Characteristics of Pi2 pulsations at an equatorial station and its occurrence association with the phase of the Moon

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Abstract. Diurnal variations of occurrence hours and the period of Pi2 pulsations at Choutuppal (India) for nearly half a solar cycle are presented. Maximum occurrence is noticed to be around local midnight in all the seasons. Shorter periods are observed in the late afternoon hours in E- and J-seasons. Lunar influence on the occurrence of Pi2 pulsations at this station is inferred with the occurrence due to this influence peaking in the vicinity of the lunar phase 4.

Keywords. Pulsations; equatorial station; lunar influence; diurnal variations.

1. Introduction

The irregular pulsations, Pi2, are shortlived fluctuations of the geomagnetic field ranging from 40–150 sec (Jacobs 1970). Pi2 are generally observed, simultaneous with the onset of substorms, over a wide range of latitudes on the ground and in the magnetosphere (Saito 1969; Gupta et al. 1971; Gupta 1981). The characteristics of Pi2 have been studied earlier, especially in the auroral and high latitudes. However, such studies for low latitudes and equatorial regions are sparse. For a thorough understanding of the wave characteristics responsible for these Pi2s, a comprehensive morphological study at all latitudes will be useful.

In the present paper, the occurrence frequency and the diurnal variations of the period of Pi2s from an equatorial station, Choutuppal (Hyderabad) (Geomag. Lat. 7.5° N), a permanent pulsation recording station in the Indian region, are reported. These morphological characteristics at the equatorial station are compared with those obtained at middle and high latitudes by other investigators. It is shown that the occurrence frequency of Pi2s peaks at more or less the same local hours at different latitudes. Considering that Pi2s observed at all latitudes originate in the geomagnetic tail, which itself extends well beyond the lunar orbit, an attempt is made to investigate lunar influence on this class of pulsations.

2. Data analysis

The basic data for the study are extracted from the magnetic and telluric pulsations records for the period 1 January 1968 to 31 December 1972. These have been published by the National Geophysical Research Institute, Hyderabad. The method for decodin
the pulsation data is the same as that adopted by Rao (1978) for Pc5 data. By a similar procedure, Pi2 activity reported for each day is decoded for 24 consecutive hours. The hourly interval is considered to have pulsational activity irrespective of the duration of activity. The data are sub-divided into three seasonal groups, summer (J, May to August); winter (D, November to February) and equinoxes (E, March, April, September and October). Diurnal variations of the occurrence of Pi2 as a function of local time (LT) for seasons and for the entire period considered (Y) are shown in figure 1. Also, median, 25th and 75th percentiles of the Pi2 periods for each of the hours are calculated and are shown in figure 2.

3. Results and discussion

3.1 Diurnal variation of occurrence hours

It is apparent from figure 1 that Pi2 activity is predominantly observed during local night at Choutuppal. The maximum occurrence is around local midnight in all the seasons. Similar results have been reported by Sanker Narayan and Sarma (1975) for the same station and by Channon and Orr (1970) for another equatorial station. At middle and high latitudes also, the maximum occurrence of Pi2 is near midnight (Yanagihara 1960; Smith 1973; Gupta 1981). No obvious seasonal variation is observed in the peak occurrence time of Pi2 at Choutuppal which is found to be between 00–01 LT.

![Figure 1. Diurnal variation of occurrence hours of Pi2 pulsations at Choutuppal for J, E and D seasons as well as for the entire period, designated as Y.](image-url)