SOUTHEASTERLY WINDS OF THE SOUTHERN SAN JOAQUIN VALLEY, CALIF.

By LEON J. GUTHRIE

[Weather Bureau office, Bakersfield, Calif., July 1934]

The San Joaquin Valley embraces the southern section of the Great Valley of California. It is elongated on a northwest-southeast axis and terminates in a mountainous semicircle formed by the Sierra Nevada, Tehachapi and coast ranges. Because of prevailing westerlies and the valley contour, winds persist from the northwest with few exceptions throughout the year. Southeast winds represent an occasional interruption due to major disturbances of the atmosphere. Nocturnal breezes that spring up from northeast to southeast are not considered here.

Records for Bakersfield, which is situated near the foot of the San Joaquin Valley, show the following general characteristics for southeast winds: They average 6 hours in duration and attain an average maximum velocity of 27 miles per hour; the highest recorded was 44 miles per hour. Such a velocity is remarkable in view of the sheltered topography in this area. Southeasterlies here must blow down from the mountains. A low dust cloud near the foothills, 30 miles southeast of Bakersfield, signals the beginning of the wind. Gradually the dust cloud rolls northwestward up the valley in a broad stream. Tejon Field, at the point of onset, reports the highest velocities, the winds spreading out rapidly and losing velocity as they move up the valley. They start blowing usually in the forenoon and reach a maximum velocity in the early afternoon.

Because of the foehn nature of the above winds, temperatures rise rapidly during the day, except when heavy snow lies on the mountains. Snow retards the dynamic warming of air that moves down the slopes, as also does winter radiation if the wind occurs at night. Melting snow modifies the extreme dryness of the air. The average rise in temperature with southeast winds at Bakersfield was 32 degrees during the day, the extreme was 50 degrees. From a value of 81 percent in the early morning, relative humidity fell to 5 percent on one occasion. Such a marked change in temperature and relative humidity could come only from the displacement of the surface air by air from a considerable height. The southeast wind blows most frequently in the winter and spring, and is associated with general atmospheric disturbances. It is usually accompanied by a steady falling of the barometer.

Weather charts show that southeasters portend a shift from high- to low-pressure control for the San Joaquin Valley. They seem to originate from the following synoptic situations:

(1) A vigorous cyclone approaching the coast of California.

(2) High-pressure overflow from a stagnating anticyclone over the Great Basin.

(3) Local low pressure that forms in the Great Valley due to relatively higher temperatures or other reasons.

Of course the first two situations might interact and contribute about equally to produce a southeaster of unusual strength and duration. They are far from being mutually exclusive.

Rain often follows under the first condition, and occurs principally after the wind has shifted to the west. Being essentially storm winds, the number of storms in a season determines the number of southeast winds. As a storm approaches from the west or northwest, the winds gain in velocity until arrival of the cold front and rain. At the first impact of these dry southeasters, the lowering clouds of the storm may be dispersed or ceilings forced to a high elevation. But with the arriving wind-shift line, ceilings again drop, and rain begins. The intermixing of the dry southeast winds with the moist storm winds breaks up the continuity of the storm front, producing spotted and often light rainfall. Some weak storms may be entirely checked by the blowing of too much wind from the southeast. This would partly explain why the warm front of a storm brings little or no rain to this section of California. It is a common phenomenon to have storms lose their intensity as they move down the San Joaquin Valley. Fresno which is north of Bakersfield receives about 9.82 inches of rain a year, while Bakersfield receives 5.71 inches.

The second condition of high-pressure overflow might occur without any well defined LOW off the coast of California. When an anticyclone stagnates over the western plateau and builds up to its greatest intensity, it resembles a vast reservoir of air to be disposed of. The accumulated air mass is dammed by the Sierra Nevada, and a sharp gradient develops over these mountains as a consequence. To the west, in the San Joaquin Valley, pressure continues relatively low. Subsidence begins to take place, the air seeks lower levels and an outlet to the Great Valley or the ocean. Settling of the air might equalize gradients at high levels but it intensifies them below. This calls for movement of air over the lower ranges or through mountain passes by overflow. These winds reach high velocities in mountain passes sloping downward to lowland valleys or coastal plains. Anticyclonic air restricted by the high Sierra, overflows the lower reaches of these mountains where they join the Tehachapi Range, and the overflowing air is deflected downward to the valley floor.

In the lower San Joaquin Valley, the wind appears first at Tejon Field, which is located at the exact foot of the valley. From here it propagates northward, diminishing as the valley widens out before it. Ordinarily this true overflow does not travel much beyond Bakersfield. It varies much in respect to turbulence, judging by the heights to which dust is carried. With a southeast dust storm, dust was reported as high as 4,000 feet by pilots on March 6, 1931, but during most of these storms, only shallow dust clouds were stirred up. Despite some turbulence the air was stable in the beginning, otherwise it could not have flowed down into the valley. That the air is of high altitude origin is amply shown by its foehn characteristics—its extreme dryness and transparency. When the surrounding mountains stand out in fine relief, old residents believe that it is a sign of rain. This condition may be followed by low dust clouds at the foot of the valley, rolling to the north or west. Simultaneously, fresh to strong velocities reported at Tejon Field indicate that the southeast blow has come to the surface. Although the wind blows toward Bakersfield with as much as 40 miles per hour velocity, it may take 3 hours to cover the intervening distance to that city. This fact tends to show that the air stream spreads out and mixes by turbulence with the old valley air. Upon arrival at the more northerly station, velocities are usually diminished.

Some of the most violent of the continental overflows into the valley are caused by a stagnant Great Basin HIGH being wedged in between a cyclone lingering over the coast of southern California, and a companion or secondary cyclone over Arizona and New Mexico. In this case a high-pressure wedge extends down Nevada and the Sierra Mountains. Such a squeeze results in a forcing of air out of the HIGH with spilling of air down to the lower San Joaquin Valley. The wind pours through convenient mountain passes or over the crests of low ranges. At the same time, Los Angeles might experience a Santa Ana type of wind, blowing from the northeast down to the sea. High pressure overflow winds are evidenced at nearby mountain stations by strong northeasterlies and these same winds are in evidence at nearby coast stations, often to high altitudes. On one occasion the anticyclonic circulation was apparent over California even at the 10,000-, 12,000-, and 14,000-foot levels. These same winds are veered when reaching the San Joaquin Valley and blow from the southeast. As the barometer falls steadily with the blowing of the southeast winds, the anticyclone gradually expends itself and disappears, following which, in winter, a new air mass overlies the lower valley and the usual condition of valley ground fog may be forestalled for some period.

The third synoptic situation of low pressure developing locally in the Great Valley is attended by nearly the same phenomena as the approach of an ocean cyclone.

IS LOW RELATIVE HUMIDITY A GOOD INDICATION OF PRECIPITATION WITHIN THE NEXT 48 HOURS?

By A. R. Long

[Weather Bureau office, Memphis, Tenn., September 1934]

(Abstract [1])

A tabulation of 7,305 observations of 8 a. m. (seventy-fifth meridian time) relative humidity at Memphis, Tenn., during 1907–26, inclusive, classified by wind direction and season, and compared with the occurrence of precipitation during the following 12-, 24-, 36-, and 48-hour periods, led to the following results (after the omission of cases with less than 10 observations):

In all seasons, when the 8 a. m. humidity is from 51 to 80 percent, the chances for precipitation within 36 hours or less are very small, and remain small even up to 48 hours; from 81 to 90 percent, the chances increase, but the highest probability is only 0.81 within 48 hours with an east wind; from 91 to 100 percent, the chances (which, of course, vary with wind direction) are considerably greater.

These results do not bear out the contention sometimes made that low humidity is a good indication of precipitation within the next day or two; on the contrary, low humidity appears to be a good indication that precipitation will *not* occur within 48 hours. As a rule, the *higher* the humidity, the greater the chances that precipitation will occur within 48 hours.

AN UNUSUAL SNOWSTORM IN SOUTHEASTERN WEST VIRGINIA

By W. J. Humphreys

[Weather Bureau, Washington, September 1934]

The storm in question was that of February 26, 1934. The phenomena mentioned were described to me early in the following September by Mr. A. M. Eppling and others, of Gap Mills, W. Va. Here the snow fell until about 27 inches deep, and then changed to rain, followed by a freeze, that covered the whole with a sheet of ice 1 to 2 inches thick. A rare joy it was to boys with skates and sleds, but to stockmen a horror, for hundreds of sheep perished beneath it and neither cattle nor horses could cross it, even a short distance for feed or water, since at every step or attempted step the jagged edges of the broken crust cut their legs.

Then as the landscape lay bleak and imprisoned came mysterious sounds—muffled rumbles as of distant thunder or far-off blasting, owing, as finally found, to the sudden ripping of long rifts in the dense, thick glaze. Some of these were 2 inches wide, half a mile, or more, in length and quite straight.

Presumably it was a decrease in the temperature of the ice crust that caused it to become so strained that it finally broke; and a crack once started in this crust doubtless traveled with the high speed of the transverse elastic wave, producing as it went violent tremors and thereby a loud sound, muffled by the snow beneath, along its entire course. At any rate, owing to the damage done by this snow, the annoyance it caused, and the strange sounds it produced, the date of its occurrence is now one of the fixed points in the local chronology.

[1] The complete original manuscript is on file at the central office of the Weather Bureau, Washington, D. C.