

before in the Tri-Cities as far as is known, except possibly over very limited areas. It has been noted that, for the 30-year period, 1893 to 1922, inclusive, 10,956 days, the record at the Davenport station shows 213 days with dense fog. In other words, there has been only one day with dense fog out of every 51 days during the past 30 years.

Although the fog may have extended much farther, it is known that dense fog prevailed along the Mississippi River from Princeton, Iowa, about 20 miles upstream from Davenport, to Muscatine, Iowa, about 30 miles downstream. Its probable extent inland on either side of the Mississippi was from 2 to 5 miles. However, the area of denser fog apparently extended from east of Moline due westward and northwestward over the Tri-Cities to considerably beyond Nahant, a distance of about 10 miles, with the densest fog overlying parts of Moline and Rock Island. In Davenport, the dense fog seemed to be broken here and there by spots where one could see objects from 500 to 1,000 feet distant, and from where the cloudlike tops of the denser fog areas could be faintly distinguished. From the latter it was estimated that the thickness of the fog was probably 600 to 800 feet.

Referring to the weather map on the morning of November 3, it will be noted that high pressure prevailed

over Iowa and Illinois and that there was little or no wind. The rainy weather of November 1, followed by entirely overcast skies until about 10 p. m. on November 2, resulted in high humidity, the relative humidity at 7 p. m. on November 2 being 79 per cent at a temperature of 54°. A cubic foot of air at a temperature of 54°, with a relative humidity of 79 per cent, contains approximately 3.73 grains (troy) of water vapor. By cooling, a cubic foot of air with a water vapor content of 3.73 grains (troy) reaches the point of saturation at a temperature of about 47.3°. From 7 p. m. of the 2d to 2 a. m. of the 3d, the temperature on the roof of the post-office building in Davenport dropped from 54° to 48°. It will be noted that the fog changed from light to dense at about 2 a. m. The temperature continued to fall slowly till about 7:30 a. m., when the minimum of 42.4° was recorded.

The weather conditions overlying the Tri-Cities on November 3 as pictured on the morning map, that is, high pressure, clear skies over the surrounding territory, and little or no wind movement, together with the conditions that prevailed locally during the preceding two days, were ideal for the formation of very heavy fog over this vicinity. The visibility during the fog was undoubtedly lessened by the presence of city smoke.

WINDSTORM AT INDEPENDENCE, CALIF., FEBRUARY 12, 1923.

By C. D. ASHER, Observer.

[Weather Bureau Office, Independence, Calif., February 27, 1923.]

The storm described in this note was remarkable in that it seems to have been a violent downrush of wind from the high Sierras immediately to the westward of Owens River Valley, extending in a north-south line for a hundred miles or more. At the time of the windstorm there was a cyclonic system that had moved inland and a little southeastward from the Oregon coast during the early morning of the 12th, 300 miles due north of Independence. Since it occurred in the early morning hours, vertical convection must be eliminated as a contributing cause. The absence of any whirling motion as indicated by the distribution of the debris seems to preclude the idea of a tornado, although the barograph trace, Figure 3, is quite suggestive of pressure fluctuations in a tornadic storm.—*ERROR.*

A mountain windstorm of unprecedented severity for eastern California occurred on the Sierra side of Owens River Valley during the morning of February 12, 1923. The wind at Independence blew at the rate of 70 miles per hour or more from 3:30 a. m. to 5:30 a. m., and reached a maximum of 80 miles per hour from the southwest at 4:20 a. m. The direction of the wind varied from southwest to west, coming directly down from the mountains—the highest section of the Sierras. Much damage was done by the wind in a strip of country about 100 miles long along the highway from Levinning Valley in Mono County to some distance south of Olancho in Inyo County, the damage varying in intensity at different points. In Long Valley and Round Valley and approaching Big Pine considerable damage was done, while Bishop, Big Pine, and Lone Pine, all in the northern part of Inyo County, escaped with practically no destruction. At Aberdeen, Fort Independence, Independence, Manzanar, Cartago, and Olancho much damage was done. The Sierra Power Co. sustained the greatest individual loss. Forty-three of their big transmission-line steel towers, foundations and all, were wrecked. More than 90 pole structures of this company between Bishop and Hot Creek went down. The steel towers that were wrecked stood in the vicinity of Olancho, between Olancho and Lone Pine and between Big Pine and control station.

The Inter-State Telegraph Co. was probably the next heavy loser. A great part of their line through the valley was blown down. Their loss will exceed \$10,000.

Much damage was done to the power plant, belonging to the city of Los Angeles, at Division Creek and Cottonwood.

In the Aberdeen section north of Independence a number of houses were wrecked, but fortunately the occupants escaped injury; great damage was done to pumping plants, plowed fields, farming implements, trees, etc. In some cases the wind not only demolished houses but carried away household effects and wearing apparel.

The historic old mill on Oak Creek was demolished and the Mount Whitney Fish Hatchery further west on Oak Creek lost about half of its tiled roofing. In Independence the principal damage was to the new courthouse, although there was considerable private property loss. All homes were damaged to some extent. The courthouse damage will amount to about \$7,000. At least 24 of the large plate-glass window panes were demolished by the storm. About 500 trees in town were uprooted and many others broken off.

Further down the valley, at Cartago, five 3-room houses were overturned or wrecked and the store at Olancho was demolished.

It was not a tornado but a straight blow, which was evidenced by the fact that all the wrecked trees and houses throughout the territory were blown in the same direction, namely, toward the northeast. The most remarkable fact about the storm effect was the amount of sand, rocks, and debris that the wind carried along with it and the force with which it was carried. The roads were swept clean of sand, soil, and pebbles, leaving only the larger rocks. At some places windrows of gravel were made, leaving the ground not unlike an abandoned cornfield. Plowed fields were swept clean. The rain-

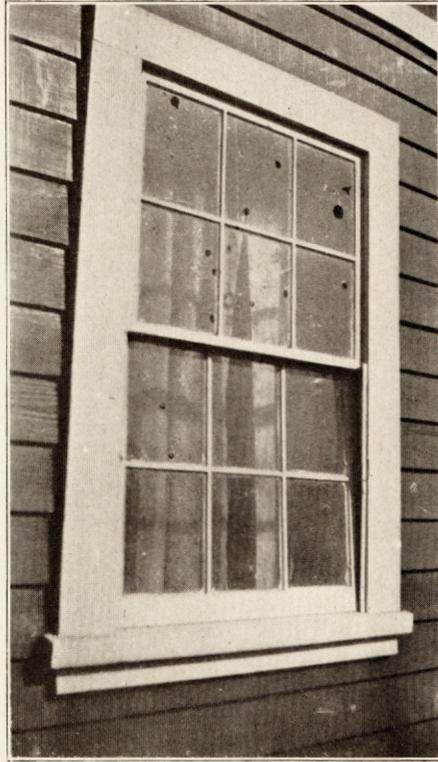


FIG. 1.—Windows penetrated by pebbles in wind-storm at Independence, Calif.



FIG. 2.—Demolished ranch house at Fort Independence, Calif. Sierras in background.

gage and other painted instruments of the Weather Bureau equipment had the paint sand-blasted from them, as did some houses about town. The rain gage on the Weather Bureau grounds registered 0.15 inch of sand.

Figure 1 gives an idea of the velocity of the pebbles that were carried by the wind. The window is riddled

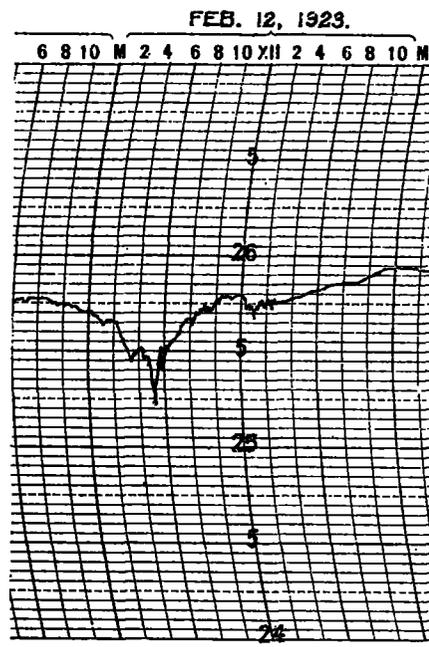


FIG. 3.—Barograph trace at time of windstorm at Independence, Calif., Feb. 12, 1923.

as if a machine gun had been turned on to it. The pebbles passed through without cracking the panes to the edge. Figure 2 shows a ranch house at Fort Independence after the storm.

The loss of the roof of the courthouse is explained as the result of internal pressure. No doubt if the windows

had not blown in the roof would have held intact. All windows in this building were heavy plate glass. It was the foreign objects in the wind that broke the windows and not the force of the wind. The writer experienced a 110-mile hurricane, with air free of débris, at Tatoosh Island, Wash., during which no windows in the Weather Bureau building were broken. The storm at Independence blowing 80 miles an hour carried a blast of sand and pebbles through all of the windows in the Weather Bureau office facing the wind.

During the blow the sky was clear over the area of destruction, but a thick, heavy bank of stratus clouds hung over the eastern side of the valley, where but little effect of the wind is seen. During the evening of the 11th low temperature prevailed, but on the morning of the 12th the temperature increased with the wind. During the maximum phase of the storm the barograph trace for Independence shows (Fig. 3) a fall of half inch during the three hours preceding the highest wind. A fall of twenty-five hundredths inch took place during the 30-minute period preceding the peak of the storm. Light winds occurred at all the surrounding stations, except at Reno, Nev., about 200 miles to the northward. These facts lead to the conclusion that the influence of the storm was felt to the westward and northward only.

During the warm months the prevailing direction of the wind is up the valley, and in the other months it is down the valley. During the winter months moderately high winds from the northwest frequently occur. These winds, whether up or down the valley, are regular winds. Winds from the northeast or east seldom occur. The northwest winds are cold and dry and bring clear weather, and often continue at a rate from 25 to 50 miles an hour for several days at a time, but rarely reach destructive velocities. The destructive winds come from the west or southwest down from the mountains.

Since 1914 wind velocities of 60 miles an hour, or more, have occurred at this station six times.

Previous to this storm Owens River Valley has suffered but little from windstorms.

PREDICTING MINIMUM TEMPERATURES.

By WALTER J. BENNETT, Meteorologist.

[Weather Bureau Office, Tampa, Fla., February 19, 1923.]

The relation between relative humidity and dew point at the p. m. observation and the minimum temperature the next morning has been shown by Prof. J. Warren Smith and others to be a very real one. (Supplement 16, MONTHLY WEATHER REVIEW.) Also it has been shown that for some localities the mean solar noon observation may be used with great accuracy, and thus give a determination of the minimum temperature early enough in the day to be of practical benefit. (E. M. Keyser, MONTHLY WEATHER REVIEW, October, 1922.)

But it would be a mistake to put too much faith in the relative humidity and dew point observations, especially in cases when a drop in temperature is to be expected not from radiation alone, but from the bodily movement of a large mass of cold air. Such cases are of great importance in Florida.

A tolerably exact forecast of the minimum temperature is a real necessity for this section of the country.

A study of past records shows that when the temperatures mentioned in the next following paragraph are reached the results as indicated will follow. The temperatures are those recorded in the Weather Bureau thermometer shelter exposed on the roof of the post-office

building in Tampa. Ground and grove temperatures will run from 2° to 10° lower within a few miles, depending upon local conditions.

A temperature of 40° to 42° indicates light frost with little damage; 38° to 40° means considerable damage to tender vegetables; 36° to 38° much greater damage; 34° to 36° a damage of 50 per cent or more to vegetables; 32° to 34°, almost complete destruction of vegetables, except when protected or in specially favored localities; 30° to 32° kills vegetables and damages the young growth on citrus trees; 28° to 30° will kill young trees unbanked; 26° to 28° will freeze some oranges, kill young trees and seriously damage young growth; 24° to 26° will freeze many oranges and damage trees; 22° to 24° means practically all oranges frozen and many trees frozen to the ground. Below 22° means extremely great damage to all groves not protected by heaters.

To determine how valuable the indications of the noon relative humidity and dew point would be in determining the minimum temperatures, dot charts were made for the several months of December, January, February, and March covering five years past, and curves were drawn free hand. Separate charts were first made for clear,