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By AMY P. LESHER

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SOLAR OBSERVATIONS

[Meteorological Research Division, EDGAR W. WOOLARD in charge]

SOLAR RADIATION OBSERVATIONS, DECEMBER 1939

By IRVING F. HAND

Measurements of solar radiant energy received at the surface of the earth are made at nine stations maintained by the Weather Bureau, and at ten cooperating stations maintained by other institutions. The intensity of the total radiation from sun and sky on a horizontal surface is continuously recorded (from sunrise to sunset) at all these stations by self-registering instruments; pyrheliometric measurements of the intensity of direct solar radiation at normal incidence are made at frequent intervals on clear days at three Weather Bureau stations (Washington, D. C., Madison, Wis., Lincoln, Nebr.) and at the Blue Hill Observatory of Harvard University. Occasional observations of sky polarization are taken at the Weather Bureau stations at Washington and Madison.

The geographic coordinates of the stations, and descriptions of the instrumental equipment, station exposures, and methods of observation, together with summaries of the data, obtained up to the end of 1936, will be found in the MONTHLY WEATHER REVIEW, December 1937, pp. 415 to 441; further descriptions of instruments and methods are given in Weather Bureau Circular Q.

Table 1 contains the measurements of the intensity of direct solar radiation at normal incidence, with means and their departures from normal (means based on less than 3 values are in parentheses). At Madison and Lincoln the observations are made with the Marvin pyrheliometer; at Washington and Blue Hill they are obtained with a recording thermopile, checked by observations with a Marvin pyrheliometer at Washington and with a Smithsonian silver disk pyrheliometer at Blue Hill. The table also gives vapor pressures at 7:30 a. m. and at 1:30 (75th meridian time).

Table 2 contains the average amounts of radiation received daily on a horizontal surface from both sun and sky during each week, then departures from normal and the accumulated departures since the beginning of the year. The values at most of the stations are obtained from the records of the Eppley pyrheliometer recording on either a microammeter or a potentiometer.

Direct radiation intensities averaged close to normal at all four stations.

Total solar and sky radiation was above normal at every station during December. With the exception of Twin Falls, Riverside, and Miami, all stations showed an excess in total solar and sky radiation during the entire year; the excess being particularly marked at Washington, Madison, and Chicago.

Polarization observations made at Madison on 4 days give a mean of 69 percent with a maximum of 73 percent on the 8th. These are close to normal for December.

The normal incidence reading of 0.048 gram calorie (corrected for mean solar distance), made at 5.0 air mass on the afternoon of December 12, 1939, at Lincoln, is the lowest ever recorded by this bureau through any of the standard air masses. K. W. Kemper's original notations on the record sheets for this day read, "Sky very dusty. Visibility fair. Brisk northwest wind. No clouds."

With no clouds present, the depletion of radiation cannot be attributed to condensed water-vapor, while the "fair visibility" clearly indicates that most of the dust was above the observer, or at an elevation of more than 100 feet above ground. The brisk northwest wind proves that this duststorm was general rather than local.

Figure 1 shows the relationship between the actual observed normal incidence radiation on the afternoon of December 12 and the 25-year normals for the same air masses.

This severe dust cloud gives added verification of the extreme drought conditions which prevailed in the mid-West during 1939.

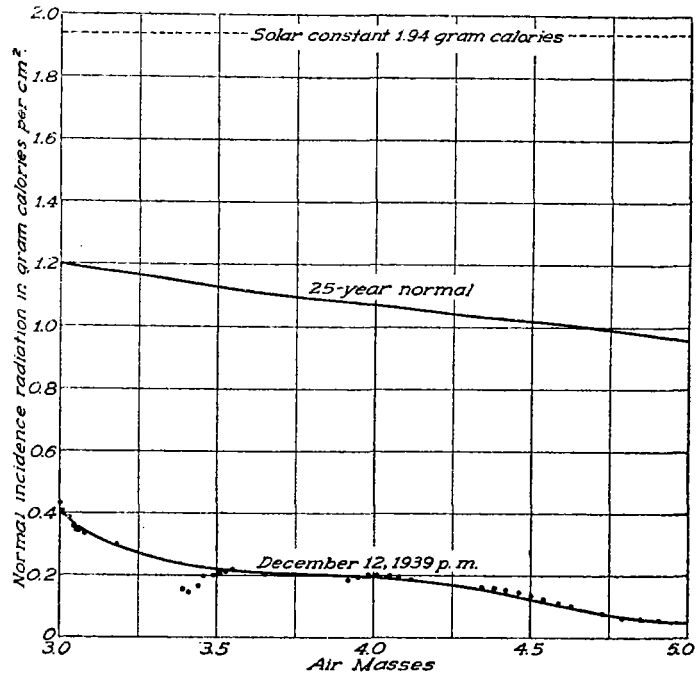

FIGURE 1.—Plot of normal-incidence readings made on the afternoon of December 12, 1939, at Lincoln, Nebr., showing the effect of the duststorm.