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AN OBSERVATION OF VARIABLE WATER-VAPOR CONTENT IN RAPIDLY-MOVING AIR MASSES

By ARTHUR ADEL and C. O. LAMPLAND

[Lowell Observatory, Flagstaff, Ariz., March 1939]

In the course of systematic measurements, at the Lowell Observatory, of the water-vapor content of the entire depth of the atmospheric column, an effort is being made to secure observations under varied conditions that should be fairly representative of the weather for the different seasons, including extreme as well as average conditions.

The present note deals with one of the rather unusual records. In the Southwest, in late autumn or winter, there occasionally blows a strong, cold, and dry wind from the northeast. This peculiar wind, which may continue for from 1 to 3 days, is accompanied by characteristic conditions, in that rarely is there any appreciable precipitation; the barometer is generally at maximum height; there is little or no cloudiness; and the surface humidity is low. The transparency of the atmosphere is excellent, as shown by the deep blue of the daytime sky and the sparkling brilliance of the stars at night. These strong winds from the northeast are, in general, accompanied by low temperatures, but there are exceptions to this condition.

The observations here to be described were made during such a wind.

As already mentioned, under these conditions humidity measurements by dry- and wet-bulb readings near the surface indicate a low water content for the air. This property was long ago found to be true for the entire atmospheric column as determined spectrographically in connection with the Observatory's planetary spectroscopic investigations. At that time, however, it was not feasible to determine quantitatively the absolute amount of water vapor in the atmospheric column. With the installation of a recording infrared spectrometer in 1937, such quanti-

tative determinations have become a part of an Observatory program of atmospheric research. The spectroradiometer installation occupies the northeast corner of the main building of the Observatory, the building itself being located on the northeast promontory of the Observatory mesa. It may also be mentioned that on this high plateau and the mountainous regions to the northeast, there are no extended bodies of water.

The 23d of November 1938, offered a favorable opportunity to measure the water-vapor content of rapidly-moving air masses during a strong wind from the northeast. Fowle's spectroscopic method for determining the water-vapor content of the entire atmospheric column was employed, with the sun as the source of radiation; and the percentage absorption in the water vapor band Phi, center at 1.14 μ , was the specific item utilized on this date.

Three independent spectroscopic measures of water vapor were made respectively at 10:28 a. m., 10:34 a. m., and 10:47 a. m., M. S. T., surface temperature 25° F. The measures were accordingly made through very nearly air mass 2. Reduction to unit air mass, which may not be significant in view of such variability, yielded in millimeters of an equivalent layer of liquid water: 0.3, 0.8, and 0.5, given in order to correspond to the times of observations listed above.

It is worth mentioning that probably the reason for the fluctuation being of the order of the vapor content itself is in great measure the smallness of the latter. In other words, had this fluctuation of a fraction of a millimeter occurred during the wettest part of our summer rainy season when the water-vapor content of the air averages about 18 millimeters it would have passed unnoticed.

UNUSUAL FLUCTUATIONS IN THE DEW-POINT ALONG THE SOUTHERN CALIFORNIA COAST

By DEAN BLAKE

[Weather Bureau Office, San Diego, Calif., June 1938]

San Diego was one of the first Weather Bureau stations to use hygrometrical data in predicting minimum temperatures. In 1917, Henry F. Alciatore, then in charge, experimented with formulas for the citrus belt of San Diego County, the basis being the dry-bulb and dew-point temperatures, and the relative humidity at the regular 5 p. m. observations (P. S. T.). Besides developing hygrometrical formulas, various of the other methods then being tested, such as the "least square" and "median temperature," were carefully studied and applied.

It was early discovered that there was a sufficiently constant relation between the dew-point at San Diego and minimum temperatures the next morning at back-country stations to justify the issuance of forecasts. This was particularly gratifying as the observations were taken 62 feet

above ground on the roof of the Post Office and Custom House Building, and the elevations of the stations, for which the predictions were made, were from 110 to 657 feet above sea level, and their distances from San Diego ranged from 8 to 32 miles.

After further investigation a statistical method employing combinations of the dry-bulb temperature, dew-point, and relative humidity at 5 p. m. was adopted as the most practical and accurate. In view of the lack of psychrometric readings at the stations for which the predictions were made, the percentage of verification was unexpectedly high.

In the main, Alciatore's method is still in use at San Diego, and the dew-point, because of its relative conservatism, continues the basis for the predictions. It is true,