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WEST INDIAN HURRICANES OF AUGUST AND SEPTEMBER, 1932

THE TROPICAL STORM OF AUGUST 12-14, 1932, IN THE GULF OF MEXICO

[Weather Bureau, Washington, D. C.]

The active development of this disturbance occurred in the south-central, or middle, Gulf of Mexico, and its increase in intensity was phenomenally rapid. On the morning of the 12th, vessels in the northern Gulf indicated a disturbed condition over the middle Gulf, and coast stations were advised accordingly. On the morning of the 13th the S. S. *J. C. Donnel*, lat. 27°, long. 93° (about 190 miles southeast of Galveston), reported a barometer of 28.88 inches, wind southwest, fresh gales and heavy, confused seas. Advices were immediately issued as follows:

AUGUST 13.—Hoist NE. storm warnings 9:30 a. m. Port O'Connor to Morgan City. Tropical disturbance of increasing intensity attended by gales central about 175 miles southeast of Galveston apparently moving northwestward. Increasing northeast winds to-day, probably reaching gale force late this afternoon or early to-night. More detailed advices this afternoon.

As special reports indicated more clearly the direction of movement of the disturbance, hurricane warnings were ordered at 2:30 p. m. from Freeport to Port Arthur, and at 4:30 p. m. between Freeport and Seadrift.

During the night of the 13th, the center crossed the coast line near and slightly to the east of Freeport, passing almost over East Columbia (Brazoria County) in the interior. Winds of hurricane force were experienced near the center even for some distance inland. Mr. Tracy Clark, at East Columbia, at about 12:40 a. m. of the 14th reported lowest barometer reading as 28.17 inches (corrected 27.83 inches). Mr. Clark estimated the wind velocity at 100 m. p. h., and reported that the so-called eye of the storm was experienced. Capt. E. E. Howell, of the motor vessel *Texas Sport*, at Freeport, reported lowest barometer 28.03 at 9:25 p. m. of the 13th, but no indications of the eye of the storm. By back tracking the center prior to the 13th, taking into consideration its direction and rate of movement during the 13th and 14th, its origin may be tentatively traced to a slightly disturbed condition on the evening of the 10th, between Belize and Tela in Honduras. The complete track is shown on Chart VIII, at the end of this REVIEW.—*R. H. Weightman.*

TROPICAL STORM OF AUGUST 25-31, 1932

A tropical disturbance of very slight intensity appeared southeast of Puerto Rico on the 24th, and advanced on a course about northwest by west with an average speed of about 10 miles per hour, gradually increasing in intensity until it passed across the extreme southern part of Florida. The center passed over the southwestern part of the Island of Puerto Rico without causing damage. It was not attended by strong winds until the 28th, on the evening of which date it was about 100 miles south-

southeast of Nassau, Bahamas, at which time storm warnings were ordered for the Florida coast between Jupiter and Key West. During the next 12 hours its center advanced to the south of Andros Island and storm warnings were ordered between Key West and Fort Myers. On the afternoon of the 29th, hurricane warnings were hoisted between Everglades on the west coast to Fort Lauderdale on the east coast, with the advice that the disturbance was of considerable intensity but small diameter and would pass near and probably south of Miami, attended by dangerous shifting gales and possibly winds of hurricane force near the center. On the evening of the 29th, when the center was about 50 miles south-southeast of Miami, hurricane warnings were extended northward on the east coast to West Palm Beach and northward on the west coast to Boca Grande and storm warnings were extended northward on the west coast to Tarpon Springs and on the east coast to Eau Gallie. The center, which was quite small, passed about 35 miles south of Miami attended near, but only quite near, the center by winds of hurricane force. The disturbance continued its northwestward course, being central on the morning of the 30th, about 30 miles south of Fort Myers. By the following morning it was about 110 miles south by west of Apalachicola. Storm warnings had been previously ordered for the Gulf coast between Carrabelle, Fla., and Morgan City, La. Shortly after noon of the 31st, hurricane warnings were hoisted between Biloxi, Miss., and Panama City, Fla. The center passed inland a short distance west of Mobile about 11 p. m. of the 31st, and recurved to the north and northeastward over western Tennessee and northwestern Ohio, with greatly diminished intensity. The lowest barometer at Fort Morgan was 29.16 inches at 10:30 p. m., of the 31st, and a ship about one mile south of Fort Morgan gave a reading of 28.92 inches at 10:50 p. m. of the 31st. At Bayou Battre at 1:45 a. m., of September 1, a pressure of 29.03 inches was recorded, while the lowest pressure at Mobile was 29.21 inches at 1:45 a. m. of September 1. The disturbance was attended by shifting gales and winds probably reaching hurricane force near the center. The maximum wind at Pensacola was 72 miles per hour from the southeast and at Mobile 52 miles. (See Chart VIII at the end of this REVIEW.)—*R. H. Weightman.*

THE TROPICAL STORM OF AUGUST 30-SEPTEMBER 15, 1932

This disturbance was first noted north of the Virgin Islands the evening of August 30, at which time it was of minor intensity. Its center passed a short distance north of Turks Island, West Indies, and moved west-northwestward during the night of September 2-3, while the storm increased to moderate intensity. During the next three days it increased greatly in intensity, passed east of Nassau, Bahamas, the morning of the 5th, moving

northwestward, then recurved to the north and northeast and passed over Great Abaco Island the afternoon of the 5th, with a reported pressure of below 27.50 inches. Great damage was done by the storm on this island; 16 persons were reported killed and about 300 injured. Capt. H. B. Roberts, master of the Government steamer *Priscilla* and a resident of Green Turtle Cay for 40 years declared, according to the Miami (Fla.) Daily News, that the storm was the worst in his memory. He said that two churches, both built of heavy stone walls almost 3 feet in thickness, were demolished, and the wind, estimated by him at over 200 m. p. h., carried some of the heavy stone blocks nearly half a mile. Photographs published in the News indicate that winds in excess of 150 m. p. h. must have prevailed at Green Turtle Cay.

Several vessels were near the hurricane center during the 6th and 7th; the S. S. *Yankee Arrow* at 3:15 a. m. of the 7th, in lat. 29° 24' N., long. 76° 30' W., reported a lowest pressure of 27.65 inches and the S. S. *Deer Lodge*, near the same position, reported 27.58 inches at 6 a. m. These vessels, as well as several others, reported shifting winds of force 12. As the storm moved northeastward over the ocean during the next few days it was attended by winds of force 11-12 near its center. The highest velocity reported at a land station in the United States was 56 m. p. h. from the northeast and north during the night of the 8th-9th at Nantucket, Mass.

The storm passed over and south of Newfoundland during the 11th, reached Iceland on the 14th, and passed Jan Mayen Island on the 15th, with central pressure still 29 inches, or lower.

Twice-daily advisory warnings were issued in connection with this storm from August 31 to September 9, inclusive. Northeast storm warnings were ordered displayed from Punta Gorda to Daytona, Fla., at 10 a. m. of the 5th, and north of Daytona to Wilmington, N. C., at 9:30 p. m. of the same date. On the morning of the 6th warnings were extended northward to Cape Hatteras and on the following morning to the Virginia Capes. By the morning of the 7th the storm was moving northeastward more rapidly and northeast warnings were ordered north of the Virginia Capes to Eastport, Me. (See Chart VIII at the end of this REVIEW.)—*C. L. Mitchell.*

THE TROPICAL DISTURBANCE OF SEPTEMBER 9-19

A disturbance of moderate intensity that was first located some distance north of Frontera, Mexico, in the southwestern Gulf of Mexico on September 9, moved very slowly northward for two days, then slowly northeastward for three days, being central about 100 miles south of the mouth of the Mississippi River on the morning of the 14th. This disturbance moved as far during the ensuing 24 hours as it had in the preceding five days, the center passing into the Atlantic Ocean near Jacksonville, Fla., on the morning of the 15th. It continued to move northeastward, passing inland over the coast of Maine on the 17th, then moved northward and later northwestward, reaching western Hudson Strait on the morning of the 19th. The highest wind velocities reported at land stations were 40 m. p. h. at Hatteras and Atlantic City, and 48 m. p. h. at New York City.

Northeast storm warnings were ordered displayed at 4 p. m. of the 12th from Morgan City, La., to Pensacola, Fla., and east of Pensacola to Cedar Keys at 6 p. m. of the 14th; at 10 p. m. of the 14th northeast warnings were displayed from Savannah, Ga., to the Virginia Capes. They were extended northward to Atlantic City at 10 a. m. of the 15th and to Boston at 4 p. m. of the same

date. The next morning they were extended to Eastport, Me. (See Chart VIII at the end of this REVIEW.)—*C. L. Mitchell.*

THE TROPICAL DISTURBANCE OF SEPTEMBER 17-21

Another disturbance of slight to moderate intensity moved north-northeastward over the western Gulf of Mexico during the 18th and 19th and passed inland over the Louisiana coast a short distance west of Morgan City shortly after noon of the 19th. No winds of gale force were reported. The disturbance moved north-eastward during the next two days and dissipated over southwestern Pennsylvania during the 21st. The lowest pressure reported was 29.66 inches at Morgan City, La., on the 19th.

Northeast storm warnings were displayed from Corpus Christi to Port Arthur, Tex., at 10 p. m. of the 18th, and southeast warnings on the Louisiana coast at 9:30 a. m. of the 19th. (See Chart VIII at the end of this REVIEW.)—*C. L. Mitchell.*

"SAN CIPRIAN"—HURRICANE OF SEPTEMBER 26-27, 1932

[Weather Bureau Office, San Juan, Puerto Rico]

Trajectory.—With extraordinarily high pressure prevailing over the entire Atlantic and the eastern half of the continent, this storm departed from a normal course and traveled slightly north of west from near St. Barthelemy to Puerto Rico, thence slightly south of west in almost a direct line to the coast of Yucatan south of Belize.

Statistics.—The vortex entered the Island of Puerto Rico near Ceiba at 10 p. m. of September 26, probably directly over the harbor of Ensenada Honda, where the steamers *Jean* and *Acacia* had taken refuge. The former reported 27.70 inches and the latter 28 inches as the low pressure, with a diametric windshift and brief lull. The vortex passed a short distance south of San Juan (28.95 inches at 1 a. m.) and left the island near Aguadilla about 5:30 a. m. of the 27th. The maximum wind velocity at San Juan is estimated at not less than 120 miles per hour. Unfortunately, the wind-instrument tower, an old one already in course of replacement, was blown down at 12:08 a. m., when the record was 66 miles per hour from the northeast. Rainfall was not unusually heavy compared with that during other visitations of this character.

Information.—The first information received at San Juan was from Antigua on the morning of the 26th, indicating that a moderate disturbance had passed there about 3 a. m. The news that St. Barthelemy was near the vortex with a pressure of 29.65 inches and an estimated velocity of 60 to 90 miles per hour was received by mail a week later. Current reports at 8 a. m. of the 26th located the vortex as having passed between St. Kitts and St. Martin. By evening the reports indicated that the vortex was passing between St. Thomas and St. Croix and the following bulletin was issued:

SEPTEMBER 26, 1932.—Advisory 7 p. m. Storm center passing between St. Thomas (29.53 inches) and St. Croix (29.54 inches) apparently moving west-northwest about 10 miles per hour. Will affect east coast before midnight and remainder of island progressively later. Velocities up to 60 miles per hour reported from both St. Croix and St. Thomas.

(Signed) HARTWELL.

All agencies of the insular government, the naval radio, and WKAQ did heroic work in disseminating the information after the first bulletin was issued, and the loss of life and property damage were materially reduced thereby.

Losses.—Many lives were lost from collapse of buildings which were supposed to be safe; some from flying debris,

some from drowning, the loss from the first cause being by far the greatest. As usual, first reports of loss of life were wildly exaggerated, but it would be difficult to exaggerate the effect of the storm on buildings. Only the heaviest construction of masonry and concrete, with cemented tile roofs, came out of the zone of heavy damage unscathed. Concrete walls with "lean" mixtures or too widely spaced reinforcement and with roofs improperly or poorly anchored were wrecked, in many cases with appalling loss of life. The common corrugated iron roofs, put on with smooth or even twisted nails, were carried off like so much cardboard. This material, put on with bolts and nuts over a properly anchored frame, in many cases remained intact. Casualties were 225 dead and 3,000 more or less injured. Property damage, including crops, will total near \$30,000,000. The temporarily homeless were variously estimated from 75,000 up to near a quarter of a million, but these latter figures are somewhat mitigated by the fact that a considerable percentage live in comparatively crude shelters which are quickly replaced. Of crop losses the greatest percentage was citrus, as the citrus belt is almost wholly within the zone of heavy damage. Minor crops were generally a total loss, but they do not represent more than the loss of a single season, whereas citrus and coffee are set back by the loss of much tree growth which will take years to replace. The coffee belt was not all included in the zone of heavy or even moderate damage, but a contributing cause to heavier damage to that industry was the loss of their temporary shade, for which since San Felipe (September 13, 1928) banana plantings had been utilized. Moderate winds will wreck a banana or plantain planting and the heavy stems in falling break the young coffee trees. Sugarcane, in percentage, was probably least injured because, unless actually washed out of the ground by overflow, the canes will continue to grow and will mature. Sugar's greatest damage was to buildings and equipment.

Moderate damage was done on St. Barthelemy, on Tortola, also on St. Thomas and St. John of the United States Virgin Islands. St. Croix reports no damage. Culebra and Vieques, important islands off the east coast of Puerto Rico both suffered heavily; their figures are included in the losses for Puerto Rico.

After passing Puerto Rico, the southern part of Santo Domingo and Haiti felt the storm on the 27th, but no definite reports of losses from these Republics or from Jamaica are available. San Pedro de Macoris (90 miles per hour) and Santo Domingo City (50 miles per hour) give the best idea of intensity in that district.

Shipping.—The Bull Line S. S. *Jean* and the lighthouse tender *Acacia* both dragged their anchors in the harbor of Ensenada Honda near Ceiba and grounded. They were both floated by their own efforts after lightening cargo. One ship in San Juan Harbor had her bridge and boats blown away; the U. S. 3-masted schooner *Gaviota* was wrecked also in San Juan Harbor, and several pier buildings were badly wrecked. Otherwise shipping damage was confined to small craft.

More important storms in Puerto Rican history.—Santa Ana, July 26, 1825; Los Angeles, August 2, 1837; Santa Elena, August 18, 1851; San Narciso, October 29, 1867; San Felipe (1), September 13, 1876; San Ciriaco, August 8, 1899; San Felipe (2), September 13, 1928; San Nicolas, September 10, 1931; San Ciprian, September 26–27, 1932.

Comparative data of damages caused by San Ciriaco, San Felipe, San Nicolas, and San Ciprian storms

	San Ciriaco	San Felipe	San Nicolas	San Cipriaa
Loss of life.....	3,000	300	2	225
Lowest barometer (San Juan).....	29.23 inches	28.81 inches	29.17 inches	28.95 inches
Hurricane winds (San Juan).....	3 hours	12 hours	2 hours	6 hours
Maximum wind velocity.....	75 m. p. h.	150 m. p. h.	90 m. p. h.	120 m. p. h.
Maximum amount of rainfall.....	23.00 inches ¹	29.00 inches ¹	5.00 inches ²	16.70 inches ²
Advance warnings about storm.....	19 hours	36 hours	40 hours	18 hours
Damage to property, crops, etc.	\$20,000,000	\$50,000,000	\$200,000	\$30,000,000

¹ In Adjuntas.

² In Maricao.

This storm diminished greatly in intensity after leaving Puerto Rico, and no strong winds were reported west of Haiti. After passing inland near Belize, British Honduras, on October 1, the disturbance moved slightly north of west and dissipated near Vera Cruz, Mexico, on October 3.

Advisory warnings in connection with this disturbance were issued by the Washington office twice daily from September 26 to October 1, inclusive. (See Chart VIII at the end of this REVIEW.)—*F. E. Hartwell.*

BIBLIOGRAPHY

C. FITZHUGH TALMAN, in Charge of Library

RECENT ADDITIONS

The following have been selected from among the titles of books recently received as representing those most likely to be useful to Weather Bureau officials in their meteorological work and studies:

American national red cross.

Drought of 1931–32 in Montana, North Dakota, South Dakota, Nebraska, and Washington. Washington. 1932. 37 p. illus. 23 cm.

Azzi, Girolamo.

Le climat du blé dans le monde. Les bases écologiques de la culture mondiale du blé. Rome. 1930. xiii, 1165 p. figs. pl. (fold.) 23½ cm.

Barrett, R., & Barrett, K.

Cloudtop mosaics. Cambridge. 1932. ix, 176 p. 18 cm.

Clyde, George D.

Utah snow sampler and scales for measuring water content of snow. Logan. 1932. 8 p. figs. 23 cm. (Utah agric. exp. sta. Circ. 99. June, 1932.)

Convention portant réglementation de la navigation aérienne (Juillet, 1932.) [Paris.] p. 46–97. figs. pl. 31 cm.

Copper and brass research association.

Side-tracking lightning. New York. [1932.] unpag. illus. 23½ cm.

Eredia, Filippo.

Le condizioni anemologiche nella rotta Cagliari-Tunisi. Roma. 1932. 14 p. figs. 24½ cm. (Riv. aeron. Anno 8, N. 8. Agosto 1932–X.)

L'Esplorazione dell'atmosfera a mezzo di palloni piloti a bordo di navi mercantili. Roma. 1932. 26 p. illus. 34 cm. (Annali Uff. pres., v. 4, 1931–X.)

Hann, Julius von.

Handbuch der Klimatologie. Vierte, umgearb. und vermehrt. Aufl. Von Karl Knoch. Band I. Allgemeine Klimalehre. Stuttgart. 1932. xvi, 444 p. figs. 23 cm. (Bibliothek geogr. Handb., herausgeg. von Albrecht Penck.)

Jamaica. [Meteorological service.]

Tables of rainfall records from the year 1870 to year 1929. Kingston. 1932. 7 p. 32 cm.