SECTION II.—GENERAL METEOROLOGY.

SOLAR DISTURBANCES AND TERRESTRIAL WEATHER.

By ELLSWORTH HUNTINGTON, Research Associate in Geography.

[Dated: Yale University, New Haven, Conn., Mar. 7, 1918.]

(*Continued from* this REVIEW, April, 1918, p. 177.)

III. FACULÆ AND THE SOLAR CONSTANT COMPARED WITH BAROMETRIC GRADIENTS.

NOTE.—The third and final section of this paper will *appear in the next (June) number of the* REVIEW.

—EDITOR.

PREDICTING MINIMUM TEMPERATURES IN GRAND VALLEY, COLO.

By ESEK S. NICHOLS, Meteorologist.

[Weather Bureau office, Grand Junction, Colo., April 18, 1918.]

The devising of methods of predicting minimum temperature, particularly in spring, has been the object of several unpublished studies undertaken by the writer since his assignment to the Grand Junction station in the spring of 1911. These investigations, based on local records, have been of much importance locally, because of the use of temperature forecasts in connection with orchard heating in the Grand Valley, in the midst of which Grand Junction is located.

Previous studies by the writer.—The first of those special studies, made in 1911, considered the minimum temperature as a possible function of the dewpoint that had been recorded at the preceding evening observation; but the conclusion was reached that "there is no useful relation between the two meteorological elements considered. This agrees with the results obtained by Cox[1] in the cranberry marshes of Wisconsin. * * * the dewpoint itself is no indication whatever of the ensuing minimum temperature."

The most important of the special studies was the investigation of the relation between the daily maximum temperature and the ensuing minimum temperature. The individual cases were classified according to evening dewpoint and state of weather and wind in the morning. It was found that, for the month of April, at Grand Junction

$$y=\frac{5}{8}x+z$$

where y is the minimum temperature, x is the maximum temperature, and z is a variable whose value depends on the "class" to which the case belongs. The effect of atmospheric moisture in retarding nocturnal cooling is shown by the following equations, which were obtained for cases classified according to evening dewpoints.

Evening dewpoint.	*Equation.*
20° F. or lower.	$y=\frac{5}{8}x-3$.
21° to 30°.	$y=\frac{5}{8}x-1$.
31° to 40°.	$y=\frac{5}{8}x+1\frac{1}{2}$.
Over 40°.	$y=\frac{5}{8}x+2$.

The effects of state of sky, precipitation, and wind were shown in a similar manner by equations. All equations were plotted on cross-section paper, and have been used with much success in predicting minimum temperature during frost seasons.

Previous method of forecasting for Grand Junction district.—Having determined the probable minimum temperature at Grand Junction, there remains the problem of predicting the temperatures in the orchard districts of the vicinity, where several fruit-district stations have been maintained since 1913. A brief description of the topography of the fruit district, accompanied by an outline map, is contained in my article, "A temperature inversion in the Grand River Valley, Colo."[2] It was at once found:

1. That the relation between the temperature at any one station and that at Grand Junction is variable.

2. That the relations between the temperatures at the different stations on a given date are variable also. These variations accompany different types of pressure distribution and variations in cloudiness, humidity, wind direction and velocity, etc., which must be known or predicted before the temperature forecasts can be made with accuracy.

Hence the method that has been used in forecasting for the fruit district consists of three principal steps:

(*a*) Study of the weather maps and local reports to determine the probable state of the sky, pressure distribution, wind, etc., over the district the following morning.

(*b*) Computation of the probable minimum temperature at Grand Junction, using results obtained under (*a*) and the equations described above.

(*c*) Estimation of the probable minimum temperatures at the substations, using the results obtained under (*a*) and (*b*), and considering topography and individual peculiarities of each substation.

Development of Smith hygrometric formula.—While this method has been very successful, especially in predicting for Grand Junction, it is complicated and requires that the forecaster shall have had long experience in the locality. As substation records for a four-year period have now accumulated, it was intended for the sake of convenience and greater accuracy to compute substation formulæ similar to those used for Grand Junction; but a test of the hygrometric formula developed by Smith shows that it is both accurate and convenient.[3]

In considering the use of the hygrometric formula in predicting minimum temperatures for the Grand Valley stations, it occurred to the writer that the hygrometric conditions observed at Grand Junction must be representative of, or at least related to, those that exist in other parts of the valley. Therefore, it appeared probable that the readings taken at Grand Junction at the regular evening observation (5:40 p. m., local standard time) might be used in computing constants for predicting minimum temperatures at the substations. This

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[1] Cox, H. J. Frost and temperature conditions in the cranberry marshes of Wisconsin. (Weather Bureau, Bulletin T.) Page 84.

[2] MONTHLY WEATHER REVIEW, November, 1915, 43: 562–563.

[3] Smith, J. Warren, "Predicting minimum temperatures." MONTHLY WEATHER REVIEW, August, 1917, 45: 402–407.