

observed many mornings at daylight; and at Fall River, Mass., white frost on the lowland on the 19th.

### PRECIPITATION.

The rain-fall is exhibited by the figures and shading on Chart No. III, and constitutes one of the most remarkable and significant items of the month's meteorology. From the graphic exhibit of Chart No. III, it will be seen that the rain-fall in the Middle Atlantic States is normal, and that for New England is only a little in excess, while a slight deficiency was reported from the St. Lawrence valley and the Lake region. There was a deficiency of nearly half an inch on the Pacific coast, where the month was nearly rainless. There was a very marked deficiency in the South Atlantic States, and also a large deficiency in the Gulf States. In the heart of the cotton-belt, the rain-fall has been about an inch. The deficiency in Minnesota was also very great, exceeding four inches.

But in the interior, including the Ohio valley and Tennessee, and the central Mississippi and lower Missouri valleys, an equally marked excess of rain was reported. The excess was very great in the lower Missouri valley, amounting to nearly 5.00 inches, while in the Ohio valley and Tennessee the excess has been alarming and almost unparalleled, being five and a half inches more than is usual in July, or nearly three times the normal quantity that falls in that month.

In a large belt of country north of Kentucky and Missouri, the month's rain-fall ranged from 10 to 16 inches—a precipitation which has taxed the central tributaries of the Mississippi beyond their utmost drainage-power, and caused damaging floods and extensive ravages of the growing crops.

Some of the heaviest rain-falls for the month were as follows: At Louisville, 16.46 inches; at Indianapolis, 13.12 inches; at Keokuk, 12.70 inches; at Omaha, 10.00 inches; at Fort Gibson, 10.93 inches. At Beech Grove, Indiana, for the week ending August 1st, the rain-fall was 11.60 inches.

*Rainy Days.*—The number of days on which rain fell in any quantity averages about as follows: In New York and New England, 10; in the Lake region, Minnesota and Dakota, 9; in the Gulf States, 11; in the South Atlantic States, 4; from Nebraska, Kansas, and Indian Territory eastward over Iowa, Missouri, Arkansas, Tennessee, Kentucky, Illinois, Indiana, Ohio, Virginia, Maryland and Pennsylvania, 16. From many stations in the Ohio and central Mississippi valleys, over twenty rainy days, during the month, are reported.

### RELATIVE HUMIDITY.

This element averages 79 per cent. for the immediate Atlantic coast from Cape Hatteras to Maine, and is also very high, ranging from 74 to 81, from the western portions of Pennsylvania, Virginia and North Carolina, westward to Nebraska, Kansas, and Indian Territory. In the Gulf and South Atlantic States it averages 65 per cent., and in New England, New York, and the Lake region, 68. It is somewhat higher than during the month of June at the Rocky Mountain stations, being 30 per cent. at Salt Lake City, 55 at Santa Fé, 56 at Denver, and 58 at Cheyenne.

### WINDS.

The *prevailing winds* have been southerly or southwesterly at nearly all stations except those in the far Northwest and on the Lakes, where northeast and northwest winds have been very frequent. The tendency of the wind, in the Missouri valley, has been to southeast.

*Total movements of the Air.*—The larger total movements of the air for July were as follows: At Cape Hatteras, 10,586 miles; Indianola, 8,248 miles; at stations on the

New Jersey coast, from 6,000 to 7,900 miles; Key West, 6,956 miles; Wilmington, 6,786 miles, and Escanaba 6,690 miles. The smallest movements have occurred at Lynchburg, 2,037 miles; Nashville, 2,561 miles; Wytheville, 2,847 miles; Louisville, 2,859 miles; Indianapolis, 2,901 miles.

### VERIFICATION OF "PROBABILITIES" AND CAUTIONARY SIGNALS.

The usual critical comparison of the published "Probabilities" with the weather-conditions actually following their publication shows that, on the average, for all the districts in the United States for which predictions were made, 91.94 per cent. have been verified. The per centage of omissions to predict is, for the whole country, 0.16.

During the month, the total number of Cautionary Signals ordered to be displayed at the forty-three Signal Stations on the Lakes and Atlantic coast, has been two. This is a small number, compared with that of previous months. Of the two signals displayed, one was justified by the fact of succeeding high winds. One was not justified.

### NAVIGATION.

On Chart No. III., is given the usual table, showing the highest and lowest water-marks of the month. The Red river, at Shreveport, fell steadily during the month. Up to the middle of the month, the upper Mississippi was at its highest, but then fell and was very low north of Keokuk when the month closed, being six inches below bench-mark on the 31st at La Crosse, Wis. The Cumberland, at Nashville, reached its maximum height on the 19th. The lower Missouri fell towards the close of July.

The Ohio was highest on the 30th, at Louisville, Ky., and Laconia, Ind.

The floods, which were so general in the first week of August, had not become fully enough developed in July to call for extended notice in the current Review. Their history belongs to the meteorology of August.

### TEMPERATURE OF THE WATER.

This item is given in the table in the lower right-hand corner of Chart No. II. Generally, the variation in the temperature of the water has been small, not exceeding 8° in the month. The exceptions or greatest variations are at Duluth, 25°; Yankton, 15°; Pittsburgh and Milwaukee, 12°; Omaha, 11°; Leavenworth, Escanaba and Marquette, 10°. The least thermometric changes have been at Augusta, Ga., 6°; Charleston, S. C., 2°; Indianola, Texas, 2°; Memphis, 3°; Eastport, Me., 5°; Savannah, 3°, and Portland, Me., 0°.

### OPTICAL PHENOMENA.

(1) *Solar halos* were observed on the 1st, in New York, Ohio and Wisconsin; 3d, Maine, New Hampshire and Vermont; 5th, Illinois; 6th, New York; 8th, New Jersey, New York and Wisconsin; 9th, New Hampshire and Ohio; 10th, Kansas; 11th, Iowa; 14th, New York and Tennessee; 15th, Dakota; 17th, Illinois and Tennessee; 18th, Tennessee; 19th and 20th, Nebraska; 21st, Canada; 22d, Maine, Massachusetts, Mississippi and New York; 23d and 25th, Ohio; 26th, Nebraska and New Hampshire; 28th, Michigan and Tennessee; 29th, Massachusetts, New Hampshire, New York and Vermont; 30th, Canada and Wisconsin; 31st, Iowa, Michigan, New York, Ohio, Pennsylvania and Wisconsin.

(2) *Lunar halos* were reported as follows: On the 7th, in Louisiana, Mississippi; 8th, Louisiana, New Jersey and Wisconsin; 9th, Illinois; 10th, Illinois and Virginia; 12th, Alabama, Florida, Iowa and Texas; 13th, Alabama, New Jersey and Wisconsin; 14th, Tennessee and Wisconsin; 15th, Iowa and Tennessee; 16th, Mississippi and Ten-