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Field Strength Measurements A-3 Method (Oblique Incidence) at Ahmedabad during Total Solar Eclipse October 1995

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Abstract

A RACAL-17L communication receiver is used to record signal strength at Ahmedabad on 11.8 MHz transmitted from Colombo.

In the initial stages of the eclipse and again towards the ending phase the signal strength showed large undulations compared to control days.

During the main phase of the eclipse (07:40 to 08:50 IST) the undulations were not there. The signal strength continuously rose from 07:40 IST till maximum of eclipse (8.30) and later it continuously decreased up to 08:50.

On the eclipse day increased fading in signal strength with regular wave like appearance persisted even during late night hours from 19:00 to 22.00 hrs. with a time period around 24 minutes.

Key Words : Fieldstrength, Radiowave, Solar Eclipse

Observations and results

Racal-17L communication receiver is used to record signal strength at Ahmedabad on 11.8 MHz (25 meters SW) transmitted from Colombo (Sri Lanka). A half-wave dipole antenna is used. The signal without AGC is suitably integrated and then fed to a computer hardware interfacing card. This interface card converts the data into digital form which is sampled every 10 seconds and stored in a file. A print out gives a graph of signal strength against time.

The comparison of signal strength on the eclipse day with the average of a few control days gives information of the effects of the eclipse. At Ahmedabad the First contact was at 7.23 hrs. IST. the maximum was at 8.29 hrs. IST (around 83% disc was obscured) and the eclipse ended

at 9.45 hrs. IST. At mid point between Ahmedabad-Colombo, the start of eclipse was around 7.29, end around 9.56, maximum around 8.38 hrs and at maximum the obscuration was about 65% of solar disc. The 11.8 MHz Colombo-Ahmedabad propagation path has a vertical equivalent frequency 2.1 MHz for one hop ionospheric reflection.

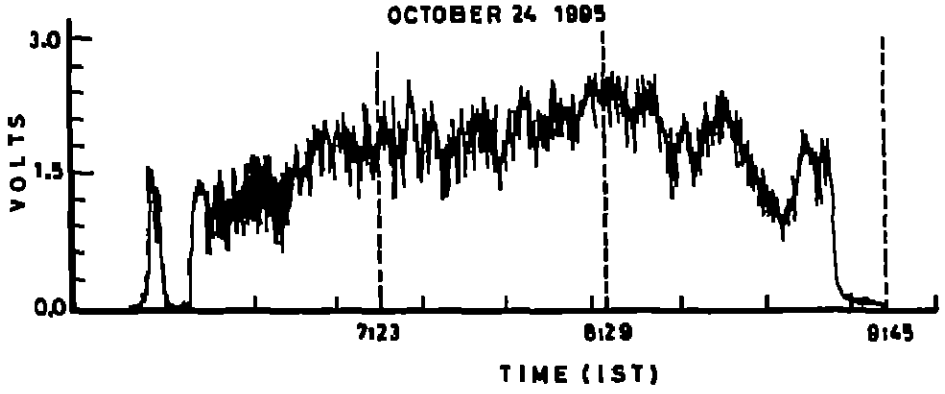

Figure 1: Field strength record on 11.8 MHz (Colombo-Ahmedabad) during total solar eclipse of 24th October, 1995.

It was observed that on the eclipse day the signal strength was lower than on the control day before the eclipse started (Fig. 1). In the initial stages of the eclipse (7.00 to 7.40) and again towards the ending phase of eclipse (8.50 to 9.30 hrs) the signal strength showed large undulations compared to control days. The signal strength oscillated around the average of control days, on the eclipse day becoming sometimes larger than on the control day and at times lower than the control days signals (Fig. 2).

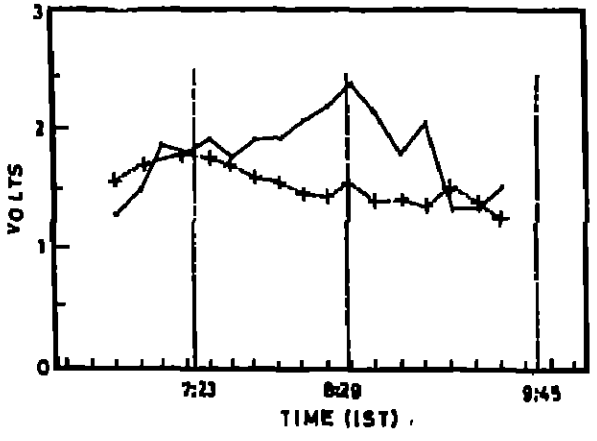

Figure 2: Signal strength (averaged over successive 5 minutes) on 11.8 MHz (Colombo - Ahmedabad) on eclipse day (continuous line and control days (Dotted line).

During the main phase of the eclipse (07:40 to 8:50) the undulations (upheavles in signal) were not there. The signal strength continuously rose from 7.40 to 8.30 hrs. (Exactly the maximum obscuration of solar disc at Ahmedabad is at 8.30 hrs). Later from 8.30 to 8.50 hrs. it continously decreased on the eclipse day. All through this main phase of the eclipse 7.40 to

8.50 hrs. the signal strength was higher than on the control days. The largest difference was at 8.30 hrs. (maximum obscuration at Mid point 65%) when the signal was around one and half times larger than on control days (3.62 dB to be exact).

The signal after eclipse appeared to be normal. But on the eclipse day the fading in signal strength was slightly increased and regular wave like appearance persisted even during late night hours (19:00 to 22:00 hrs) with a time period of 24 minutes.

During the total solar eclipse of 16 February 1980 same fieldstrength experiment was carried out. The mid-point of the path then happened to be in the region of totality. The field strength record obtained on a control day and eclipse day is shown in Fig. 3 for comparison. The contact timings of the eclipse are also shown in the Figure. (Patel *et al.*, 1986, Jani *et al.*, 1982).

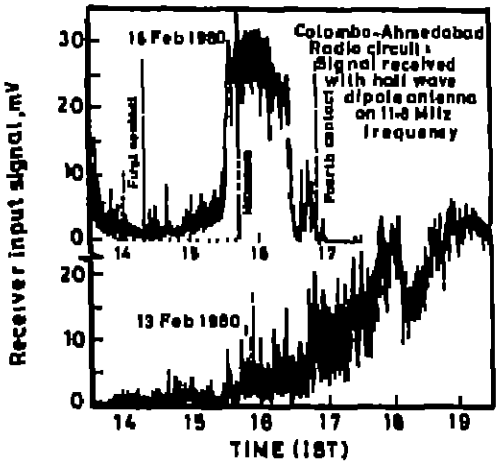

Figure 3: Pen-chart records on 11.8 MHz (Colombo - Ahmedabad) on eclipse day (16 February, 1980) and on control day.

On the eclipse day the signal strength before the eclipse is higher than on control day which is due to day to day variation in signal strength. After the Ist contact (14-18) the signal strength starts increasing slowly. This slow increase in signal strength is due to reduction in absorption of radio wave as the solar radiation is withdrawn. At 15.30 IST sharp there was a sudden rise in signal strength (from 8 mV to 25 mV) which signifies the change over from E-reflection to F-reflection. The high signals have large fast fluctuations which is a characteristic of F-layer propagation from 15:30 to 16:30 IST. The mid point of path happens to be in totality and the foE must have fallen below 2.1 MHz (which is the vertical incidence equivalent) at 15:30 hrs., causing change over from E to F propagation. After that also the signal goes on increasing very slowly reaching maximum around 16.00 hrs and then it reduces slowly till 16.30 hrs., when there is a sudden and sharp fall signifying crossover from F-reflection back to E-reflection.

At sunset the absorption due to D, E, and F-1 regions is almost equal to zero. Thus signal strength during eclipse is almost equal to signal on normal day at sunset. Thus sunset like conditions prevailed during the main phase of the eclipse.

We observe that during 24th Oct. 1995 eclipse there was only 65% obscuration of solar disc at mid point and hence foE did not drop to 2.1 MHz (vertical equivalent frequency for our propagation path). Therefore the signal throughout the eclipse continued to be reflected from the E-layer.

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