OBSERVATION OF 10.4 CM RADIO NOISE FROM THE SUN DURING THE SOLAR ECLIPSE OF 16 FEBRUARY 1980

The "radio sun" is taken to be much larger than the optically observed sun's disc, as the low frequency radio waves emanate mostly from the corona. However, at centimetre wavelengths most of the radiation appears to originate from within the chromosphere (Kundu 1965). In a total or near total solar eclipse the radio wave flux at these wavelengths should, therefore, decrease sharply (Hagen 1957).

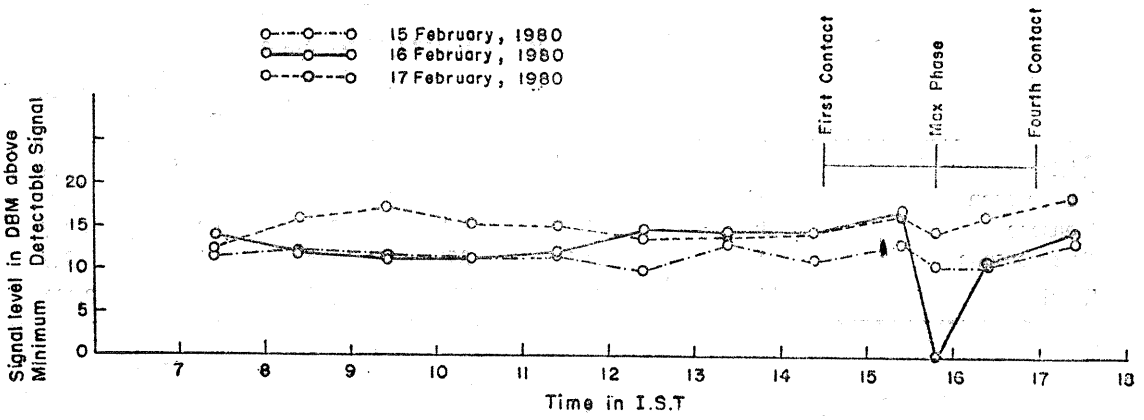

Fig. 1. Solar radiation at 10.4 cm wave length at Madras

Using the receiver and antenna of the S-band Cyclone Warning Radar at Madras, measurements of the solar radio flux at 10.4 cm wavelength were made in February 1980. The antenna has a 2 degree conical beam and a gain of 38 dB. It responds to horizontal polarisation. The receiver has a calibrated RF attenuator with an accuracy of about $\pm$ 1 dB of received power. By pointing the antenna to the sun and determining the attenuation required to bring the signal to the Minimum Detectable Signal level (MDS) it was possible to measure the received solar flux.

Hourly observations taken on the day of the solar eclipse and the adjacent dates in February 1980 are shown in Fig. 1 in terms of decibels above the MDS. The MDS of —106 dBm corresponds, at the receiver bandwidth used, to a flux density of 12 units — one unit being 10^{-22}W.m^{-2}.Hz^{-1}. Average received power on 15 and 17 February was 13.4 dB which is equivalent to 253 units. Since this represents only the horizontally polarised component, actual flux must be approximately 500 units. It may be noted that this is a period of solar maximum. There is however a scatter of the values over a range of $\pm$ 3 dB around the mean. Part of the scatter could be due to the inherent errors in the method of measurement.

On the 16th, the day of the eclipse, the received power was within the above range of scatter upto 1523 IST long after the first contact of the moon (1429 IST). But subsequently there was a rapid drop, and the signal fell to the noise level (or perhaps still lower) at the time of maximum magnitude (0.89) of the eclipse, *viz.*, 1547 IST. The power gradually recovered towards the end of the eclipse.

The drop at the time of eclipse maximum is at least 13.4 dB, *i.e.*, the flux density fell to less than 5 per cent of its normal value. This may be compared with the figure of 7 per cent given by Mayer *et al.* (1957) for the *total* eclipse of 30 June 1954 when the sun was unusually quiet.

This extremely sharp fall in the solar flux is a clear confirmation that the moon was effectively eclipsing the radio-sun at this wavelength.

Cyclone Warning Radar, Madras
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