spond inversely, moreover, with the wind velocity curve for San Francisco. An interesting feature is the sudden rise in the humidity for San Francisco, followed by an equally sudden drop between 8 and 9 p. m. on the 16th, during which period the wind decreased in force and shifted for about half an hour from northerly to southerly. There is no record of wind direction for Berkeley, but anemometer records for the period of the rise in humidity there, 2 p. m. to 9 p. m., show very light winds, from 1 to 2 miles per hour, increasing to from 10 to 20 miles per hour at about 10 p. m., the time of the sudden fall in the humidity. Northerly winds continued, shifting through northeast and northwest, at San Francisco until about 3 p. m. on the 17th, when a shift to west occurred. A sudden rise in the humidity curve is synchronous with the shift in the wind, the percentage of relative humidity increasing from 21 per cent at 3 o'clock to 64 at 5 o'clock, with a continuing normal nocturnal rise. There is a lag in the Berkeley curve, doubtless due to the fact that normally the westerly wind would be observed earlier at a point nearer the ocean. In fact, fresh northerly winds were observed in Berkeley until about 5 o'clock. At that hour a change to southerly occurred, together with a sudden rise of over 60 per cent in the relative humidity. and the fires in the city, which had seemed uncontrollable, were extinguished within a short time.

While, naturally, the changes in absolute humidity are not absolutely synchronous at all stations in northern and central California, there appears generally a tendency to reach a minimum about noon of the 17th, with a rapid rise on or before 5 p. m. of that date, continuing for the next two days.

In the Pacific Northwest members of the Forest Service have established a definite correlation between the fire hazard and the percentage of relative humidity, the first increasing as the latter decreases. The effects of winds in aiding the spread of fires, forest or otherwise, are a matter of common knowledge. The records show that in California, for the period from the 14th to the 17th of September, all meteorological factors were such as to materially increase the fire hazard, namely, a gradual decrease in humidity, both relative and absolute, accompanied by strengthening winds from the north and east. These conditions reached their climax on the afternoon of the 17th, and it is a matter of record that the fires in the several parts of the State reached their climax of destructiveness at the same time. With the change in weather conditions during the night of the 17th the fires were brought under control. The conclusions of the Forest Service officials appear to be well founded.

In the Alpine regions, or in the Plains States of America, such a Foehn condition may cause only a welcome thaw and lessening of extreme cold; in California it causes a very unwelcome and dangerous increase in the ever-present menace of forest fires. Fortunately, such conditions can be forecast before reaching their maximum of danger, and it is believed, with the lessons of the September fires fresh in memory, the forecasts will receive more general attention from the public than has heretofore been the case.

RECORD-BREAKING RAINFALL IN SOUTHERN MICHIGAN.

R. M. DOLE, Observer.

[Weather Bureau Office, Lansing, Mich., Oct. 2, 1923.]

One of the heaviest rainfalls ever recorded in Michigan occurred on July 7, 1923. On the weather map of Friday, July 6, 1923, were marked disturbances over the Great Banks and also in Canada, some distance north of Winnipeg. Between was an irregular high pressure area with centers near Birmingham, Ala., and some distance north of the Great Lakes. The latter was moving slowly southward increasing in strength.

An offshoot of the Canadian disturbance moved southeastward, thence east-southeastward, and Saturday morning July 7, 1923, was central over southern Lake Michigan. North and east of this disturbance rising pressure blocked its progress. This distribution of pressure was ideal for heavy downpours in that part of the area of activity where the gradient was steepest and where the most resistance obtained, namely, in the northeast portion, which was over southern Michigan about the noon of Saturday, July 7, 1923.

Exceptionally heavy rains, accompanied by moderate lightning, fell in a narrow strip running north and north-northwest from Hillsdale County, through Jackson, Eaton, Ingham, Ionia, Clinton, Shiawassee, through Montcalm into the southern portion of Mecosta County, in the southern section of the Lower Peninsula of Michigan.

The rainfall was such as one encounters in the South, but is unusual for Michigan. The heaviest rainfall measured fell near Jackson, amounting to 3.34 inches (0.04 of an inch fell during the night). The observer there recorded the time as from 12:50 p. m. to 1:45 p. m., or less than one hour. At Lansing, in Ingham County, 2.33 inches fell from 9 a. m. to 2:30 p. m. In one hour the amount was 2.06 inches, exceeding all previous records for that length of time. The tabulated record follows:

	Minutes.										
	5	10	15	20	25	30	35	40	45	50	60
Rainfall.....	0.05	0.16	0.36	0.41	0.45	0.63	0.96	1.33	1.65	1.92	2.06

Charts showing the distribution of pressure at 8 a. m. July 7, 1923, and the area of heaviest rainfall are given on next page.

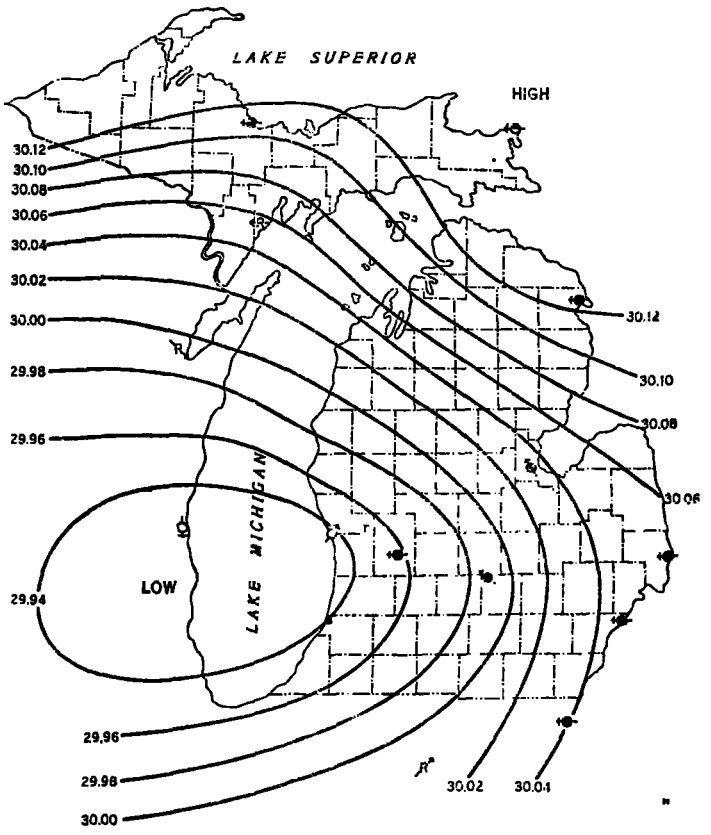

FIG. 1.—Sea-level distribution of barometric pressure over Michigan, July 7, 1923, 8 a. m., 75th meridian time.

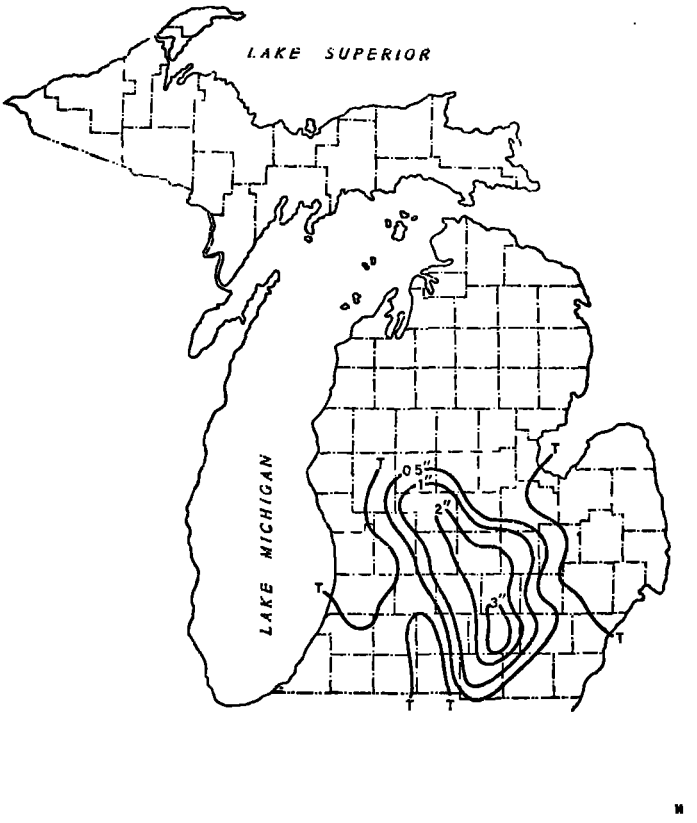

FIG. 2.—Distribution of heavy rainfall in southern Michigan, July 7, 1923.

TORNADO AT COUNCIL BLUFFS, IOWA, SEPTEMBER 28, 1923.

By M. V. ROBINS, Meteorologist.

[Weather Bureau Office, Omaha, Nebr., Oct. 5, 1923.]

On Friday night, September 28, 1923, a small tornado occurred in the southeastern part of Council Bluffs, Iowa, across the Missouri River from Omaha, Nebr. The storm struck about 7:50 p. m., and owing to darkness and a torrential rain but few people saw the cloud. One man whose house stands at the top of a steep hill overlooking the area of worst damage said: "It was a long funnel-shaped cloud with a black column extending from the ground high into the air. I heard it roaring as it swept this way and I and my family rushed into the basement. When we emerged several minutes later we found a large tree down in our back yard almost blocking the door. Trees were uprooted and sheds blown down all around the neighborhood." Another man reported what he saw resembled a ball of fire. Opinions differ as to the sound accompanying the tornado, some saying there was a roar and others that it was like steam escaping from an engine, and it is probable that the metallic roar frequently heard was dulled to a considerable extent by the almost constant thunder and the drumming of the rain.

The cloud moved from the south, especially over that part of the path where most of the destruction occurred; this was confined largely to one street to the east of which is a bluff about 200 feet high and running about due north and south. The path was narrow, a few hundred feet, and probably not to exceed 3 miles in length, but part of which was settled, so the damaged area is but a few blocks long. After the storm passed through this territory it continued over the hills for a short distance, uprooting or breaking some trees and finally dissipated.

The damage done by the tornado was less than anticipated at first, and probably does not exceed $15,000; one house was demolished and a considerable number damaged to a varying extent, but the buildings were mostly small and some were in a poor condition already.

Débris was thrown in all directions, but the trees observed were mostly torn out by the roots and were lying in a northerly direction or toward the northeast. A few roofs were torn off or partly so, one showing the part away from the direction of approach completely gone while that on the south remained almost intact, showing the explosive action of the vortex.

The greatest damage suffered by the city of Council Bluffs was from the excessive rainfall (a fall of 3.04 inches was recorded in two hours, and 6.80 inches in 24 hours at Omaha). Hundreds of people were driven from their homes in the lower sections, and even many business houses and stores were flooded and the floors covered with mud and water. Mud from the hills covered lower Broadway and some other streets for blocks, in places to a depth of more than a foot. Hundreds of homes had their basements filled with water and scores had their first floors covered with water and mud. It is the worst flood since the memorable one of the spring of 1881, which was due to high water in the Missouri River and came in from the low lands up to the higher sections, while this came from the hills and higher ground.

At the Weather Bureau office in Omaha, about 7 miles in an air line from the devastated area, during the passing of the tornado nothing unusual occurred other than a severe thunderstorm. Rain fell at an excessive rate. The barogram shows no more marked fluctuations than frequently occur in ordinary thunderstorms. The wind reached a maximum velocity of 36 miles an hour from the north at 8:04 p. m.