toward a minimum of vapor near the time of maximum temperature, especially during the warmer months of the year, but the question is much complicated by evaporation and variations in wind velocity and direction, so that the afternoon minimum is often reduced, obliterated, or even turned into a maximum.

The only thing that could cause an actual decrease in the total amount of vapor in the air during the middle of the day is cloudy condensation, which is most active at that time. But this would be a very small factor.

Vapor pressure normally decreases with increase in altitude rather rapidly. (MONTHLY WEATHER REVIEW, March, 1919, p. 160.) During the heated portion of the day, especially in the warmer months, convection is quite active, and results in mixing the surface air with the drier air above. This mixing also brings down with the air from above, some of the momentum of the upper-air currents, and results in higher wind velocity during the day, and a turbulence of the atmosphere. This mixing by convection and turbulence is probably the true reason for the depression of the vapor pressure in the middle of the day. Observations aloft would probably show a rise in vapor pressure in the middle of the day, just as the wind velocity aloft is diminished thereby.

INTENSE RAINFALL AT DUBUQUE, IOWA, JULY 9, 1919.

Mr. J. H. Spencer, meteorologist, in charge of the Dubuque Weather Bureau office, has sent us an account of a very intense rainfall which accompanied a local thunderstorm July 9, 1919. In spite of the intensity of the rainfall, "thunder and lightning were rather less severe than in some of the storms of the past eight years," and the wind velocity was light.

"At no time during the hours that preceded the period of heaviest rainfall was there much indication of a severe storm, although the weather in the morning quickly changed to warm and sultry. Rain began as a light thundershower from 10:25 a. m. to 10:55 a. m. (ninetieth meridian time). Rain began again at 11:15 a. m. and was moderately heavy until 1:50 p. m. (the total to this time exceeding 1 inch). Then followed the great downpour of 2.64 inches in 45 minutes from 1:51 p. m. to 2:36 p. m.

"The following table gives the heaviest rainfall in periods of 5 minutes, 10 minutes, 15 minutes, 30 minutes, 1 hour, and 2 hours for a number of storms. It shows how much heavier was the rainfall on July 9, 1919, within a 1-hour period, than during any storm at Dubuque in recent years:"

Storm of—	5 minutes.	10 minutes.	15 minutes.	30 minutes.	1 hour.	2 hours.	24 hours.
July 4–5, 1876	.....	.....	.....	.....	.....	[1] 4.55	4.55
Aug. 10–11, 1911	0.32	0.52	0.62	0.81	1.12	1.97	3.75
Aug. 18–19, 1912	.50	.71	.94	1.46	1.95	2.02	5.23
Aug. 31–Sept. 1, 1914	.41	.72	1.03	1.30	1.68	1.96	3.18
Sept. 14–15, 1914	.34	.51	.58	.73	.85	1.26	3.38
Sept. 25–26, 1915	.34	.46	.53	.68	1.27	2.23	4.79
Aug. 16–17, 1918	.35	.62	.79	1.37	2.10	2.96	5.22
July 9, 1919	.80	1.20	1.52	2.23	2.70	3.03	3.87

[1] 2 hours 5 minutes. 40 persons were drowned as the result of this storm.

Figure 1 shows the intense rainfall of July 9, 1919 (dotted line), in relation to other excessive rates in the North Central States plotted by Prof. A. N. Talbot.[1]

[1] Rates of maximum rainfall, Technograph No. 6, University of Illinois, 1892, 15 pp., incl. 8 diagrams.

The dashed curve A represents rates of rainfall which are rarely exceeded in the eastern United States. Its equation is $y=6.0/(x+.5)$, where y is the rate of rainfall in inches per hour for the time x expressed in hours. Curve B expresses the rate of frequent occurrence: $y=1.75/(x+.25)$.

"It is worthy of note that at Dubuque during the past nine years (1911 to 1919, inclusive) there have been seven storms in which more than 3 inches of rain within 24 consecutive hours fell, or more storms of similar intensity than occurred during the 29-year period from 1882 to 1910, inclusive, which gave only six. On the other hand, during the eight-year period from 1874 to 1881, inclusive, there were nine storms that gave more than 3 inches of rain within 24 consecutive hours."

An account of the seven lives lost and the $125,000 damage by the freshet resulting from this excessive rainfall will be found below on page 506 in the river and flood section.—*C. F. B.*

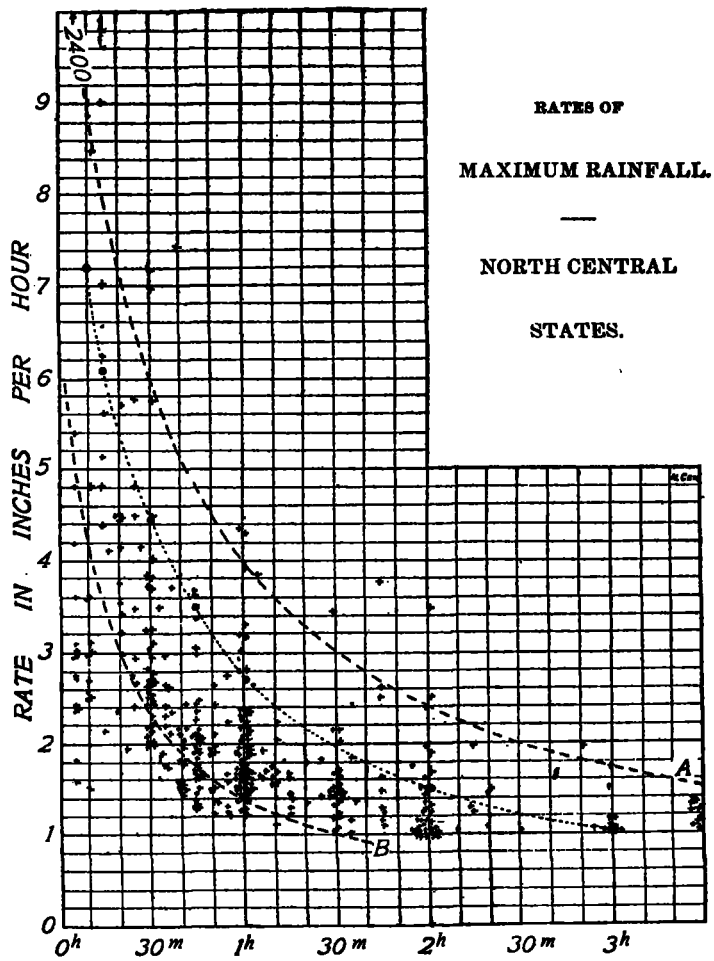

FIG. 1.—Excessive rainfall at Dubuque, Iowa, July 9, 1919, dotted line, compared with other excessive rates in North Central States. Compiled by A. N. Talbot.

HEAVY RAINS AT TAMPICO, MEXICO, JUNE 29–JULY 5, 1919.

By S. A. GROGAN.

[Dated Tampico, Tamaulipas, Mexico, July 7, 1919.]

During the week of June 29 to July 5, inclusive, more rain fell at Tampico than during the entire first six months of the year. From 6:30 a. m. on the 29th to 6:30 a. m. on the 5th a total precipitation of 15.64

inches was recorded. During the first 72 hours of the month of July 14.06 inches of rain fell in this vicinity.

The greatest 24-hour fall during that time was 8.36 inches from 6:30 a. m. on the 3d to 6:30 a. m. on the 4th. Of that, 3.55 inches fell from 6:30 a. m. to 6:30 p. m. on the 3d, and 4.81 inches fell during the night that followed.

The heaviest previous 24-hour rainfall since October, 1917, was on January 23, 1919, when a total precipitation of 2.23 inches was recorded. Our highest record in any month was 5.95 inches, during August, 1918.

There has been very little rainfall in this region during the past two years. I have no complete record for the year 1917, but the precipitation during the year 1918 was only 19.53 inches, with a total of 77 days upon which 0.01 inch or more fell. The 1918 precipitation is very likely a minimum record for several years in this vicinity, as I am of the opinion that the normal rainfall for Tampico and northern Vera Cruz is at least two or three times more than 19.53 inches. I also believe that the precipitation on July 3 of this year is a maximum 24-hour record for several years.

As may be seen from the data given below, this last excessive rain came from the east and northeast, and there was no break until the wind went to the west.

Meteorological record at Tampico, Mexico, June 29 to July 5, 1919.

[Observations at 6:30 a. m. (Tampico time) on dates given.]

Date.	Temperature.			Pressure.		State of weather.	Wind from.	Other observations.
	Max.	Min.	Mean.	Max.	Min.			
June 30..	90.5	79.5	85.0	29.88	29.82	cldy.	se.	0.14 in. rain.
July 1...	88.5	73.5	81.0	29.92	29.84	cldy.	sw.	0.98 in. rain.
2...	83.0	72.0	77.5	29.93	29.85	cldy.-rain.	ne.	2.88 in. rain.
3...	79.0	72.0	75.5	29.85	29.81	cldy.	e.	2.82 in. rain.
4...	77.0	71.5	74.3	29.86	29.80	cldy.	ne.	8.36 in. rain.
5...	79.5	72.5	76.0	29.90	29.80	cldy.	sw.	0.46 in. rain.
6...	87.0	73.0	80.0	29.92	29.88	cldy.	w.	0.00 in. rain.

Total rainfall this week.....inches.. 15.64
Total rainfall this month to date.....do.... 14.5
Total rainfall this year to date.....do.... 27.26

NOTE.—The above pressure data are shown as recorded by our recording barometer; the temperature as shown by standard maximum and minimum thermometers; and the rainfall as measured in a common rain gage.

NORTHERS ON THE EAST COAST OF MEXICO, THEIR EFFECTS, AND FORECAST BY LOCAL OBSERVATIONS.

By S. A. GROGAN.

[Dated Tampico, Mexico, July 9, 1919.]

With the exception of the tropical storms during the summer months, there is no other weather which causes more concern among the navigators on the Gulf of Mexico than do the northers along the east coast of Mexico from about the 1st of September to the latter part of April. From September, 1918, to June, 1919, 31 northers visited Tampico.

Few records show of any ships being lost in the open sea from the effects of these north winds, but many have suffered serious damage or have been entirely lost from being blown up on the coast or the breakwaters at the entrances to the ports. No records have been obtained previous to 1917, but during that year there were seven disasters in the vicinity of Tampico, which can be attributed to northers.

Mr. Wm. J. Pulford, Lloyd's agent at Tampico, has been so kind as to furnish me with the following list of disasters for that year:

March 18, American tanker *Winnifred* went ashore south Tampico breakwater. Refloated on March 23 and towed to the United States for repairs.

May 17, American barge *Vaska* went ashore and lost north of Tampico breakwater.

October 20, American schooner *El Gallo* went ashore south of Tampico. Became a total loss.

October 30, American tug *Southbay* foundered outside Tampico breakwater.

October 31, American tanker *Paddleford* driven ashore south Tampico breakwater. Floated the following spring and taken to the United States for repairs.

November 15, American tug *Relief* went ashore north of Tampico. Floated on November 17.

December 8, American steamer *Wellington* drifted ashore in heavy norther. Sustained general damage to hull, rudder, etc.

While no lives were lost in any of the above disasters they occurred at a time when there was a general demand for more ships. Of the above, the tanker *Paddleford* was probably the greatest loss. Although it was floated in the following spring, it was taken from its important duty of conveying oil to the United States during the time it laid up on the breakwater and it was being repaired in the States.

During the first part of the year 1918 the schooner *Veracruz* was blown ashore on the south breakwater.

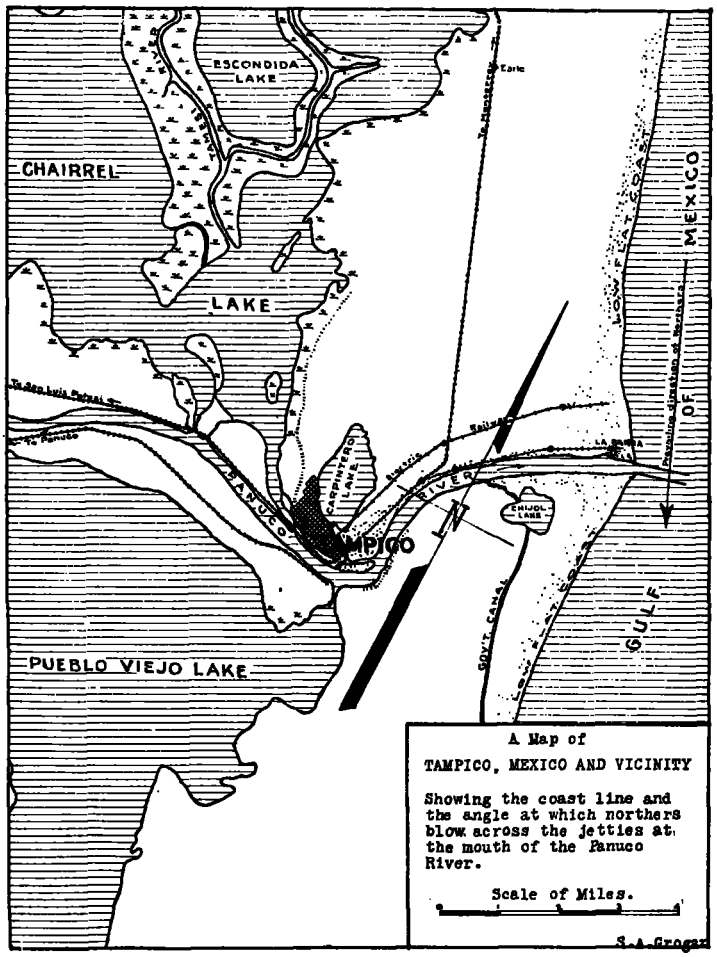

FIG. 1.

On January 22, 1919, the tug *George* left port late in the afternoon with a barge of oil to be taken outside the bar. A norther was blowing at the time, and although the out-