m., maximum wind 56 N. at 1 p. m. The calm center was felt at Brentwood, Long Island, between 1:50 p. m. and 2:50 p. m. Drizzling rain was reported at intervals, with the sun shining during two or three 5-minute periods. The wind movement was so slight during this time that "a cigarette could have been lighted in the open without difficulty." Minimum pressure readings (uncorrected) below 28.00 inches were recorded at points on Long Island.

Shortly before 4 p. m. the center reached the Connecticut coast, passing between New Haven and Bridgeport; lowest pressure at New Haven was 28.11 at 3:50 p. m. At Hartford the minimum pressure, 28.04, was reached at 4:30 p. m.

Moving at a very rapid rate, the center crossed Vermont between 6 and 9 p. m., its course having changed from north by east to north by west, while crossing Massachusetts. At Northfield the lowest barometer reading was 28.77 at 7:30 p. m. and at Burlington 28.68 at 8 p. m.

DESTRUCTIVE EFFECTS OF THE HURRICANE

Owing to the unusually rapid rate of progress of the storm across New England, the winds on the right or east side of the path were very destructive while strong winds did not extend far to the westward. Maximum wind velocities (5-minute intervals) were reported from Weather Bureau stations as follows:

Albany	42 W.	Nantucket	52 SE.
Block Island	32 SE.	New Haven (city)	38 NE.
Boston (airport)	73 S.	New York (City)	70 NW.
Burlington	47 S.	Northfield	47 S.
Concord	56 SE.	Portland	43 S.
Eastport	32 SE.	Providence	87 SW.
Hartford	46 NE.		

At Blue Hill Observatory, Milton, Mass., the maximum 5-minute velocity was 121 miles an hour and for shorter intervals the wind velocity was indicated to be 173 for one measurement and 183 for another. At the observatory on Mount Washington the 5-minute maximum was 136. The higher velocities at these stations, as compared with Weather Bureau offices, are attributed to the effect of upslope at Blue Hill and to the elevation of the Mount Washington station.

Along the shores of Long Island and New England, rises of water caused by the hurricane winds exceeded all records at a number of points. Furthermore, the rivers in the Connecticut and Merrimac Valleys were already practically bank full at the time the hurricane rains began. Over most of this area rain had been falling for about a week. The hurricane rains produced disastrous floods which will be reported in the next issue of the REVIEW.

The winds damaged buildings and broke off or uprooted trees in all parts of the area traversed by the storm center, and to a distance of about 100 miles to the eastward. Damage to buildings and trees did not extend far to the westward of the path. Destruction of property was especially heavy on the shores of Connecticut, Rhode Island, and southern Massachusetts and Long Island.

[5] Darling, Noyes. Notice of a hurricane that passed over New England in September 1815. The American Journal of Science and Arts. Vol. XLII, pp. 243–252. New Haven, 1842.

The extreme eastern and extreme western portions of Massachusetts and the western interior of Connecticut suffered relatively little.

THE INUNDATION

Damage to property along the coast was largely due to the storm wave. At Sandy Hook the tide was 8.2 feet above mean low water; at the Battery, New York City, it was 6.44 feet above mean sea level. Along the coast of Connecticut, Rhode Island, and on the shores of Naragansett and Buzzards Bays, the highest tide ranged from 12 to 25 feet above mean low water, being highest on the southern shores of Massachusetts, where the maximum stage occurred about 5 or 6 p. m. At Point Judith Coast Guard Station the water rose 18 feet above mean low water; at Fairhaven it was estimated at 25 feet; at Pocasset, 20 feet; at the Nobska Point Light Station, 15 feet. At Fall River it was reported that "the water came up rapidly in a great surge," the crest being estimated at "18 feet above normal."

The storm tide, combined with the hurricane winds, raised havoc with small craft and was very destructive to harbor, resort, and beach property.

DAMAGE AND LOSS OF LIFE

The American Red Cross reported on October 27 that 488 lives were lost in the hurricane, 100 persons were missing, 1,754 were injured more or less severely and 93,122 families had suffered more or less serious economic losses. The number of summer dwellings destroyed was placed at 6,933, and other dwellings at 1,991. Boats destroyed numbered 2,605, barns 2,369, and other buildings 7,438.

Estimates of the total economic losses, in all the areas affected, ranged from $250,000,000 to $330,000,000.

WARNINGS

The first advisory warning was issued from the forecast center at Jacksonville at 9:30 p. m. of September 17, when the hurricane was about 500 miles northeast of the Leeward Islands. Advisory messages were issued at 6-hour intervals thereafter. By 9:30 a. m. of September 19, the hurricane had approached within 650 miles of the southern Florida coast and was moving west-northwestward at a rate of about 25 miles an hour; northeast storm warnings were then ordered from Key West to Jacksonville. Later in the day it became evident that the hurricane had turned more to the northward, hence hurricane warnings were not ordered for the Florida coast. At 9:30 a. m. of September 20, storm warnings were ordered displayed on the coast south of Hatteras to Wilmington. At that time the Washington forecaster ordered storm warnings south of the Virginia Capes to Hatteras.

At 9:30 p. m. of September 20, when the hurricane was centered about 400 miles east of Jacksonville, storm warnings were ordered by the Washington forecaster for the area from the Virginia Capes to Atlantic City; and on the morning of September 21, with the center 75 miles east of Hatteras, warnings were extended from Atlantic City to Eastport, Maine. At 10 a. m. storm warnings were changed to whole-gale warnings from the Virginia Capes to Sandy Hook, and at 2 p. m. the last warning was issued, stating that the storm would likely pass over Long Island and Connecticut in the late afternoon or early night.

A further report on the meteorological aspects of this storm will appear in a later issue of the REVIEW.

TROPICAL DISTURBANCES OF OCTOBER 1938

By J. H. GALLENNE

[Marine Division, Weather Bureau, Washington, November 1938]

Three tropical disturbances were charted during October in the North Atlantic and the Gulf of Mexico.[1] The first appears to have originated over northern British Honduras on the 10th and, after pursuing an unusual course, moved inland on the 17th a short distance to the southwest of Galveston, Tex. The second disturbance was located a short distance to the northeast of Bermuda on the 17th. It moved southwestward toward the coast of Florida on the 18th and 19th, then recurved to the northeast on the 20th. The third disturbance was first observed in the west-central portion of the Gulf of Mexico on the 23d. It traveled in a northeasterly direction, moved over northern Florida into the Atlantic Ocean near the Georgia coast, followed the Atlantic seaboard and merged with a LOW trough over New England on the evening of October 24.

Disturbance of October 10 to 17.—The first evidence of unsettled conditions was noted on the evening of October 10, at which time a cyclonic circulation was centered a short distance to the southwest of Tela, Honduras, with a barometer reading of 29.69 inches. For the next 48 hours, while this depression pursued a north-northwest course, ships in the central and east Gulf regions experienced only moderate east and north winds. At 7 p. m.[2] of the 12th, the center was located near 25° N. and 90° W. The disturbance recurved to the east-northeast during the evening of October 12. The S. S. *El Estero* at 11 a. m. of October 13, reported a fresh gale from the northeast accompanied by heavy rain, while near latitude 26° N., and longitude 87° W., barometer 29.71 inches. At 1 p. m. of the same day the S. S. *El Isleo* giving her position as 26°05′ N. and 87°36′ W., reported northeast wind, force 9, the highest thus far reported in connection with this disturbance.

At 6 p. m. of the 14th, the S. S. *Wallace E. Pratt* reported a "calm center" at 25°42′ N. and 84°42′ W., pressure 29.41 inches, the lowest barometer reading of record in connection with this disturbance. The depression then moved in a northerly direction until the morning of the 15th, when it again recurved, this time toward the west-northwest with an increased progressive movement, causing generally disturbed conditions over the northern Gulf. The center passed inland a short distance to the southwest of Galveston, Tex., at about 7:45 a. m. of October 17.

Extracts from a report by the official in charge at Galveston, Tex., follow:

> The course of the storm center and time of crossing the coast lines of Galveston Island and the mainland can be quite definitely established. Wind at the Galveston station and over the western portion of the city veered from northerly to southerly. At the Galveston Municipal Airport, at the San Luis Coast Guard Station, and at Freeport, the wind backed from northeasterly to westerly. Mr. W. D. Stearns, storm warning displayman at SEABROOK, Tex., on his way to Galveston at the time, reported strong and increasing northeast winds south of Dickinson, Tex. He also noted the counterclockwise movement of lower clouds and, when nearing Virginia Point at the mainland end of the causeway at about 8:10 a. m., he encountered a distinct lull for a few minutes with the wind veering sharply to the south and increasing again. At the Fort Crockett Airport, about 3¾ miles southwest of the Weather Bureau the wind velocity record from a single register shows a maximum velocity of 36 miles at 7:11 a. m. and an extreme velocity at the same time of 42 miles, decreasing to 11 miles at 7:44 a. m. and increasing to 26 miles at 8:04 a. m. No automatic record of wind direction is made at Fort Crockett. From the above it is believed that the center of this disturbance, probably not over a few hundred yards in diameter, crossed the coast of Galveston Island at or very near Fort Crockett Airport at about 7:45 a. m., E. S. T., on the 17th and moved toward the mainland near the causeway in a west-northwesterly direction reaching the mainland about 8 a. m., E. S. T. * * * The lowest sea level reading at the Weather Bureau was 29.68 inches about 7:20 a. m. The reading at Fort Crockett at approximately the same time, as shown by the barograph trace, was 29.71 inches. The barograph at Fort Crockett is set to run with a high grade mercurial barometer in that office.

Advisories, including warnings for small craft, were issued from the forecast center at New Orleans on October 12 and at frequent intervals thereafter until the disturbance moved inland on the 17th.

Disturbance of October 17 to 20.—A rather weak cyclonic circulation, possibly not of tropical nature, was charted a short distance to the northeast of Bermuda on the morning of October 17. It moved in a general southwesterly direction toward the Bahama Islands for the succeeding 48 hours. During the 19th it crossed the northern part of Great Abaco Island and over the northeast portion of the Grand Bahama Island. From that point it moved northwestward and was located near 28° N. and 79° W., at 7 a. m. of October 20. The disturbance then recurved to the north and northeast and merged with an extratropical low-pressure trough along the Atlantic coast.

Disturbance of October 23–24.—A very shallow LOW developed near 24° N. and 93° W. on the morning of October 23. This depression moved northeastward and at 7 p. m. of the same day was centered about 225 miles south of Pensacola, Fla. At the same time, the S. S. *Bertha Brorig* near 26° N. and 89½° W., reported a fresh north-northwest gale, barometer 29.77 inches. Several other vessels in the vicinity reported encountering strong to high winds. During the early morning of the 24th, the disturbance crossed the Florida coast line north of Tampa with a maximum wind velocity of 38 miles an hour at Tampa at 6:45 a. m. During the evening of the 23d and the morning of the 24th, disturbed conditions had overspread the northeast portion of the Gulf of Mexico and the area adjacent to the Georgia and South Carolina coasts. By 7 p. m. of October 24, the disturbance had moved into a trough of low pressure over the New England States.

A succession of accurate advices and warnings was issued from the forecast centers at New Orleans, Jacksonville, and Washington, D. C., covering the progress of this disturbance.

From reports at hand it does not appear that any of these three disturbances developed hurricane force.

No loss of life occurred and but slight property damage was reported in connection with the October disturbances.

[1] The tracks of these disturbances are shown on chart X in this REVIEW.

[2] Eastern standard time is used in this report.

NOTES AND REVIEWS

"Radiosonde" an Officially-Adopted Weather Bureau Term. By L. T. SAMUELS. The term "radiometeorograph" has been used quite generally in this country for designating the instrument which is attached to sounding balloons for transmitting by radio to a ground station the upper-air pressures, temperatures, and humidities during the balloon's flight.

Since the suffix of the above term implies a recording instrument, objection to its use has been made. The substitute term "radiotelemeter" then came into use but objections to this term are likewise valid in that no indication is given as to what is measured, namely, meteorological elements. Therefore, in view of these circumstances and the wide international use of radiometeorograph observations, the Weather Bureau has decided to adopt the term "radiosonde" to designate the instrument which is attached to the sounding balloon in these observations. This term is now similarly used in both French and German literature. Additional terms logically follow: "radiosonde station," "radiosonde observation," "radiosonde record," "radiosonde recorder," etc.

However, since the Federal Communications Commission requirements are that the point from which the radio signals are transmitted must be designated as the station, the term "radio aerological sounding station," instead of "radiosonde," will be used to designate the radiosonde in connection with frequency allocations utilized in this work. In accordance therewith, a "radio aerological sounding station" is defined as a "special radio transmitting station sent aloft for the purpose of obtaining information regarding atmospheric conditions."

WEST INDIAN DISTURBANCE OF NOVEMBER 6–10, 1938

By WILLIS E. HURD

[Marine Division, Weather Bureau, December 1938]

The only tropical disturbance of November 1938 in North Atlantic waters was that of the 6th to 10th. It pursued an unusual, though not unprecedented course, inasmuch as it described a track that, from a beginning south of the twentieth parallel, reached to latitude 24° N., then turned to the southwestward and dissipated in the approximate latitude of its inception.[1]

On November 4 the weather became slightly disturbed in the Leeward Islands, with wind shifts from northeast to south, but with no appreciable fall in the barometer. There was a west-northwestward movement of the small disturbed wave during the next 48 hours, but indications of organized wind circulation about a center were incomplete until the 6th when at the 7 p. m. (E. S. T.) observation, a center could be located, with some depression of the barometer, over west-central Haiti, with accompanying squalls at a considerable distance to the northward, along the southern edge of a strong anticyclone.

Even before this time the steepness of the pressure gradients along the southern slope of the HIGH was sufficient to cause winds of fresh gale force (8) from east to northeast directions, southeast of the Bahama Islands, during the night of the 5th–6th. These winds were reported by the S. S. *Coamo*, near 23° N., 68° W., and by the S. S. *Susan V. Luckenbach*, near 25° N., 74° W.

After the organization of the storm center on the 6th, the disturbance, increasing in extent, and with slowly falling central pressure, moved northwestward. November 7 was the stormiest day in connection with it. The center at 7 a. m. (E. S. T.) was near 21° N., 74° W., and at 7 p. m. near 22½° N., 75° W. During the day several ships east and southeast of the southern Bahamas, and to the north, northeast, and east of the storm center, reported gales of strength varying between force 8 and force 11. Among these, the Dutch S. S. *Bacchus*, near 24° N., 69° W., had a force-10 east gale, with squalls of force 11, lowest barometer 29.68, at about 4 a. m.; the American S. S. *Arizonan*, near 24° N., 74° W., experienced a force 10 gale from north-northeast, lowest barometer 29.65; while a short distance to the westward at 1 p. m. the Panamanian S. S. *Maravi* reported the severest gale of the storm, a north wind of force 11, barometer 29.63. Lessening gales occurred in the vicinity during the afternoon and night, and until some time in the forenoon of the 8th, when the winds subsided materially.

At the morning observation of the 8th the center was farthest north, near the south end of Andros Island. Thereafter it took a southwesterly trend across west-central Cuba, and disappeared in the northwestern Caribbean Sea on the 10th.

The following quotations are taken from the report of Forecaster Dunn, Jacksonville, Fla.:

> During the passage of this storm * * * on the 7th * * * San Salvador Island reported a 50 mile current velocity at their 1:30 p. m. observation. Miami, Fla., reported a maximum wind of 28 m. p. h. on the 8th and somewhat higher winds were reported from exposed places on the southeast Florida coast and Keys. The lowest reported reputable pressure was 29.54 inches at Great Ragged Island in the Bahamas.
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> Due to repeated warnings small craft kept in port and damage was reported to be negligible. However, wind and wave erosion was considerable on the east Florida coast and damage was estimated between $75,000 and $100,000 in the St. Augustine area alone. Damage by this storm and by another northeaster a few days later will necessitate some repair and extension on the land end of the north jetties at the mouth of the St. Johns river.
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> While the strong winds reported during this disturbance were largely gradient winds and mostly north of center, much less frequent but occasionally heavy squalls were reported south of the center. The Cuban Telephone Co. reports damage to lines in the vicinity of Baracoa on the 7th, also a 35 to 50 mile wind at Antilla and a heavy rainstorm at Caimaneira during the afternoon of the same day.
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> Due to high winds off the ground it was difficult to obtain upper air information in connection with this storm. Velocities of 35 to 45 m. p. h. prevailed off the surface over the Florida peninsula for 36 hours or longer while the storm was moving over the Bahamas. Miami reported a 52 mile east wind at 3,000 feet at 11 a. m., November 7.

Advisories and storm warnings were issued from the Jacksonville office of the Weather Bureau, beginning with the evening of November 6, and ending on the night of the 8th. Storm warnings were ordered for portions of the Florida coast early on the 8th.

[1] Chart IX in this issue of the REVIEW shows the weather conditions on the morning of the 8th, and also the track of the disturbance.