LETTERS TO THE EDITOR

OCCURRENCE OF NIGHT SPORADIC-E (Es) IN RELATION TO GEOMAGNETIC STORMS

THE morphological characteristics of night sporadic-E (Es) in the equatorial region have been studied by several workers[1-4] for stations in the American, African and Asian Zones, which brought to light the existence of a definite longitudinal effect in the occurrence and characteristics of night sporadic-E. However, not much information exists in literature as to the response of the occurrence of night Es to enhanced geomagnetic activity in particular, its behaviour during geomagnetic storms. The only available information on this aspect is the work of Awe[2] which showed that at Ibadan, in the African Zone, there is no significant difference in the occurrence of night Es during magnetically quiet and disturbed days. We have therefore attempted a study of the occurrence characteristics of night Es at Kodaikanal (10·0° N, 77·5°E, dip 3·5° N) during geomagnetic storms, the results of which comprise this brief communication. The study covers periods of both low sunspot activity (January 1964–December 1965) and high sunspot activity (January 1968–December 1969). This is done to infer the influence, if any, of the phase of the sunspot cycle on the response of night Es to geomagnetic storms. Quarter hourly ionogram data at Kodaikanal has been carefully examined to evaluate the occurrence of night Es for seven nights around each of a total of 38 SC type geomagnetic storms that occurred during the four year period under consideration. Out of these 38 storms, 21 correspond to low sunspot activity conditions and 17 to high sunspot activity conditions.

In Fig. 1 are shown the time histories of the percentage occurrence of night Es (defined as the percentage of the number of ionogram frames exhibiting the presence of Es to the total number of ionogram frames available for a particular night) for seven nights around each of the 38 storms studied. The times of the storm sudden commencement (SSC) in U.T. and the severity of the storms are also indicated in the figure. It can clearly be seen from Fig. 1 that, in a majority of the storms, there is a definite trend of an increase in the occurrence of night Es of appreciable magnitude with in 0–3 days of the initiation of the storm. This behaviour of night Es at Kodaikanal during geomagnetic storms appers to be indepedent of the phase of the sunspot cycle (hence the severity of the storm) as the increase in occurrence is noticed during low sunspot activity as well as high sunspot activity condition. Examination of the relevant La Cour normal run magnetogram data at Kodaikanal showed that the noticed increase in the occurrence of night Es is not associated with any significant changes in the horizontal component of the earth's magnetic field. In a recent study we have noticed that at Kodaikanal, night Es manifests not only in the well known flat and now blaketing type (Esf) of configuration but also in two other configurations, blanketing type (Esb) and multiple layered type. A study of the ionogram data showed that there is no preferential occurrence of any particular type of Es configuration during storm conditions. Similarly, there is no indication of any significant change in the values of fb Es (which represents the maximum ionization density in the Es layer) during storm conditions compared to pre-storm conditions.

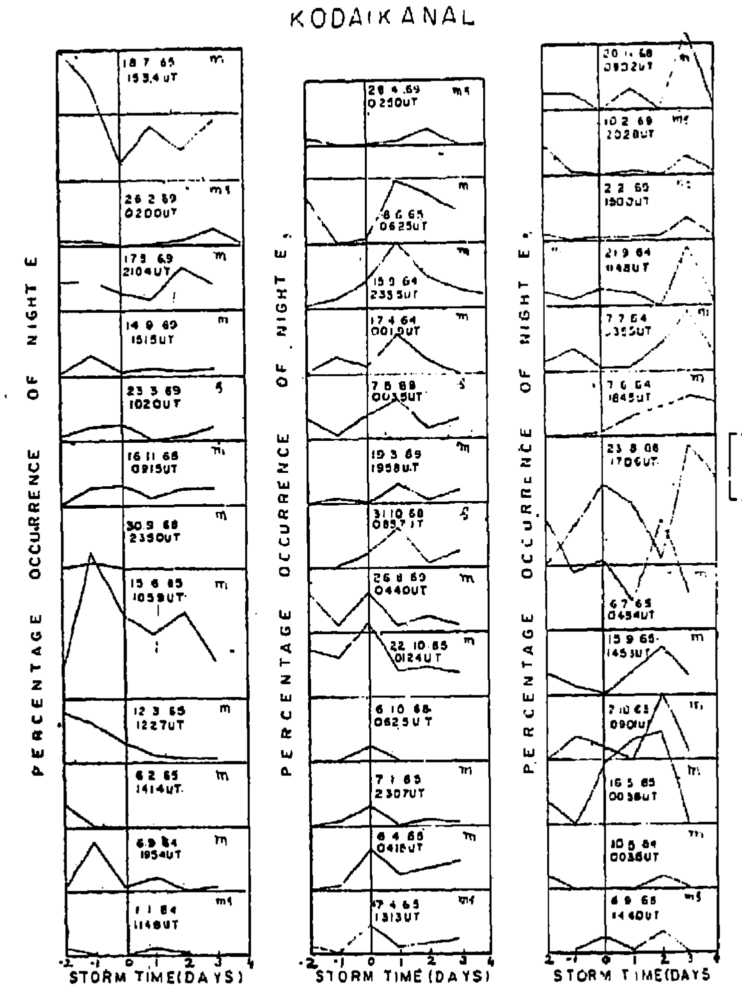

FIG. 1. Variation of the percentage occurrence of night Es at Kodaikanal with storm time for 38 storms that occurred during the periods: January 1964–December 1965; January 1968–December 1969. Also indicated in the diagram are the times of the storm sudden commencement (SSC) in U.T. and the severity of the storms (*m*, *ms* and *s*).

The present study thus indicates a positive response of the occurrence of night Es at Kodaikanal to geomagnetic storms, although the nature and characteristics of the Es configuration do not appear to change significantly. Very recently, Batista and Abdu[5] reported evidence of a significant enhancement of E_s layer parameters: f_bE_s and f_tE_s at Cachocira Paulista (22·6° S, 45·0° W), located near the center of the Brazilian Geomagnetic Anomaly, within 1–3 days after the initiation of geomagnetic storms of moderate intensity. It is known from satellite observations that protons in the energy range 10–1000 key exist in the equatorial region above 400 km and that their flux gets enhanced significantly during geomagnetic storms[6–7]. Recent calculations have shown that the extra ionization due to the precipitation of these energetic protons in the equatorial region will be significant at E-region altitudes during geomagnetic storm conditions[8]. The results obtained here therefore suggest a possible role of charged particle precipitation in the behaviour of night Es at equatorial latitudes, following geo-magnetic disturbances. The present investigation also suggests the need for further studies of this type at stations in other longitude zones (American and African) to obtain a detailed picture of the behaviour of night Es during geomagnetic storms.

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