

## WEATHER, FORECASTS, AND WARNINGS FOR THE MONTH.

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

During the first decade of October the weather was fair and cool over the eastern portion of the United States and light frost occurred at intervals during that period in the Middle Atlantic and New England States.

From the 3d to the 10th a barometric disturbance advanced from Alaska to the Great Lakes where it deepened and remained nearly stationary until the 15th when the center moved eastward over the St. Lawrence Valley and Canadian Maritime Provinces. This disturbance was attended by rain in middle and northern sections of the country from the Pacific to the Atlantic, by gales over the Great Lakes, and on the 14th by severe local storms in Tennessee, northern Alabama, and northern Georgia. It was followed by snow from the upper Mississippi Valley over the Lake region and the interior of New York and New England. The area of high barometer that followed the disturbance carried the frost line over the interior of the east Gulf and South Atlantic States. Reports indicate that the high barometer area extended far to the southward and caused a sweep of cold air over the central states of Mexico that was destructive to crops. It is probable that the action of the tropical storm described as the Key West hurricane contributed to the flow of cold air currents over Mexico.

## THE KEY WEST HURRICANE OF OCTOBER 11, 1909.

One of the general laws of cyclonic movement in the West Indies, announced by the late Father Viñes, implies that hurricane tracks are traced farther and farther to the westward as the season advances.

So ancient is belief in this rule that the ecclesiastic authority, from time immemorial, wisely ordained that priests in Porto Rico should recite in the mass the prayer, 'Ad repellendat tempestates,' during the months of August and September, but not in October, and in Cuba it should be recited in September and October, but not in August. All of which proves that the ecclesiastical authority knew by experience that the cyclones of October were very much to be feared in Cuba, but not those of August, and that in Porto Rico, on the contrary, the hurricanes of August are disastrous, while those of October are rare.—Viñes.

Weather Bureau records verify the general law referred to. They also show that during the principal hurricane months these storms are liable to appear in any part of the region between the tenth and twenty-fifth parallels of latitude and east of the eightieth meridian and to recurve northward in any part of the area that is bounded by the sixty-fifth and ninety-fifth meridians. It is evident, therefore, that averages of tracks can be given but little weight in forecasting the course of individual hurricanes.

The hurricane season of 1909 presented marked departures from the general law of cyclonic movement. The storms of the early portion of the season reached the west coast of the Gulf of Mexico, and as the season advanced the tracks were traced farther and farther to the eastward. Of the six hurricanes that appeared but two recurved to the northward, one over Louisiana in September and the other over extreme western Cuba and Key West in October, and no storms of marked intensity occurred over Porto Rico and the Lesser Antilles. The sixth important storm of the season in tropical waters moved from the western Caribbean Sea over the lower Gulf of Mexico from October 22 to 24.

Indications of a storm development over the south-central Caribbean Sea were noted as early as October 2. The character and the probable course of the storm could not, however, be determined until October 6. Beginning that date and continuing daily until the 9th shipping interests and coast ports were advised regarding its movement and increasing intensity, and vessels bound for western Cuban waters were advised to exercise caution. Attending the presence of the storm over the western Caribbean Sea on October 9 a tidal wave swept from

the Gulf of Mexico over low-lying islands and sea coasts along the Yucatan Peninsula, drowning, it is reported, a large number of persons, mostly fishermen and their families. On the 10th storm warnings were ordered on the southern Florida coast, and at 6 a. m. of the 11th storm warnings were changed to hurricane at Sand Key and Key West, Fla. Following this action, Florida Weather Bureau stations were telegraphed as follows:

Hurricane now central near Key West promises to be destructive to life and property over a large portion of the Florida Peninsula. You are authorized to incur any necessary expense and to adopt every reasonable measure to disseminate warnings to the islands, coast cities, and even the interior of the State.

The pressure distribution at 8 a. m. of the 11th is shown on fig. 1.

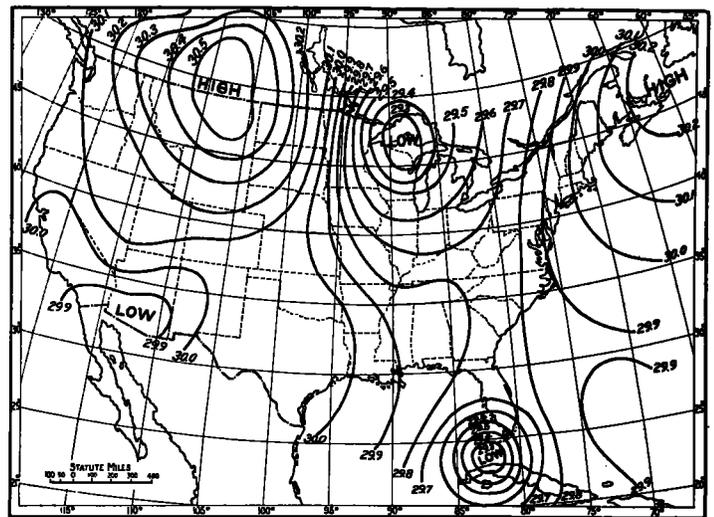


FIG. 1.—Isobars over the United States, 8 a. m., seventy-fifth meridian time, October 11, 1909.

Later in the morning the following special bulletin was telegraphed Atlantic and Gulf Weather Bureau stations and furnished the public press:

The West Indian storm that has been moving westward over the Caribbean Sea during the last week has developed into a hurricane of marked intensity and at 8 a. m. Monday morning was central west of Key West, Fla. At Sand Key the wind was 60 miles from the east. At 10 a. m. the pressure at Key West was 28.94 inches with a wind velocity of 56 miles from the east and a very high sea swell. Storm warnings were ordered Sunday afternoon from Key West to Mobile and changed to hurricane warnings early Monday morning. Hurricane warnings were also ordered on the Atlantic coast as far north as Charleston. The center of the storm will probably move northward over Florida to-night and Tuesday and be felt Tuesday off the entire south Atlantic coast. All shipping in the affected area has been warned to seek refuge immediately. Hourly observations will be taken and all ports kept advised of the direction of the storm.

Advices were issued during the day in which the northeast course of the storm was given and the statement was made that there was apparently no further danger in the Gulf of Mexico. On the following morning the advices stated that the storm had passed northeastward beyond the region of observation.

At 6 a. m. of the 11th the hurricane was central west-southwest of Habana and over or near the western portion of the Province of Pinar del Rio and its advance over that province was preceded and attended by torrential rain and winds of hurricane force. At Habana the storm raged for several hours sinking or stranding small craft in the harbor, prostrating trees, and flooding the streets with water. The following notes by Mr. Dague, Observer Weather Bureau, are descriptive of the action of the storm at Sand Key:

The office was abandoned at 8:30 a. m., and the barograph and supplies were carried to the light-house. At 8:45 a. m. the signal tower fell and the sidewalk was carried away. A little later the outhouses were washed away. When the station was abandoned the barometer had begun to fall rapidly and the wind had reached a velocity of 75 miles an hour. At 9:15 a. m. the anemometer cups were blown away. At this time the wind was estimated at 100 miles an hour with gusts that exceeded that velocity. Heavy rain obliterated objects more than 50 feet distant. At 9:30 all trees had been blown down, the atmosphere appeared like a white mist and water was beginning to cover the island. Five minutes later heavy seas swept over the island. At 10 a. m. the entire island was covered with water to a depth of about 4 feet and all sand was washed from the island. At 10:30 the Weather Bureau building went over and was immediately washed out to sea.

A heavy swell from the southeast prevailed during the storm. The barometer fell rapidly from 4 until 11:30 a. m. when the minimum reading, 28.37 inches, was registered. A rapid rise then set in that continued until 6 p. m. at which time the weather had moderated. Excessively heavy rain fell until 1 p. m., when it began to decrease and ended at 2 p. m. After the wind had backed to the northwest the swell from the southeast opposed it and caused the water to spray from the top of the swells through the air with the wind. Two windows in the top of the light-house were broken during the most violent part of the storm and the openings caused a draught through the tower that made it impossible to open the door at the bottom of the tower.

The following report has been made by the Weather Bureau observer at Key West, Fla.:

From 9 p. m. of the 10th to 6 a. m. of the 11th the barometer fell steadily to 29.52 inches. From 6 to 11:40 a. m. of the 11th the barometer fell to 28.50 inches, the lowest reading ever recorded at this station. At 11:40 a. m. the wind shifted from northeast to northwest and in thirty minutes the barometer rose one-half an inch. At 7 p. m. it had risen to 29.61 inches. The wind increased from 2:30 until 8:50 a. m. and from the latter hour it continued at hurricane force until 1:05 p. m., with maximum velocity 83 miles from the northeast between 10:05 and 10:10 a. m. and an extreme velocity at a rate of 94 miles an hour at 10:07 a. m. From 4 to 11:45 a. m. 8.02 inches of rain fell and between 8:45 and 11 a. m. there was a downpour of 6.13 inches. At 9:30 a. m. the waves had covered the Weather Bureau grounds and considerable spray had fallen in the gage, making it necessary to discard stick measurements.

The estimated storm damage in the city was close to \$1,000,000. About 400 buildings collapsed or were blown down. In the northern section of the city, where the tide rose through the streets and houses, the water and the wind carried frame buildings across lots and many other buildings were lifted by the water. Along the water front 300 boats, large and small, were destroyed. It seems almost miraculous that only one life was lost during the storm.

Ample warnings of the storm were furnished by the Weather Bureau from the 8th to 11th. At 5 p. m. of the 10th northeast storm warnings were hoisted and advices were bulletined and telephoned throughout the city. At 6 a. m. of the 11th hurricane warnings were hoisted and the following was telephoned and bulletined to all local interests and sent to the Florida East Coast Railroad:

"Take every precaution immediately to secure life and property. Hurricane close."

During July, 1909, when a temporary telephone line was built by the Florida East Coast Railroad the official in charge of this office made arrangements with engineers on the extension work to telephone all storm warnings and weather reports. By this means they were in direct communication with the office day and night.

The Key West Citizen of October 12 states:

"Warnings had been issued by the Weather Bureau and the time of the climax was predicted almost exactly by the Official in Charge, who stated it would reach its worst about noon."

Editorially the same paper states on October 16:

"When during the storm most persons abandoned their business the Weather Bureau force stuck to their posts and kept the public informed of the progress of the storm."

After leaving Key West the hurricane swept the Florida Peninsula south of Miami, as shown by fig. 2. On the extension of the Florida East Coast Railroad, about 3,000 workmen were withdrawn from dangerous points. Vice-president J. P. Beckwith, of the road states:

Positively not a life was lost in the storm. Very little damage was done to the right of way or work on the extension. The road will be open to traffic within a few days to Knights Key. Warning by the Weather Bureau enabled us to fully protect all employes and equipment.

Mr. A. J. Mitchell, Weather Bureau Observer at Jacksonville, Fla., reports as follows:

The correctness of the warning and the effectiveness of its distribution are indicated in the small loss of life, about one dozen, along the lines of the projected railroad. Those who were drowned paid the penalty of remaining

aboard a tugboat, which sank, instead of seeking shelter, as others did. With about 3,000 laborers scattered many miles over the low islands of the sea along the proposed route of the Florida East Coast Railroad the fact that the loss of life was so small is an eloquent tribute to the wisdom of the railroad officials in obeying implicitly the information given out by the Weather Bureau. In 1906 many hundreds of laborers were drowned during a tropical storm as a consequence of ignoring warnings. While many tug-boats, lighters, and other auxiliary equipment were saved, the losses of the railroad company will reach hundreds of thousands of dollars, and it is conceded by the company and by the public press that hundreds of lives were saved through the warnings issued in connection with the storm of October 11, 1909.

About Miami, Fla., the principal damage was to the citrus fruit crops that were blown from the trees in immense quantities. At Nassau, Bahamas, the storm was felt the night of the 11th when the barometer fell to 29.37 inches and the wind reached a velocity of 50 miles an hour from the southwest. After crossing the northern Bahamas the storm area expanded with a rapid loss of intensity.

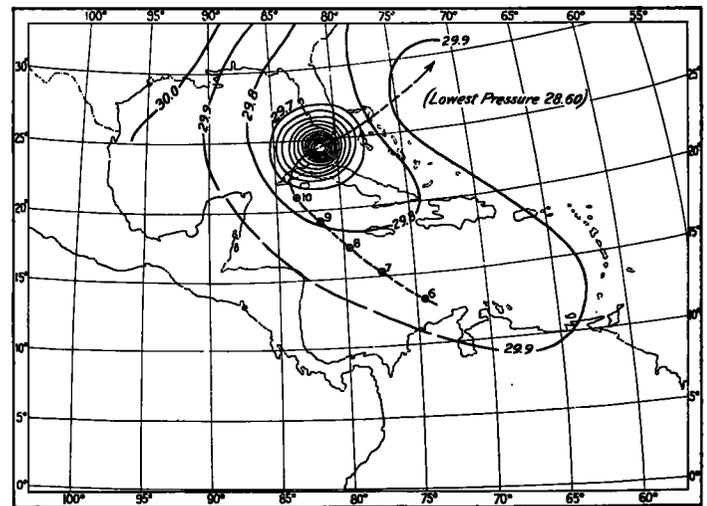


FIG. 2.—Isobars over the United States at noon, seventy-fifth meridian time, October 11, 1909.

While a summary of available information regarding this storm shows that protective measures employed upon the receipt of the warnings reduced losses of life and property to a minimum, it appears certain that many fishermen, spongers, and others in small boats, and dwellers on the low-lying islands or keys that fringe the coast of the southern Florida Peninsula that were outside the zone of communication were lost.

From the 19th to 22d a disturbance moved from the north Pacific coast to the St. Lawrence Valley, with rain on the middle and north Pacific coast and in the middle and northern States east of the Rocky Mountains. Attending the movement of the storm center eastward over the northern Lake region a tornado occurred the afternoon of the 21st about 25 miles south of Erie, Pa. A disturbance that advanced from the middle Rocky Mountain region to the Canadian Maritime Provinces from the 21st to 25th, was followed by a cool wave that caused heavy frost in the east Gulf and South Atlantic States.

From the 22d to 24th a storm passed from the western Caribbean Sea over the lower portion of the Gulf of Mexico attended by excessive and persistent rains that caused destructive floods in the State of Tabasco, Mexico. During the closing days of October a cold wave of unprecedented severity for the season was reported in the valleys near Mexico City.

From the 23d to 27th a disturbance moved from the British Northwest Territory to the St. Lawrence Valley, and on the 28th a disturbance appeared over the British Northwest that at the close of the month extended in a trough of low pressure, from Lake Superior southwestward, with lowest barometer over eastern Kansas.

In the tropical regions of the Pacific Ocean the typhoon season of 1909 has been unusually free from severe storms. On October 24, however, a typhoon that crossed northern Luzon is reported to have been attended by a rainfall of 18 inches in 9 hours and 26 inches in 24 hours and by a wind velocity of 95 miles an hour, that was measured before the wind gage was blown away.

*Average temperatures and departures from the normal.*

Districts.	Number of stations.	Average temperatures for the current month.	Departures for the current month.	Accumulated departures since January 1.	Average departures since January 1.
New England.....	12	49.9	- 0.5	+ 2.1	+ 0.2
Middle Atlantic.....	16	52.8	- 3.0	+ 4.5	+ 0.4
South Atlantic.....	10	61.9	- 1.7	+ 8.2	+ 0.3
Florida Peninsula*.....	8	73.0	- 0.2	+15.7	+ 1.6
East Gulf.....	11	66.0	+ 4.4	+14.8	+ 1.5
West Gulf.....	10	68.3	+ 1.9	+17.3	+ 1.7
Ohio Valley and Tennessee.....	13	54.3	- 2.7	+ 3.1	+ 0.3
Lower Lakes.....	10	47.7	- 3.9	- 3.7	- 0.4
Upper Lakes.....	9	45.6	- 2.0	+ 4.1	+ 0.4
North Dakota*.....	9	42.6	- 0.8	+ 0.2	+ 0.0
Upper Mississippi Valley.....	14	50.8	- 2.0	+ 3.0	+ 0.3
Missouri Valley.....	12	53.4	+ 0.7	+ 8.5	+ 0.8
Northern slope.....	9	46.5	+ 1.8	+ 0.4	+ 0.8
Middle slope.....	7	46.5	+ 0.7	+ 7.9	+ 0.8
Southern slope*.....	6	56.3	+ 0.3	+12.9	+ 1.3
Southern Plateau*.....	10	59.5	+ 0.4	+ 4.5	0.0
Middle Plateau*.....	11	50.1	+ 1.2	+ 4.5	0.2
Northern Plateau*.....	11	48.8	+ 0.8	1.8	0.2
North Pacific.....	7	51.7	+ 0.7	8.6	0.3
Middle Pacific.....	5	59.5	- 0.1	2.0	0.2
South Pacific.....	4	54.1	+ 1.8	+ 0.2	+ 0.2

\*Regular Weather Bureau and selected cooperative stations.

*Average cloudiness and departures from the normal.*

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
New England.....	5.3	- 0.1	Missouri Valley.....	4.3	+ 0.2
Middle Atlantic.....	4.2	- 0.6	Northern slope.....	4.6	+ 0.2
South Atlantic.....	2.6	1.4	Middle slope.....	3.8	+ 0.4
Florida Peninsula.....	5.7	+ 1.0	Southern slope.....	2.8	- 1.8
East Gulf.....	2.4	- 1.5	Southern Plateau.....	1.3	+ 0.9
West Gulf.....	2.4	- 1.3	Middle Plateau.....	3.4	+ 0.1
Ohio Valley and Tennessee.....	3.8	- 0.6	Northern Plateau.....	5.2	+ 0.6
Lower Lakes.....	6.0	+ 0.1	North Pacific.....	6.8	+ 0.5
Upper Lakes.....	6.3	+ 0.3	Middle Pacific.....	5.0	+ 1.2
North Dakota.....	5.5	+ 0.3	South Pacific.....	3.1	0.0
Upper Mississippi Valley.....	4.7	+ 0.1			

*Average relative humidity and departures from the normal.*

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
New England.....	73	- 6	Missouri Valley.....	64	- 3
Middle Atlantic.....	70	- 9	Northern slope.....	62	+ 2
South Atlantic.....	72	- 6	Middle slope.....	61	+ 2
Florida Peninsula.....	77	- 4	Southern slope.....	58	- 5
East Gulf.....	71	- 1	Southern Plateau.....	45	0
West Gulf.....	69	- 3	Middle Plateau.....	48	- 1
Ohio Valley and Tennessee.....	69	- 2	Northern Plateau.....	50	- 4
Lower Lakes.....	71	- 1	North Pacific.....	86	+ 6
Upper Lakes.....	78	0	Middle Pacific.....	72	+ 2
North Dakota.....	75	+ 3	South Pacific.....	66	- 4
Upper Mississippi Valley.....	71	0			

*Average precipitation and departures from the normal.*

Districts.	Number of stations.	Average.		Departure.	
		Current month.	Percentage of normal.	Current month.	Accumulated since Jan. 1.
New England.....	11	1.70	47	- 1.9	- 1.8
Middle Atlantic.....	16	1.44	44	- 1.8	- 1.7
South Atlantic.....	11	1.67	43	- 2.2	- 8.0
Florida Peninsula*.....	8	3.57	76	- 1.1	- 2.5
East Gulf.....	11	2.25	79	- 0.6	+ 6.2
West Gulf.....	10	2.66	96	- 0.1	-11.2
Ohio Valley and Tennessee.....	13	2.52	96	- 0.1	+ 3.0
Lower Lakes.....	10	1.80	60	- 1.2	+ 1.0
Upper Lakes.....	12	1.52	54	- 1.3	- 1.3
North Dakota*.....	9	0.68	68	- 0.3	- 0.1
Upper Mississippi Valley.....	15	2.51	104	+ 0.1	+ 0.7
Missouri Valley.....	12	1.74	94	+ 0.1	+ 2.0
Northern slope.....	9	0.37	38	- 0.8	- 0.1
Middle slope.....	6	1.49	100	- 0.0	- 1.5
Southern slope*.....	7	1.37	49	- 0.7	- 8.6
Southern Plateau*.....	11	0.06	8	- 0.7	- 0.1
Middle Plateau*.....	10	0.54	57	- 0.4	+ 0.4
Northern Plateau*.....	11	0.92	75	- 0.3	- 0.0
North Pacific.....	7	4.22	102	+ 0.2	+ 3.2
Middle Pacific.....	7	1.54	107	+ 0.1	+ 6.9
South Pacific.....	4	0.38	49	- 0.4	+ 4.6

\*Regular Weather Bureau and selected cooperative stations.

*Maximum wind velocities.*

Stations.	Date.	Velocity.	Direction.	Stations.	Date.	Velocity.	Direction.
Amarillo, Tex.....	31	58	w.	Minneapolis, Minn.....	11	51	nw.
Atlanta, Ga.....	14	56	w.	Mount Tamalpais, Cal.....	28	52	nw.
Block Island, R. I.....	16	50	w.	Do.....	29	54	nw.
Do.....	29	50	nw.	North Head, Wash.....	19	62	s.
Buffalo, N. Y.....	13	56	sw.	Do.....	20	62	se.
Do.....	13	50	sw.	Do.....	21	58	se.
Detroit, Mich.....	12	50	sw.	Do.....	22	58	se.
Do.....	21	50	sw.	Do.....	29	56	se.
Duluth, Minn.....	11	56	nw.	Do.....	30	64	se.
Do.....	13	58	nw.	Oklahoma, Okla.....	31	52	sw.
El Paso, Tex.....	23	54	ne.	St. Paul, Minn.....	11	50	nw.
Galveston, Tex.....	31	54	nw.	Sioux City, Iowa.....	7	60	s.
Key West, Fla.....	11	83	ne.	Tatoosh Island, Wash.....	10	50	e.

**RAINFALL IN JAMAICA.**

Through the kindness of Mr. Maxwell Hall, meteorologist to the government of Jamaica and now in charge of the meteorological service of that island, we have received the following data:

*Comparative table of rainfall.*

[Based upon the average stations only.]  
OCTOBER, 1909.

Divisions.	Relative area.	Number of stations.	Rainfall.	
			1909.	Average.
Northeastern division.....	25	17	13.13	13.89
Northern division.....	23	41	7.88	8.36
West-central division.....	26	20	14.08	13.62
Southern division.....	27	26	12.32	12.14
Means.....	100		11.85	12.00

The rainfall for the Island was therefore the average. The heaviest rainfall, 31.38, was recorded at Radnor and the smallest, 3.34, was recorded at Sandy Bay.

**RIVERS AND FLOODS.**

River matters were quiet and uneventful during the month, and the usual seasonal low water stages prevailed in all the rivers. There was a moderate rise in the lower portions of the Texas rivers toward the close of the second decade of the month, but it was not sufficient to cause any apprehension.

Hydrographs for typical points on several principal rivers are

shown on Chart I. The stations selected for charting are Keokuk, St. Louis, Memphis, Vicksburg, and New Orleans, on the Mississippi; Cincinnati and Cairo, on the Ohio; Nashville, on the Cumberland; Johnsonville, on the Tennessee; Kansas City, on the Missouri; Little Rock, on the Arkansas; and Shreveport on the Red.—H. C. Frankenfield, Professor of Meteorology.