

were submerged. The inundated district in St. Louis was confined to Front street and to railroad tracks on low ground in the northern portion of the city. A few railroad embankments gave way in East St. Louis, and small areas were flooded. The loss in the two cities was, therefore, nominal, and resulted mostly from the suspension of business in the overflowed districts. The loss of, and damage to, property for the entire district was about \$500,000, and the value of the crops destroyed was about \$4,000,000. Damage to farm lands by erosion and deposit amounted to about \$100,000. The loss sustained thru the suspension of business amounted to about \$200,000. Timely warnings, issued in advance of this flood, gave ample opportunity for the removal of all portable property and live stock from the threatened districts to places of safety, and it is estimated that property to the value of \$750,000 was saved by heeding them. There was no loss of life due directly to the flood, so far as press reports show. Between Louisiana, Mo., and the mouth of the Missouri River the stages were not alarming.

More moderate floods occurred in the Mississippi River from Chester to Cairo, Ill., for which warnings were issued as occa-

sion required. While these warnings were frequent and accurate, much damage of an unavoidable character was done. The season was so late that the floods were much more destructive than usual, except in the vicinity of Chester, Ill., where the damage was small. Below Chester the losses and damage amounted to about \$850,000, principally to growing crops. There were also local floods in small streams in various portions of the country during the month of July, due to heavy rainfall. Considerable damage was done in interior New York, northern and western Maryland, southern Virginia, southeastern Nebraska, Colorado, and southwestern Idaho.

The highest and lowest water, mean stage, and monthly range at 207 river stations are given in Table IV. Hydrographs for typical points on seven 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.*

SPECIAL ARTICLES, NOTES, AND EXTRACTS.

RAIN-MAKING IN NEW ZEALAND.

An article on experiments in rain-making in the New Zealand Times of Wellington, October 23, 1907, lately came to the attention of the Editor as another illustration of the waste of public money consequent upon popular ignorance and superstition. Of course it is not to be expected that every one should appreciate the positive knowledge that constitutes meteorology, but it is to be hoped that every illustration of this kind may contribute something to the education of the public.

We understand that both climatology and meteorology are combined in the Meteorological Office of New Zealand, but that of course the former branch of the science is likely to receive the greater amount of attention. It would seem that the people and the Government initiated the rain-making business at Oamaru in the North Otago district which had been suffering from a drought for several months; and it was only left for the Meteorological Office to send the Rev. D. C. Bates, F. R. M. S. and Government Meteorologist, to watch the experiments and report on the results. Of course he knew that the production of rain by cannonading is hopeless, and it would have been proper to regard the experiment as a stupendous farce. But it had a tragic aspect, since on the one hand he, on arriving at Oamaru, seems to have been hailed as a plenipotentiary armed with dynamite, guncotton, gunpowder, special railway trains, motors, and a posse of troops to do his bidding, in the presence of thousands of strangers. On the other hand, the local rain-making committee had caused the churches to offer up prayers for rain and for the success of the experiments, and now stood ready to denounce both religion and science if rain did not follow the cannonading. It seemed like a contest between paganism and intelligence in which forbearance, silence, and patience are the better weapons.

The official report by Mr. Bates has been published almost entire in the local papers of New Zealand and we reprint it as a most instructive scientific and educational document. The result should go far to prevent other communities from making such foolish experiments and should draw the attention of every one to the need of saving the rainwater after it has fallen. It is a case where conservation is possible and production impossible.—*C. A.*

REPORT UPON THE DRY PERIOD AND RAIN-MAKING EXPERIMENTS AT OAMARU, NEW ZEALAND.

By D. C. BATES, Government Meteorologist. Dated Wellington, N. Z., September, 1907.

The district of North Otago, often called after its chief town, the Oamaru district, is sheltered on the west, north, and south

by mountainous ranges, which condense and precipitate on their windward slopes much of the moisture borne by the winds from these directions, and it must therefore depend chiefly on easterly weather [winds] for its rains. The northeasterly and southeasterly winds which accompany cyclonic disturbances and are usually laden with water-vapor, sweep up the Kakanui and Waitaki valleys, causing the most abundant rains to fall over the district. In some seasons, however, these atmospheric movements do not extend their influences so far south, and then, while the North Island gets more than the usual amount of rain, those parts of the South Island depending upon them are liable to experience droughts. A prolonged dry period of an unusually severe character for any part of New Zealand, extended over the Oamaru district during the years 1889, 1890, and 1891. The years 1897 and 1898 were also very dry, and the last period of deficient rainfall from January, 1906, to August, 1907, was 45.7 per cent below the sum of the average monthly rainfalls for the eighteen months included.

Rainfall observations for the Meteorological Office have been kept at Windsor Park, Oamaru, since 1892 by Messrs. E. and W. Menlove; also at Kauroo Hill, near Maheno, by Messrs. R. A. Chaffey, C. de V. Teschemaker, and A. French from January 1, 1890. While in Oamaru I learned that much older records, extending from 1866 to 1893, had been kept by the late T. W. Parker, esq., Resident Magistrate, and these were presented to the Meteorological Office by Mr. H. Edwards, who had continued Mr. Parker's work for a few years. Another valuable record, from 1888 to the present, with many interesting details of the effects of the weather upon pastoral and agricultural affairs, was also loaned us by Mr. Jas. Macpherson of Totara Station.

The annual rainfalls for Oamaru are as follows:

TABLE 1.—Annual rainfall at Oamaru, New Zealand, 1867 to 1906.

Year.	Inches.	Year.	Inches.	Year.	Inches.	Year.	Inches.
1867	23.58	1877	26.75	1887	26.28	1897	14.12
1868	25.73	1878	20.26	1888	29.10	1898	15.96
1869	13.38	1879	25.26	1889	14.33	1899	27.41
1870	32.82	1880	20.37	1890	14.15	1900	20.36
1871	16.32	1881	13.47	1891	16.60	1901	18.79
1872	19.93	1882	25.67	1892	23.03	1902	23.56
1873	28.00	1883	23.23	1893	20.04	1903	13.37
1874	21.79	1884	26.82	1894	23.71	1904	19.62
1875	23.39	1885	16.81	1895	24.26	1905	23.26
1876	17.20	1886	26.36	1896	23.75	1906	14.81

The average rainfall for these forty years is 21.87 inches;