EFFECT OF SECTOR BOUNDARY PASSAGE ON THE DAILY VARIATION OF EQUATORIAL GEOMAGNETIC FIELD

SUBSTANTIAL evidence showing interesting relationships between terrestrial geomagnetic activity and the interplanetary magnetic field (IMF) direction in the ecliptic plane has been reported in literature in the wake of the discovery of the sector structure of IMF. Several articles reviewing the status of the knowledge on the topic have been written in recent times[1–4]. Rangarajan[5] recently examined the variation of the daily range of H-field at three stations in the Indian zone, spanning latitudes from the dip equator to near the Sq focus, in relation to sector boundary crossings using the sector boundary dates given by Svalgaard[6,7]. He noticed the mean daily range to show a conspicious increase on the day of the boundary crossing (irrespective of the type of boundary) at all the three stations, which feature was inferred by him to be essentially of non-ionospheric origin as the magnitude of the response at the three stations was found to be almost the same. This response of the daily range of H-field at equatorial latitudes to sector boundary passage was interpreted by him as due to a component of disturbance associated with sector boundary crossing. However, from a study of the behaviour of equatorial Dst in the vicinity of well defined sector boundaries, Kane[8] reported earlier that there is no definite and unambiguous relationships of equatorial Dst to solar magnetic sector structure. It is therefore felt worthwhile to re-examine the effect of sector boundary passage on the characteristics of the daily variation of H-field at equatorial latitudes using H-field data corrected for disturbance effects, to gain some insight into the origin of the effect of sector boundary passage noticed by Rangarajan[5]. In this brief communication, we present the results of such an analysis of H-field data at two stations in the Indian equatorial region.

The present study is based on the hourly H-field data at the two stations, Alibag (dip 23·0° N) and Kodaikanal (dip 3·5° N) for the period 1962–70. Of the two stations, Kodaikanal is under the direct influence of the equatorial electrojet while Alibag is outside the influence of the electrojet. The hourly data are first corrected for disturbance effects using the equatorial Dst values of Sugiura and Poros[9] and then used to evaluate the daily range of H-field, defined as $(H_{max} - H_{min})$ where H_{max} and H_{min} are the maximum and minimum values respectively in a Greenwich Day. The daily values of the range thus obtained at the two stations for the period 1962–70 have been used in a superposed epoch analysis with the well established sector boundary dates, based on satellite observations, listed by Wilcox[10] as the Key days. With a view to infer the solar cycle dependence of the response of daily range to sector boundary passage, the results for the years 1962–66 and 1967–70 have been combined separately to get the response corresponding to periods of low and high solar activity respectively. The analysis detailed above is similar to the one carried out by Rangarajan[5] but for the difference that the H-field data are corrected for Dst effects.

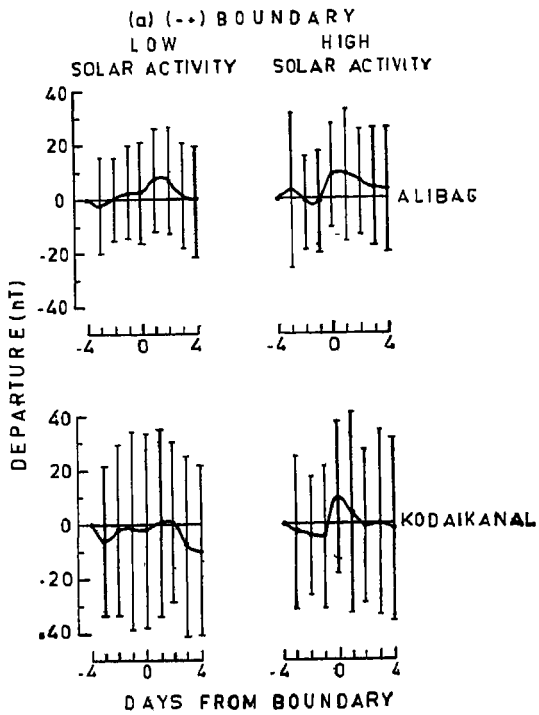

FIG. 1 (*a*). Response of the range of daily variation of H-field at Kodaikanal and Alibag to the passage of (− +) sector boundary during periods of low and high solar activity.

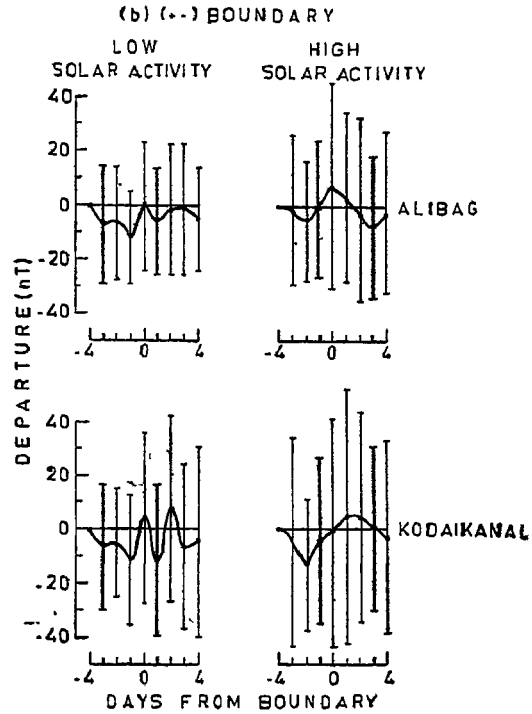

FIG. 1 (*b*). Same as in (*a*) but showing the response to the passage of (+ −) boundary.

Figure 1 (*a*) depicts the changes in the mean daily range of H-field at Alibag and Kodaikanal for four days on either side of the (− +) boundary, as departures from that four days prior to the boundary, separately for periods of low and high solar activity. The changes in the mean daily range at the two stations in the vicinity of (+ −) boundary are presented in the same format in Fig. 1 (*b*). The results presented in Figs. 1 (*a*) and (*b*) clearly show that the changes in the mean daily range of H-field at equatorial latitudes in the vicinity of sector boundaries are quite irregular in nature. Further, the changes in the mean daily range are not statistically significant as can be seen from the standard deviations shown in Figs. 1 (*a*) and (*b*). The above features show that once the disturbance effects are eliminated from the H-field data, there is no systematic and significant response of the daily range of H-field at equatorial latitudes to sector boundary passage. This finding of the present analysis thus lends support to the qualitative interpretation of Rangarajan[5] that the sector boundary effect on the characteristics of the daily variation of H-field at equatorial latitudes is primarily a disturbance effect.

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