

the fall at Roswell amounted to 22° during the 24 hours ending at 8 p. m. Sunday, the minimum temperature on Monday morning was 28° or 8° above the verifying limit. Snow fell in northern New Mexico and eastern Arizona on the 8th-11th, with rain, turning to heavy snow, in extreme eastern and southern New Mexico on the night of the 9th-10th, the snow continuing through the 11th. Gales prevailed in central and western New Mexico on the 10th and 11th. According to newspaper reports, 11 persons lost their lives in northern New Mexico as a result of the storm, and hundreds of automobile tourists were unable to proceed across the northwestern portion of that State on account of the heavy snow.

Another storm began to develop over the southern Rocky Mountain Plateau on the 18th and was central over southern Nevada on the morning of the 19th. On the morning of the 20th, when the center was over northern Arizona, warnings of a moderate cold wave and livestock warnings were issued for southwestern Colorado, extreme northwestern New Mexico, north-central and northeastern Arizona, and southern Utah. On account of a decrease in intensity of the LOW, the cold-wave warning was verified in north-central and northeastern Arizona, only. Snow fell in all of the sections specified throughout the 20th and continued in northern New Mexico and southwestern Colorado until the night of the 21st-22nd.

Warnings of a moderate cold wave were issued on the evening of the 26th for northern and eastern Colorado, and on the morning of the 27th for Colorado, northern New Mexico, northern and central Arizona, and southeastern Utah, because of the southeastward movement of a LOW of considerable intensity which was central on the evening of the 26th over eastern Colorado and which on the morning of the 27th extended from the upper Lake region southwestward to northern Arizona, with the principal center over southern Iowa. Owing to the failure of the western extremity of the barometric trough to advance southward, and because of the development of a secondary storm over eastern Colorado on the 27th-28th, the warnings were not verified, although the temperature fell sharply on the western slope of Colorado. During the 27th-29th a disturbance of decided intensity advanced southeastward from Alaska, with its center on the morning of the last-named date over Wyoming, while an area of high pressure, attended by a severe cold wave, occupied the extreme northeastern Rocky Mountain slope. Warnings of a severe cold wave and livestock warnings were issued for eastern Colorado on the morning of the 29th and extended to north-eastern New Mexico at 2 p. m. of the same day. Warnings of a severe cold wave in eastern and central Colorado and northeastern New Mexico were repeated on the evening of the 29th, and on the morning of the 30th these were extended to include southeastern New Mexico. Warnings of a moderate cold wave were also issued on the morning of the 30th for western Colorado, northwestern New Mexico, northeastern Arizona, and southeastern Utah, together with livestock warnings for southwestern Colorado, northwestern New Mexico, north-eastern Arizona, and southeastern Utah. The warning of a severe cold wave in southeastern New Mexico was repeated on the evening of the 30th, followed on the morning of the 31st by a further warning of a moderate cold wave in the same section.

These warnings were completely verified, except that the fall in temperature at Roswell between the mornings of December 31 and January 1 amounted to but

14°, with a minimum of 14°. Temperatures below zero extended to northeastern Colorado on the morning of the 30th and to all of southern Colorado and extreme northern New Mexico on the morning of the 31st. The cold wave was preceded or accompanied by snow in about all portions of the district except extreme southern New Mexico and southern Arizona, with heavy snow during the 30th in southwestern Colorado and north-eastern Arizona.

A cold wave, without warning, occurred in north-central Colorado on the 13th, due to the eastward movement of a secondary depression which was central over the southeastern portion of the State on the morning of that date, and to the rapid southeastward advance of a HIGH from the north Pacific slope. Local cold waves, also without warning, occurred at Roswell and Durango on the 23d.

Freezing temperatures were forecast for south-central Arizona on the 9th and 12th and for southeastern Arizona on the 13th and 31st. Warnings of heavy frost were issued for south-central Arizona on the 4th, 5th, 6th, and 23d; for south-central and southwest Arizona on the 9th and 12th; for southwestern Arizona on the 13th and 31st; for southern Arizona on the 20th, 21st, 22d, 25th, and 27th.

The temperature failed to reach the freezing point in the sections mentioned on the mornings of December 10 and 14 and January 31. As a rule, the frost warnings issued were verified by temperatures at which frost might be expected to occur.—*J. M. Sherier.*

#### SAN FRANCISCO FORECAST DISTRICT.

Although December was more stormy than usual in the north portion of the district, the rainfall was unusually light in the California valleys, and there was at the close of the month a marked deficiency in the amount of snow in the Sierra Nevada Mountains. Storms moved with considerable regularity across the northern boundary of Washington and Idaho, but only a small one entered the United States south of the Columbia River, and that was not till the next to the last day of the month. The most severe storms occurred on the 6th, with a maximum wind velocity of 84 miles from the south at North Head; 10th-11th, maximum wind Nelo city 76 miles south at Talovsh Island; 18th, maximum wind 80 miles south at North Head; and on the 25th, with a maximum wind velocity of 72 miles from the southwest at North Head. This Christmas storm also caused a maximum wind velocity of 68 miles from the south at Seattle, which is one of the most, if not the most severe wind ever experienced in that city. Storm warnings were issued for one or more places in the district on 17 days and in all cases well ahead of the occurrence of the high winds.

Although frost formed frequently in California and it was necessary to issue frost warnings on no less than 18 days, the damage done by them was not great, largely on account of the protective measures taken by the growers to prevent injury. A cold-wave warning was issued on the morning of the 30th to cover places in eastern Oregon, eastern Washington and Idaho. The temperature eventually reached the zero mark in these localities, but not soon enough to completely verify the forecast.

The stormy conditions in the north and the lack of precipitation in the south were due to persistent low pressure over Bering Sea and the Aleutian Islands, which made the northern track for storms the most feasible to take in their eastward movement.—*E. A. Beals.*