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Study of tri diurnal anisotropy of cosmic ray intensity on quiet days at equatorial station

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ABSTRACT. The cosmic ray intensity (CR) data recorded with Equatorial Neutron Monitoring stations located at different latitudes has been investigated on sixty quietest days (QD) in a year for studying the variation in tri-diurnal anisotropy during the solar cycle twenty one and twenty two. It is observed that the amplitude of third harmonics of daily variatrion on QD is larger by a factor of two during the period nineteen eighty three and nineteen eighty six i.e., the declining phase of solar cycle-twenty one as it is observed eleven years ago i.e., declining phase of solar cycle twenty, at equatorial station. Thus, eleven year variation in the tri-diurnal anisotropy of cosmic ray intensity has been observed by the Equatorial Neutron Monitoring stations during different phase of solar activity.

1. INTRODUCTION

The spatial anisotropy of the galactic cosmic ray intensity in the interplanetary space manifests itself as daily variation with a period of 24 hours (and its higher harmonics) due to the rotation of the Earth in the course of a day. The Power Spectrum analysis as well as the Fourier analysis of the long term data of the 24-hour values of cosmic ray (CR) intensity observed by Earth based detectors have provided confirmatory existence alongwith the characteristics of the first three harmonics of daily variation of extra terrestrial origin. However, the amplitude of the fourth harmonics is still controversial (Pomerantz and Duggal, 1971; Rao,1972; Venkatesan and Badruddin, 1990; Ahluwalia and Singh, 1973; Agrawal, 1981). Moreover, it has been observed that the amplitude and phase of tridiurnal variation of CR intensity on quiet days also vary considerably from one period to another.

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2. ANALYSIS OF THE DATA

The CR intensity data (corrected for meteorological effects), on geomagnetically five quietest day (QD), for two neutron monitoring stations during the period 1980-90, have been used in this analysis. The long term effects have been removed by appplying the trend corrections (Yadav and Naqvi, 1973). Such a set of data have been subjected to Harmonic analysis for each day. The average values of the amplitude (%) and phase (hrs) in local time of the station of the third (tridiurnal) harmonics have been obtained. The days with abrupt changes in CR intensity have not been considered in deriving the average harmonics.

3. RESULT AND DISCUSSION

The amplitude (%) and phase (hrs) of the tri-diurnal anisotropy of CR intensity on QD for Tokyo (35.75N, 11.5 GV) and Mount Norikura (36.12N, 11.39 GV) during the period 1980-90 have been investigated.

The yearly average amplitude of the third harmonics of daily variation for Tokyo and Mount Norikura Neutron Monitoring Stations during the period 1980-90 have been plotted in Fig. 1 and 2 on quiet days. It is quite apparent from Fig. 1 and 2 that there is no systematic change in the amplitude of third harmonics on QD at both the Neutron Monitoring Station. Nevertheless, the amplitude of third harmonics on QD remain relatively large during declining phase of solar cycle 21 as compared with the declining phase of earlier solar cycle 20 (Kumar *et al.*, 1995; Richharia *et al.*, 1999). The enhancement explicity point out the 11 year periodicity (El Borie *et al.*, 1995). Further, the

amplitude of third harmonics of daily variation on QD is observed to be significantly low during the year 1981, which coincides with phase reversals of the solar poloidal magnetic field. Furthermore, amplitude of third harmonics on QD have low value during minimum solar activity period.

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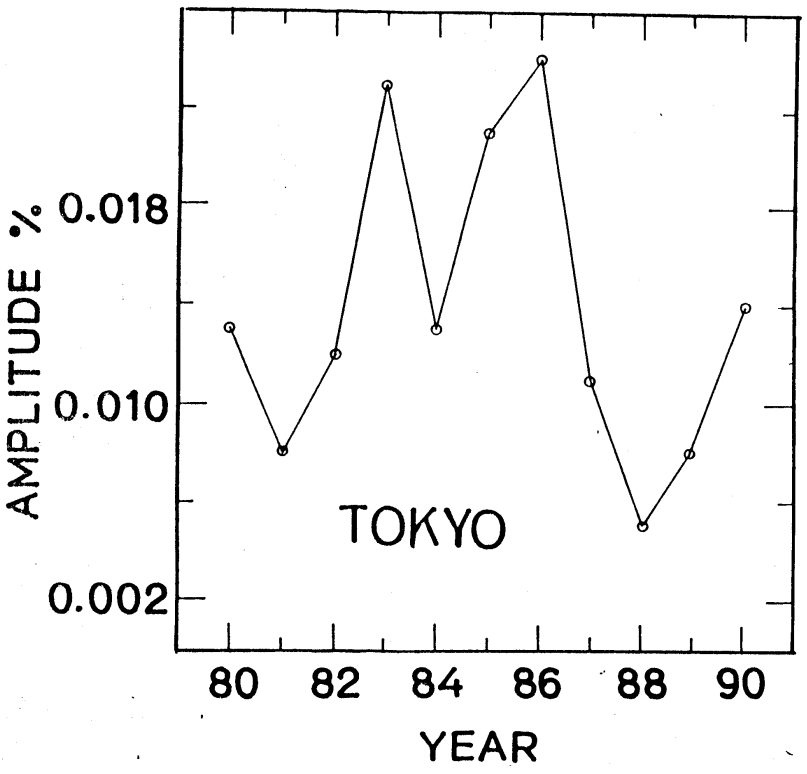

Fig.1. The annual amplitude (%) of tri-diumal anisotropy of CR intensity on quiet days during 1980-1990 at Tokyo Neutron Monitoring Station.

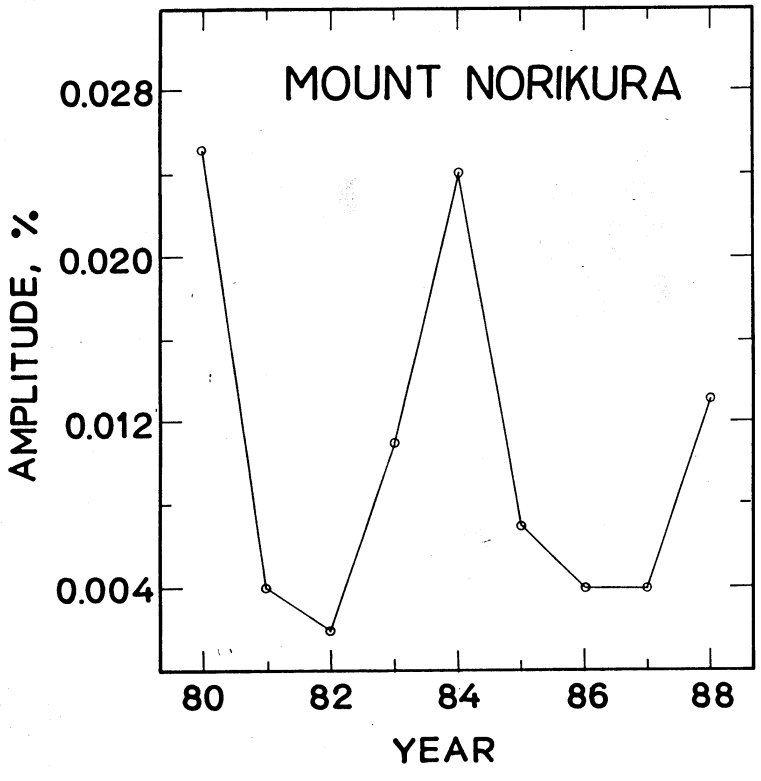

Fig.2. The annual amplitude (%) of tri-diurnal anisotropy of CR intensity on quiet days during 1980-1988 at Mount Norikura Neutron Monitoring Station.