

wave in western Colorado, northeastern Arizona, and southeastern Utah were also distributed on the morning of the 20th. Snows occurred in the region mentioned, with a cold wave in southern Utah and extreme eastern New Mexico. The required fall in temperature, however, failed to occur in western Colorado, north-central and northwestern New Mexico, and northeastern Arizona, as the low which was over western Colorado decreased slowly in intensity and finally disappeared over New Mexico on the morning of the 23d. Warning of a moderate cold wave in eastern Montana, issued on the evening of the 29th, was verified in the extreme eastern portion of the State.

Local cold waves without warning occurred on the 13th at Lander; on the 20th and 25th at Havre, and on the 31st at Miles City. More general cold waves without warning occurred in eastern Montana on the 17th, and in southern and western Montana and eastern Wyoming on the 21st, due to the unexpected development of HIGHS along the northwestern border. In the latter instance the temperatures throughout about all of that region were already severely low on the morning of the 20th.

Warnings of strong southerly to westerly winds in eastern Colorado and Wyoming were issued on the evening of the 6th for the benefit of aviation interests. A warning of strong westerly winds in the same region was furnished to these interests on the evening of the 28th. Both warnings were fully verified.—*J. M. Sherier.*

SAN FRANCISCO FORECAST DISTRICT

The month opened with a disturbance of marked intensity central over the Gulf of Alaska, in which the minimum pressure was below 28.50 inches. This disturbance moved east-northeast and caused rains over the north and central portions of this forecast district and southerly gales along the Washington-Oregon coast, for which storm warnings were issued the morning of the 1st. The highest wind velocity reported during the prevalence of this disturbance was 76 miles an hour from the south at North Head, Washington. This disturbance was the first of a number to move eastward over the northeast Pacific Ocean and give rains over the north and central parts of this forecast district and high winds on the coast. On 15 days of the month storm warnings were ordered for some part of the coast, principally the coast north of Cape Mendocino, but on the 9th, 10th, 14th, and 19th, storm warnings were displayed on the north part of the California coast. The record shows that six well-defined disturbances crossed the coast line during the month.

Beginning on the 11th and continuing through the 19th rains and snows became general over the Pacific Northwestern States and following the series of disturbances that passed over this area the barometer rose rapidly, the wind became north and northeastward, and the coldest weather of the winter overspread Washington, Oregon, Idaho, and Nevada during the 20th to 24th. This cold wave was attended by temperatures below zero over the eastern parts of Washington and Oregon and over Idaho and northern Nevada. Except in Idaho and northern Nevada, for which cold wave warnings were ordered, the fall in temperature was not sufficient to verify cold-wave warnings. Nevertheless, cold-weather forecasts were issued for all of these States well in advance of the occurrence of the cold weather. Advancing southward the cold wave was greatly modified, but it brought freezing temperature or frosts to nearly all parts of California and necessitated the issue of frost warnings for the benefit of fruit growers and others.

On the 26th when the pressure was low and falling rapidly over the Gulf of Alaska storm warnings were displayed on the Washington-Oregon coast and were repeated on the 27th for the inland waters of Washington. This was a pronounced disturbance and was attended by general rains except in southern California and southern Nevada. The highest wind velocities of the month were recorded at northern stations during this storm, maximum 80 miles an hour from the south at North Head, Wash., on the 27th.) On the 31st, when a disturbance was detected far to the westward, southeast storm warnings were ordered for the Washington-Oregon coast. This disturbance moved eastward, causing general rains and snows over the northern half of the forecast district and southerly gales along the north coast.—*E. H. Bowie.*

RIVERS AND FLOODS

By H. C. FRANKENFIELD

Tennessee River.—As was stated in the MONTHLY WEATHER REVIEW for December, 1926, the flood in the Tennessee River had just about reached Decatur, Ala., by the end of that month. The rise began with the heavy rains of December 20–21, and the still heavier rains of December 23–25 soon carried the stream to flood stage. Above Chattanooga, Tenn., the crest stages were only a foot or two above the flood stages, although some of the tributaries, notably the Clinch River and the North Fork of the Holston River, were relatively much higher. The moderate flood at Knoxville, Tenn., came mainly from the Holston River drainage. The average rainfall below Chattanooga from December 20 to 29 was a little less than 9 inches and the flood was a severe one, with crest stages ranging from 4.3 feet above the flood stages at Bridgeport, Ala., to 17 feet above at Riverton, Ala.

The usual warnings were issued well in advance of the flood and frequent supplementary advices during its progress, although over the middle and lower river the distribution of the latter, as well as the receipt of reports, was much hampered by ice on wires and local interruptions due to the holiday season. Direct losses above Decatur, Ala., were about \$60,000, mainly in corn in river bottoms which for some reason was not removed when the warnings were issued. In the city of Chattanooga about 2,500 persons were out of their homes at the height of the flood, and some relief measures were necessary. Below Decatur reported losses were \$360,000, of which \$269,950 was in matured crops, while the reported value of property saved through the warnings was \$192,000.

Green River of Kentucky.—The flood in the Green and Big Barren Rivers was likewise severe. Preliminary warnings were issued on December 21, or as soon as the first reports of heavy rain were received, and frequently thereafter. The highest water reported was 49.3 feet, 16.3 feet above the flood stage, on December 27, at Lock No. 4, Woodbury, Ky. Reports as to losses and damage were so conflicting as to be worthless. They were of the usual character, but probably least in crop losses owing to the time of the year.

Ohio River.—During the December-January period the Ohio River was in flood only from Dam No. 44, Leavenworth, Ind., to its mouth, and only moderately so above the mouth of Green River. The crest passed Cairo, Ill., into the Mississippi River on January 12 with a stage of 48.9 feet, 3.9 feet above flood stage. While the warnings issued were timely and accurate, the losses in matured crops were great. The flood was the earliest winter flood of consequence of which there is record, and long periods of wet weather during the