ON THE NATURE AND DYNAMICS OF IRREGULARITIES CAUSING EQUATORIAL VHF SCINTILLATIONS

THE aim of this article is to report some new results of a spaced receiver satellite scintillation experiment conducted for the first time in the equatorial region over Indian sub-continent. The earlier single station multi-frequency observations conducted using ATS-6 satellite in this region suggested that the ionospheric scintillations are severe (~15 db) in the electrojet region and at times violate the frequency dependence law (Rastogi *et al.*[4]). The present results show that the amplitude recordings of a geostationary satellite can be used to infer motion, generation, decay and size of the ionization irregularities causing VHF scintillations, in addition to morphology of ionospheric scintillations and its association with other geophysical parameters.

For this, radio beacon at 136 MHz from a geostationary satellite ETS-2 (130° E) has been used. The experimental set-up is located at Tiruchirapalli (long. 79° E, lat. 11° N) and consists of three crossed yagi antennas situated at the vortices of a triangle shown in Fig. 1 *a*. The sub-ionospheric coordinates for 350 km altitude for the ray path from ETS-2 satellite to Tiruchirapalli are 84° E long., 10° N lat. and 4·1° N dip. The signal received on these antennas are amplified and fed to the receivers through matched cables. To minimise the amplitude variations due to the drift in local oscillators all the three receivers have been super-heterodyned using same oven controlled crystal oscillators. A typical example of amplitude records at Tiruchirapalli for 2330 h (75° EMT) on 28th January 1978 is shown in Fig. 1 *b*. The records show excellent similarity with almost no time delay between north and south antenna records. However, there are clear time shifts on the records of west antenna with respect to north and south antennas. Such scintillation records can suitably be used for the estimation of the motion, size and orientation of the ionization irregularities. The continuous variations of rate of scintillations and speed would give a valuable information about the growth and decay of irregularities in the ionosphere. Using correllation analysis method developed by Briggs *et al*,[1] and extended by Phillips and Spencer[3] the sample records are processed. Fig. 1*c* shows the auto and cross-correlograms of the sample records. Apparent and true drift velocities for these records are found to be 130 m/s and 115 m/s respectively and thus the random velocity of the irregularities is very small. The results are in agreement with the earlier drift observations using spaced receiver technique at HF (2·5–5·0 MHz) in the same region (Vyas *et al.*[5]). The irregularities are found to have an average (half-correlation) size of 550 meters in East-West direction and 5,000 meters in North-South direction. These results are in agreement with earlier observations of Koster[2] in Ghana (Africa) employing similar technique. Further detailed analyses using VHF scintillation records and the simultaneous drift records are in progress.

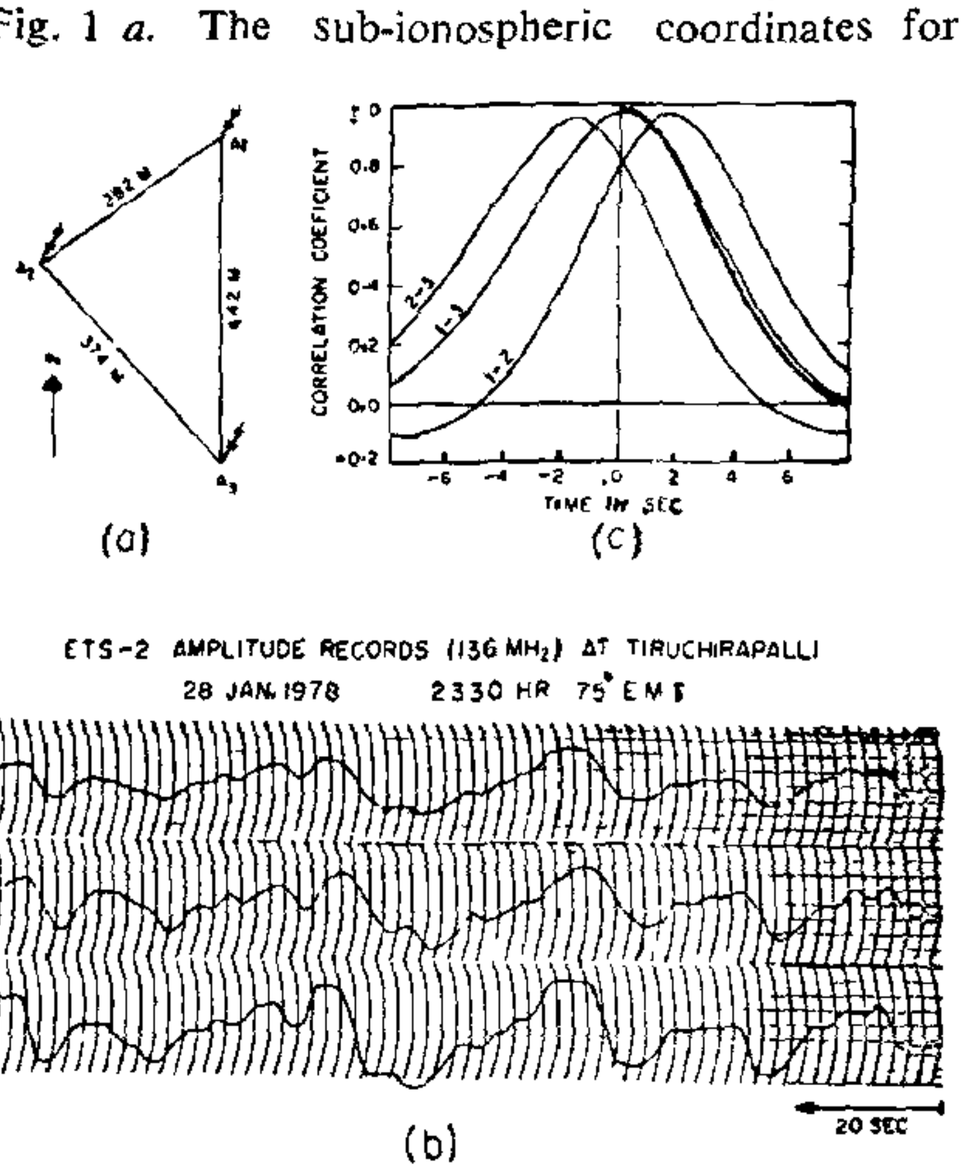

FIG. 1. The location of the three spaced aerials (Fig. 1 *a*), sample amplitude records (Fig. 1 *b*) and the mean auto and cross-correlograms (Fig. 1 *c*) of the sample record used in deriving information about the nature and movement of ionospheric irregularities from the ETS-2 amplitude scintillation experiment (136 MHz) conducted at Tiruchirapalli.

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