Measurements of solar radiation at Lövånger in Sweden during the total eclipse 1945

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(Manuscript received November 15, 1953)

The meteorologic work at Lövånger (64° 22′ N, 21°19′ E) during the total eclipse on 9 July 1945 included continuous observations of the solar radiation. A Moll thermopile with 80 sets of junctions was used for measuring the radiant energy in different parts of the visible region. It was provided with a cylindrical screen at the upper end of which colour filters were introduced in succession. The device has been earlier described in detail (JOHNSON and OLSSON, 1944). Infra-red screening was achieved by means of the Schott and Genossen filter BG 19 in order to attain a high degree of accuracy in the visible range.

The experiments were conducted under favourable conditions with a clear sky and no wind. At 13: 10 and 13: 30 before and at 16: 15 and 16: 25 after the eclipse, complete measurements were carried out, *i. e.* with the whole set of 12 colour filters as well as without filter. During the eclipse, when quick observations were desirable, only 5 filters were used, *viz.* RG 8, RG 1, OG 2, VG 9, and BG 12. Thus a series of readings was accomplished every fifth minute from 13: 50.5 to 16: 04.5. The duration of totality was from 15: 01.5 to 15: 02.1.

These records of the sun's spectral energy are expected to contribute some information about a possible change in atmospheric conditions during the eclipse. The extinction of solar radiation is made up of three components. One is due to molecular scattering, the second to absorption and scattering by liquid and solid particles, and the third to absorption by atmospheric gases, chiefly water vapour and ozone.

According to a method elaborated by ÅNGSTRÖM (1929) and later revised by SCHÜEPP (1949) the extinction caused by particles is expressed by the formula

$$m_h \beta (2\lambda)^{-\alpha},$$

where β is the extinction coefficient for λ = 500 mμ and for the relative air-mass $m_h = 1$, and α is an exponent indicating the dependence of scattering on wave-length.

Values of α and β have been derived from the observations. The factor α shows small irregular variations with the time which are, however, within the experimental errors. On an average α amounts to 2.0. The trend of the extinction coefficient, β, is a slow decrease (fig. 1) which is probably associated

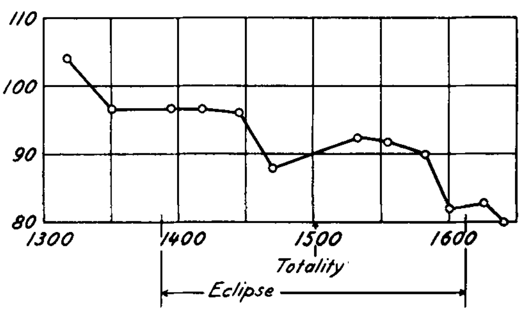

Fig. 1. The extinction coefficient $\beta \cdot 10^3$.

with an observed dissolution of the inversion at an altitude of 1,000 m. The irregularity in β near the totality may suggest that this dissolution, caused by the rising temperature in the low air layers, was retarded during the eclipse.

Following Schüepp's procedure it is possible to arrive at a determination of water vapour on account of its selective absorption in the spectral range 625 – 3,000 mμ. The actual observations do not clearly establish any alteration in the content of water vapour during the eclipse.

Furthermore the amount of ozone has been estimated from wave-lengths within the Chappuis bands (fig. 2). Although the resulting values are not obtained with a high exactitude it is established that an appreciably lesser quantity ozone was present in the atmosphere after the eclipse (0.2 cm) than before it (0.3 cm). Whether this is an effect of the eclipse or due to a normal weather change is thus far an open question.

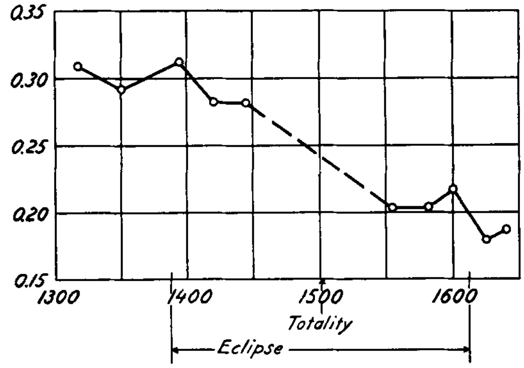

Fig. 2. The content of ozone.

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