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I. PHYSICS

Astrophysics (Ionosphere)

EFFECTS OF THE SOLAR ECLIPSE OF 16 FEBRUARY 1980 ON THE CHANGE IN PHASE HEIGHT AND ABSORPTION AT 2.2 MHz

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ANALYSIS of the data on absorption by Haug *et al.* (1970) showed that during the solar eclipse of May 20, 1966, over Crete, Greece, the observed changes in absorption at 1.98 MHz were proportional to the gross variation of the electron density in the D-region. Moreover, the observed change in phase height at 2.2 MHz was found to be very sensitive to the change in reflection height in the E-region of the ionosphere (Fraser & Vincent, 1970; and Bhar *et al.*, 1974). It is, therefore, expected that the eclipse data on absorption and change in phase height, if available, can provide a clue to study the relative change in the electron distributions in D- and E-regions caused by the solar eclipse. Keeping this in view, a programme of observation was initiated at Haringhata on the occasion of the eclipse of February 16, 1980, to procure these data at a frequency of 2.2 MHz.

Keywords : Effects of Solar Eclipse; Electron Density; Phase Height; Diurnal Curve Variations.

EXPERIMENT

Description

The equipment used for the experiment consisted of a pulsed transmitter delivering 13 KW peak power to a 600 ohms folded dipole antenna erected at a height of $\lambda/4$ above ground. The signal, after being reflected vertically from the E-layer was received by two 600 ohms horizontal aerials. The output from one of the aerials was used for measuring absorption by A_1 method and that from the other one was processed for the estimation of the change in phase height by a method described by Purkait (1977).

RESULTS

The results of the simultaneous measurement of change in phase height and absorption for a control day (the day just before the eclipse day) and also for the eclipse day are shown in Figs. 1 and 2. It is seen from Fig. 1 that on the control day the values of absorption at different hours exhibits the normal trend i.e., it gradually increases from morning hours upto the local noon; near the noon period, it passes through a broad maxima and then gradually decreases as the late afternoon hours are approached. On the eclipse day, however, before the beginning of the eclipse, hourly values of absorption showed reasonable agreement with the corresponding hourly values for the control day. But with the progress of the eclipse the values of absorption exhibited deviation from the hourly values for the control day until a maximum

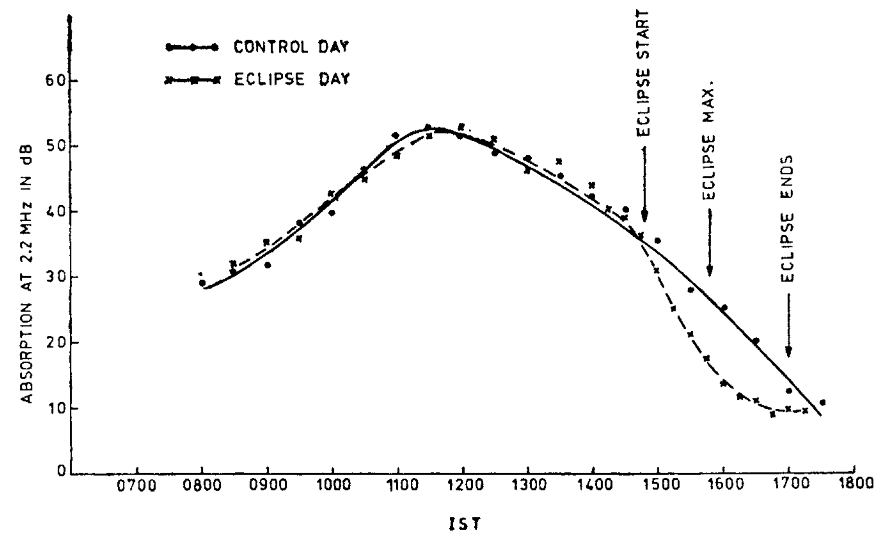

FIG. 1. Diurnal variation of absorption at 2.2 MHz for the control day and also for the eclipse day.

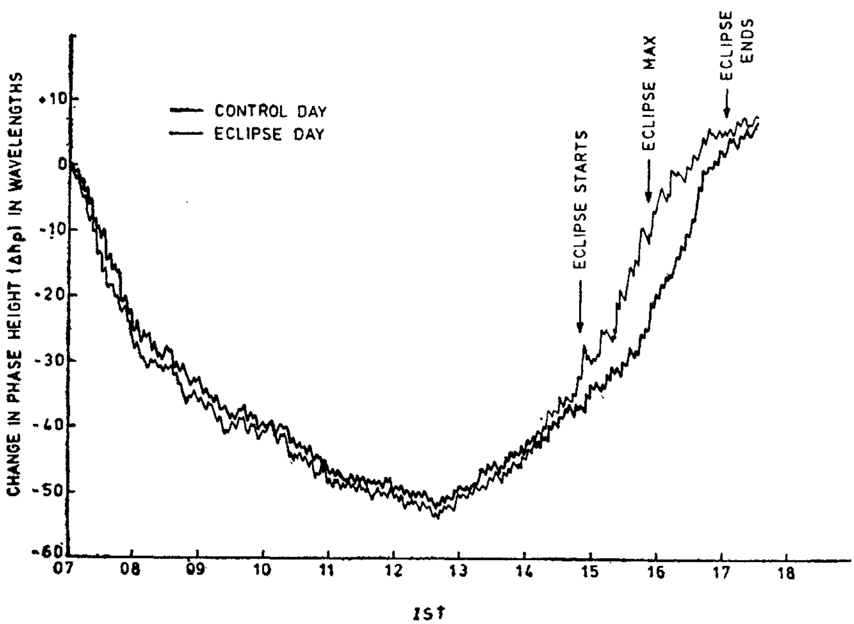

FIG. 2. Hourly variation of the change in phase height for the eclipse day and also for the control day.

deviation of about 10 dB ($\simeq$40%) did occur near the instant of maximum obscurity. Afterwards, the departure between the diurnal curves on absorption gradually decreased.

From Fig. 2, it has been found that except during the period of the eclipse, the diurnal curves on change in phase height for both the days show satisfactory agreement among themselves. It has been noted further that the individual diurnal curve retains their usual trend i.e., from early morning upto the local noon the phase height decreases, at about an hour after the local noon it attains its minimum value and in the afternoon hours, it increases rapidly. Superimposed on the regular diurnal variations for both the days are the short period fluctuations which are produced by the internal gravity waves (Vincent, 1969). With the start of the eclipse, the diurnal curve for the eclipse day indicates a faster rise in phase height. Near the time of maximum occultation, it is elevated by about 2km with respect to the height for the control day. Attributing this elevation in phase height to the changes in reflection height in the E-layer, the deviative component of the total absorption is expected to occur at a height of smaller collision frequency. This will cause the deviative absorption to be reduced by nearly 30 per cent. Since at the maximum phase of the eclipse the measured change in absorption is found to be 10 dB, the contribution of the E-layer to this change would be 3 dB and the remaining change of 7 dB is expected to occur in the underlying D-region.

LOCATION

Ionosphere Field Station, Haringhata. Geogr. co-or. 22° 58′N, 88° 34′E Geomag. + 12.2°, 159.6°.

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