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ON EQUINOCTIAL ANOMALY IN $N_m F2$ DURING HIGH SOLAR ACTIVITY

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This study has been carried out for the high sunspot years at low and mid–latitude stations situated in northern hemisphere. The equinoctial anomaly at Bombay is found stronger than that at the mid – latitude stations. Also, it has been found that the time of occurrence of anomaly is different for the stations under study.

INTRODUCTION

Many authors have studied the annual and semi–annual variations in peak electron density of F2-layer (N_mF2) as well as the total electron content both for northern and southern hemispheres. They all concluded that the values of N_mF2 and TEC are found maximum during equinoxes (March, April, September, October) as compared with the solstices (May, June, July, August, November, December, January, February) [1,2]. The dependence of solar activity on the magnitude of these variations has been studied by Titheridge [3] and Da Rosa *et al* [4].

Recently, Essex [5] has shown an anamolous behaviour of the equinoctial variation in the peak electron density (N_mF2) for southern hemisphere only. He found that the median values of N_mF2 during March–April are greater than the values during September–October. This equinoctial anomaly in the semi–annual variation of N_mF2 is carried out for the years of high solar activity.

This study has been carried out to investigate the equinoctial anomaly in the median variation of N_mF2 during high solar activity for the ionospheric stations located in northern hemisphere.

DATA

In order to investigate the equinoctial anomaly, the median values of foF2 were obtained for the stations listed in Table 1. These hourly median values have been converted into N_mF2 by using the formala [8].

$$N_mF2\ (\text{electron/cm}^3) = 1.24 \times 10^4\ (foF2)^2$$

RESULTS AND DISCUSSION

The variation of N_mF2 during high sunspot years is represented in Fig. 1. The equinoctial anomaly can be noticed both at low and mid–latitude stations. This anomaly is observed stronger at low latitude station Bombay than the mid–latitude stations such as Ashkabad, Alma Ata and Delhi.

The equinoctial anomaly at Bombay and Delhi have similar pattern. The anomaly appears around 0700 hour in the morning and persists around 0300 hour in night. How-

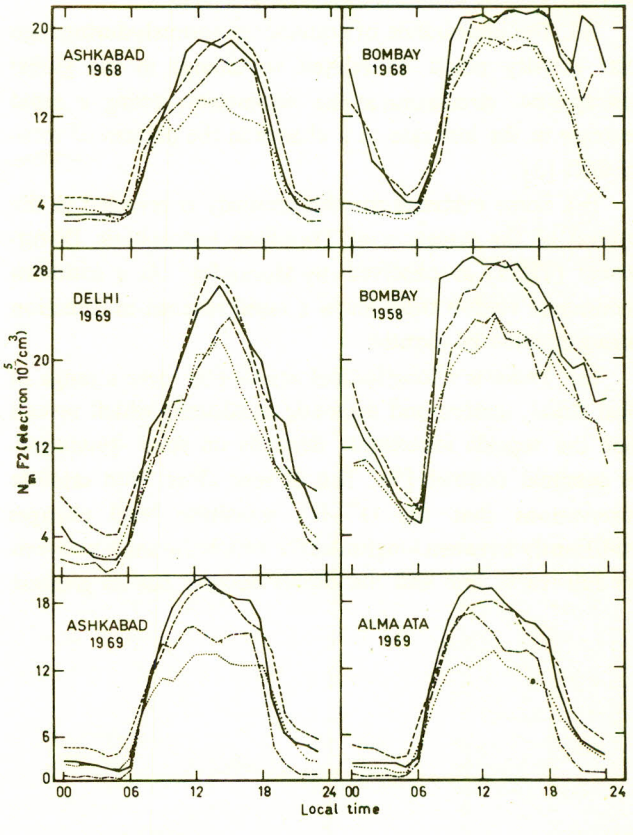

Fig. 1. Median variation of N_m F2 for the months of March, April, September and October. The following symbols are used ———— March, – – – – – – – – April ..... September –.–.–.–.–.–. October.

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Table 1. Ionospheric stations located in northern hemisphere.

Stations	years	Average sunspot number	Geo-latitude	Geo-longitude
Bombay	1958	200	18° 55′N	72° 50′E
	1968	105		
Delhi	1969	115	28° 38′N	77° 17′E
Ashkabad	1968	105	38° 00N	57° 50′E
	1969	115		
Alma Ata	1969	115	43° 15′N	76° 57′E

ever, the anomaly is very pronounced around noon at Bombay as compared with that at Delhi. On the other side, at Alma Ata and Ashkabad the time of occurrence of anomaly is quite different and one can also see that the anomaly at Ashkabad is almost stronger than at Alma Ata.

The results of the present study for the high solar activity period for the northern hemisphere stations are very much consistent with the results obtained by Essex [5] for the southern hemisphere. The cause of the equinoctial anomaly may be due to the following effects:

(a). The appearance of equinoctial anomalyduring high solar activity could be related to change in the global atmospheric circulation at the equinoxes, giving a rapid decrease in the loss rate or a change in the pattern of vertical drift [3].

(b). Some evidence for this anomaly is revealed in the reversal of the direction of Travelling Ionospheric Disturbences (TID's) as observed by Munro [6]. At a southern hemisphere station these show a rapid reversal in direction during equinoctial months.

(c). There is a longitudinal asymmetry over a range of local times, seasons and magnetic conditions which reveals that the topside ionosphere depends on solar–geomagnetic seasonal control [7]. This is very clear from satellite observations that the O^+–H^+ transition level changes significantly between longitudes for which the angle between the sun–earth line and the dipole equator has its greatest variations. This ambient ion concentration can change by a factor of ten between contrasting longitude even though the altitude and magnetic activity remain nearly constant.

(d). One effect which may be dominant is the meridonal convection of O^+ from the southern to the northern hemisphere due to lower magnetic intensities in the southern hemisphere [5].

It is however, difficult to conclude, which of the above effects is dominant to produce equinoctial anomaly in the equinoctial semi–annual peak of electron content during high solar activity.

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