

pressures persisted most of the time in western Canada east of the Continental Divide and on the extreme northeastern Rocky Mountain slope.

Warnings of moderate cold waves were issued as follows: North-central Arizona on the morning of the 1st, northeastern Colorado and southern Wyoming on the evening of the 10th, southeastern Colorado on the morning of the 14th, Wyoming and northeastern Colorado on the morning of the 20th, east of the Divide in southern Montana and Wyoming on the evening of the 20th, eastern Colorado on the morning of the 21st, eastern Colorado and southeastern Wyoming on the evening of the 21st, southeastern Colorado on the morning of the 22d, east of the divide in Montana on the morning of the 26th, and southwestern Utah on the morning of the 29th. Warning of a severe cold wave was issued on the evening of the 19th for that portion of Montana immediately east of the divide and on the morning of the 21st for Wyoming. As a rule, the warnings were verified.

Cold waves without warnings occurred in eastern Montana and northern Wyoming on the 10th-11th, in north-central Arizona on the 23d, in northeastern Montana on the 29th, and in southeastern Wyoming and portions of central and northeastern Colorado on the 30th.

As snow and strong northerly winds were indicated in southern Wyoming at the time of the evening forecast of the 10th, and rains, turning to snow, with fresh to strong westerly winds, becoming northerly, when the morning forecasts of the 20th were made, livestock warnings were included in the cold-wave warnings for that State. The warnings were justified.

For the benefit of aviation and livestock interests, warnings of strong winds were also issued for Wyoming and eastern Colorado or portions of this region on the 2d, 6th, 7th, 8th, 9th, 10th, 19th, 20th, 21st, 24th, and 25th, for Montana and Wyoming on the 25th, and for Montana, Wyoming, and northeastern Colorado on the 27th and 28th. These forecasts were generally verified.

Frost warnings were issued for south-central and southeastern Arizona on the 1st, 22d, 23d, and 30th. The warnings of the 22d and 30th were verified, but those of the 1st and 23d failed of verification, due to the failure of HIGHS which were then over the plateau to advance southward.—*J. M. Sherier.*

SAN FRANCISCO FORECAST DISTRICT

The weather charts of the month showed that seven well-defined depressions crossed the coast line and passed into the interior and affected the weather over a part or the whole of this forecast district. Four of these depressions crossed the coast line north of Cape Flattery and three, those of the 6th, 9th and 12th, in their eastward movement crossed the coast line south of Cape Flattery and caused general rains over the southern parts of this forecast district.

The month was a stormy one over the northeast Pacific Ocean and as disturbances were detected over the ocean the issue of storm warnings became necessary, this occurring on a number of occasions, namely, for a part or the whole of the coast line, on the 1st, 8th, 11th, 12th, 15th, 18th, 22d, 26th, and 29th. The storm following the warning of the 18th was the severest of the month along the coast of Washington and Oregon, the wind reaching a velocity of 72 miles an hour at North Head and 82 miles an hour at Tatoosh Island during the night of the 18th. The storm of the 23d following the warning issued on the 22d was also severe, and, like that of the night of

the 18th, caused distress to a number of vessels off the north coast. The other storms during the month were of only moderate severity, but in all instances the attending winds justified the issue of the storm warnings. The warning issued on the 22d was a warning for a whole gale and was equivalent to a hurricane warning.

Frost warnings were issued for northern California on the 22d, 23d, and 24th of the month, and for the northern parts of the forecast district as occasion demanded.—*E. H. Bowie.*

RIVERS AND FLOODS

By H. C. FRANKENFIELD

Aside from the disastrous New England flood, which is discussed in full elsewhere in this REVIEW, there were no rises of importance during November. Such others as did occur were without damage, except as noted below for the Allegheny and Willamette Rivers. The rise in the Illinois, which continued into December, will be reported upon in the REVIEW for that month.

Allegheny River.—Over the drainage area of this stream the precipitation for the month was large, and moderate floods occurred on November 18 and again on November 27 and 28. At Lock No. 5, Freeport, Pa., water from the first rise cut into the left bank just below the dam and damaged the bank and adjacent property. The highway was undermined and washed away; also three houses on the opposite side of the highway. The damage amounted to about \$15,000. Crest stages at Pittsburgh, Pa., were 21.4 feet at 10 a. m. November 19 and 23.1 feet at 8 a. m. November 29.

Willamette River.—Heavy rain on November 24 over the lower portion of the drainage area, where, owing to a previous excess of precipitation, the ground was saturated and the streams already unusually high for the season, caused a rise to above flood stage at Portland, Oreg., on the 26th. Thereafter further rains and high water in the Columbia River increased the Portland stage until, on the 29th, the crest of 17.5 feet was reached at 3 p. m. The damage was slight, except at Kelso, Wash., where it is reported that, due to overflow from Coweman Creek, part of the city was under water for several days. Some damage was done also to highways, bridges, and railroads along small streams. In Portland the flood warnings, which were ample and well verified, permitted the removal of property from threatened basements and docks, so that the losses were practically negligible.

River and station	Flood stage	Above flood stages—dates		Crest	
		From—	To—	Stage	Date
ATLANTIC DRAINAGE					
Merrimac:	<i>Feet</i>			<i>Feet</i>	
Concord, N. H.	10			12.2	Nov. 5.
Manchester, N. H.	8			11.2	Do.
Connecticut:					
White River Junction, Vt.	15	4	8	35.0	Nov. 4.
Bellows Falls, Vt.	12	7	7	35.6	Do.
Holyoke, Mass.	9	4	8	14.8	Nov. 5.
Hartford, Conn.	16	4	10	29.0	Nov. 6.
Hudson:					
Troy, N. Y.	15	4	5	21.7	Nov. 4.
Albany, N. Y.	12	4	5	16.9	Nov. 5.
Susquehanna:					
Oneonta, N. Y.	12	4	5	13.2	Nov. 4.
Bainbridge, N. Y.	11	24	24	11.0	Nov. 24.
Unadilla: New Berlin, N. Y.	8			9.0	Nov. 18.
GREAT LAKES DRAINAGE					
St. Joseph: Montpelier, Ohio.	10			14.0	Nov. 30.

¹ Estimated.