RECORD RAINFALL FOR MIAMI, FLORIDA

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On June 19, 1930, the following note was made in the local station records:

> During the 24-day period beginning with May 27 and ending with this date, 33.16 inches of rainfall were recorded. This amount equals 60 per cent of the normal annual rainfall, and it greatly exceeds any amount previously recorded at this station in a period of 24 days. All low lands were flooded by the heavy rains, and a large acreage of corn and potatoes was destroyed.

During this period of excessive rainfall several records were broken for the Miami station. From the information available, it is believed that the five-day period from May 29 to June 2, inclusive, was one in which the total duration of excessive precipitation, compiled according to rule, eclipsed all previous records for southern Florida, and probably for continental United States for a similar period, by a comfortable margin.

The first station record to fall was the greatest amount in 24 hours for the month of May. The previous record had been 5.26 inches, established on May 30–31, 1919. The new record is 9.36 inches, on May 31–June 1, 1930. Of this amount, over one-half fell in the last 11 hours of May 31.

The next record is remarkable for the duration of time during which precipitation occurred at an excessive rate. According to the rule used for computing excessive precipitation in the Weather Bureau, a duration of 43 hours and 56 minutes at the rate of 2.50 inches in twenty-four hours is indicated. During this period 16.49 inches of rainfall were recorded. The period began at 12-47 p. m. on May 31, and continued until 1:20 p. m. on June 2.

The pressure conditions attending this record fall and duration of excessive precipitation are as follows: For several days preceeding this period, the pressure over the tropical regions to the south had been relatively low. The 8 a. m. weather map of May 29, 1930, showed indications of a disturbance over the lower Rio Grande Valley. During the day, this slight disturbance increased somewhat in intensity and moved eastward over the Gulf of Mexico. In the meantime a high pressure area of wide extent, attended by low temperatures, was quite rapidly overspreading the central plains states and the Ohio valley. The following morning the LOW appeared as a well defined disturbance over the Florida peninsula. The HIGH had continued a southeastward movement and had, on the morning of the 30th, extended its influence to the Atlantic coast.

During the day of the 30th the Florida disturbance moved quite rapidly northeastward, attended by heavy rains locally over the Florida Peninsula. The HIGH then settled over the Carolinas where it remained practically stationary for the next five days. Table 1 shows the hourly rainfall for the 24 days.

DISCUSSION

The above record of almost continuous rainfall for a period of close to 44 hours has several noteworthy features; for convenience of discussion the 24-day period will be broken up into several shorter periods as follows:

(1) The rains of May 29–30 (thunderstorm).
(2) The rains of May 31–June 2 (??)
(3) The rains of June 8–19 (thunderstorm).

The rains of Group 1 were due essentially to the movement of a strong anticyclone, 30.40 inches, from Manitoba on May 29 to the Carolina coast on June 1, especially to the influence exerted by this movement upon the development and movement of a secondary cyclone over the Gulf of Mexico on May 30 at a time when pressure was low and the gradients over that body of water were weak. This secondary on the morning of May 30 merged with a trough of low pressure that stretched from Florida to Hatteras, N. C. The trough disappeared on the afternoon of that date but not before yielding several thunderstorms and fairly heavy rains on May 29–30.

The rains of Group 2 seem to belong to a different type although they began with a thunderstorm in the afternoon of May 31. At that time the anticyclone above mentioned had begun to control the oceanic winds east of Florida and the winds at Miami backed from south through west and north to northeast and east. Almost coincidently with this change in wind direction light rain set in only to be immediately followed by a thunderstorm and heavy rain. (See Table 1.)

At the first burst of the oceanic winds over Florida general though not heavy rain set in; these rains north of Miami soon ceased and while it rained continuously at Miami for two days the skies over northern Florida were clear until the next day when clouds again formed.

The oceanic winds were not strong at any time, averaging about 14 miles per hour.

Table 1 shows that maximum hourly rainfalls occurred as follows:

(1) Hour ending at 5 p. m. May 31.
(2) Hour ending at 10 a. m. June 1.
(3) Hour ending at 3 a. m. June 2.

with a secondary maximum about noon of the same date.

It is assumed in explanation of these rains that the oceanic air brought onto the southeast Florida coast was not only cooler than the air in situ but of greater moisture content; that a condition of vertical instability was created as is evidenced by the thunderstorm that broke soon after the beginning of the rain on May 31. Examination of the direction of the rain clouds that passed over Miami reveals the fact that they varied from southeast to northeast from which it is assumed that the maximum hourly falls may have been due to a slight change in the direction of the incoming rain clouds, thus bringing fresh masses of moist air over Miami.

The 24-hour record rainfall in the United States held by the rains of September 9–10, 1921, at Taylor, Tex., was not broken. The total for that storm was 23.11 inches in 23 hours and 58 minutes.—*A. J. H.*

TABLE 1.—*Hourly precipitation, inches and hundredths, at Miami, Fla., May 27 to June 19, 1930, inclusive*

[Traces omitted]

Date	A. M.												P. M.												Total
	1	2	3	4	5	6	7	8	9	10	11	Noon	1	2	3	4	5	6	7	8	9	10	11	Mid-night	
May 27											0.33	0.86	0.30		0.02										1.51
May 29																	0.88	0.72					0.03	0.02	1.65
May 30		0.03				0.02		0.03			.01			0.23	.04	0.01									.37
May 31				.02	.02								.01	.14	.94	1.22	1.51	.72	.02	.03	.01	.08	.02	.08	4.82
June 1	.03			.03	.21	.17	.08	.03	.05	1.87	1.20	.30	.32	.33	.12	.02	.33	.20	1.02	.37	.24	.13	.09	.03	7.17
June 2	.64	.42	.72	.10	.16	.14	.12	.16	.09	.12	.44	.71	.56	.22	.04		.03		.02	.42	.15	.01			5.27
June 5				.02																					.02
June 7				.03																					.03
June 8			.07	.17	.01										.01			.19	.10	.87	.53	.94			2.89
June 9										.02	.05	.95				.03	.01								1.06
June 10				.03																	.02				.05
June 11																					.01				.01
June 12																					.02	.78	1.58	.52	2.90
June 13	.23	.04										.01	.01	.02	.06	.01	.03	.07	.05	.07	.02	.02	.01	.05	.70
June 14		.01		.05	.01																				.07
June 15							.02			.07	.09	.01		.54		.81	.08			.01					1.63
June 17		.06																		.09	.07	.43	.80		1.45
June 18			.07														.03	.02							.12
June 19			1.44																						1.44
Sums	.90	.56	2.30	.45	.41	.33	.22	.22	.14	2.08	2.12	2.84	1.20	1.48	1.23	2.10	2.90	1.92	1.21	1.86	1.07	2.39	2.53	.70	33.16

NOTES, ABSTRACTS, AND REVIEWS

An upper air temperature indicator for use with pilot balloon, by G. Chatterjee. Reprinted from "Gerlands Beiträge zu Geophysik," vol. 24 (1929), pp. 343–352, Vienna.—Author's summary: The paper describes a simple instrument intended to be used with ordinary pilot balloons for determining temperature levels in the atmosphere. The instrument is essentially a 2-pronged fork in which both prongs are bimetallic strips that open outwards as the temperature falls. At a set temperature, the opening of the prongs releases a chemical "trigger" by allowing a very small capillary U-tube containing strong sulphuric acid to drop into a finely powdered mixture of sugar and potassium chlorate. This burns the string holding the instrument to the balloon. The release of the instrument from the balloon at the predetermined temperature is observed in the field of view of a theodolite and the height of the balloon at the moment is determined by the tail method. The weight of the instrument is about 40 grams.—*C. F. B.*

The electric field of overhead thunderclouds,[1] *by S. K. Banerji.*—Changes in the electric field produced by eighteen thunderclouds during their passage over the Colaba Observatory in 1929 suggest that the majority were of the "unitary type" and had their front part negatively charged, the central part positively charged, and the rear negatively charged. A few were of the "double type" and produced changes in the field as if two thunderclouds of unitary type had passed over in succession. In those thunderclouds which caused heavy rainfall, fluctuations in the central positive field occurred by loss of charge by rainfall or by increased concentration of positive charge by increased vertical current, in agreement with the breaking-drop theory. The monsoon clouds produced an electric field which was preeminently negative during periods of rainfall.

A new rainfall chart of the earth.[2]—The author has collected, mainly from World Weather Records and the volumes of Reseau Mondial 1911–1920, more than 500 records of precipitation for the 10 years, 1911–1920. The majority of the records cover the full 10 years, those which have less than 9 years have been adjusted to the full period and used in the compilation of the chart. The latter is on a scale of 1 :100,000,000, and shows the distribution of rain over land and sea according to the following scale of intervals: 0–25, 25–50, 50–100, 100–150, 150–200, 200–300, 300 and more centimeters.—*A. J. H.*

The rôle of the oceans in the weather of western Europe,[3] *by C. E. P. Brooks, D. Sc.*—Doctor Brooks is the author of two Geophysical Memoirs, Nos. 34, 1926, and 41, 1928, bearing upon the influence of oceanic currents and Arctic ice, respectively, upon the weather of Europe. In the present paper he draws upon the information presented in those memoirs to elaborate and present in much detail his ideas as to the bearing of oceanic conditions upon the weather of adjacent land areas.

In his opening paragraph he likens the North Atlantic to a great bath having one hot and two cold taps; the hot tap is, of course, the Gulf Stream and the two cold ones the Labrador and East Greenland currents. These taps are always running sometimes at full capacity and at others much diminished in volume.

Some curious interrelationships are described, one in particular will be mentioned. This relates to the pressure variations at Iceland and the west coast of Ireland following variations of the ice index of 5 units above normal. The ice index is merely a convenient unit to express the distribution of ice in Kara Sea, Greenland Sea and Barents Sea. It was computed for each year from 1895 to 1928 during which period its largest value was 145 in 1917, a year of rather low winter temperature in both Europe and North America.

The relations between variations of the ice index and subsequent pressure changes in Iceland and Valencia are striking. The author remarks in this connection:

> These curious relationships present some difficult problems for the meteorologist to solve, especially the reason why a large amount of ice in the Arctic should cause high pressure and fine weather at one season, low pressure and stormy weather at another season. We may summarize the position as follows:
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> (1) When there is much ice in the Arctic, pressure in spring and summer tends to be above normal in the northwest (Greenland, Iceland, and the Faroes) and below normal in the southwest (the Azores).

[1] Reprinted from Nature, May 10, 1930.
[2] Erwin Ekhardt in Petermanns Mitteilungen Heft 3/4.
[3] Condensed from Quart. Jour. Roy. Met. Soc. LVI: April, 1930.