DAY TO DAY VARIABILITIES OF THE EQUATORIAL ANOMALY OF THE IONOSPHERIC TOTAL ELECTRON CONTENT NEAR THE NORTHERN EQUATORIAL ANOMALY CREST DURING MINIMUM SOLAR ACTIVITY

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In low latitude, the distribution of the maximum electron density of the ionosphere exhibits a trough at geomagnetic equator and two humps on both sides of equator during day time and lasts for several hours after sunset. This phenomenon is known as the equatorial anomaly (Appleton, 1954). The latitudinal distribution of the total electron content of the ionosphere also shows similar phenomenon (Huang et al., 1987). The diurnal development and the day to day variability of the equatorial anomaly of the total electron content are best studied by measuring differential Faraday rotation (e.g. Hunter, 1970; Walker et al., 1980; Walker 1981) or differential Doppler shift (de Medonca, 1965; Huang et al., 1987) of the radio waves transmitted from low latitude polar orbiting satellites to obtain the latitudinal variation of the total electron content.

In order to observe the latitudinal variation of ionospheric total electron content near the equatorial anomaly crest, the coherent radio signals at frequencies of 150 and 400 MHz transmitted from the polar orbited satellites of U.S. Navy Navigation Satellite System have been received to record the differential Doppler frequency shift of the coherent radio signals for each passage of NNSS satellite at Lunping Observatory (25.00°N; 121.17°E) since March, 1984 (Huang, et al., 1987). By combining the differential Doppler shift data with the Faraday rotation data from geostationary satellite, ETS-2, the latitudinal distribution of ionospheric total electron content can be obtained for each passage of the satellite (Leitinger et al., 1984) as an example shown in Figure 1, and used to construct TEC contour plot on latitude versus local time coordinate (Leitinger and Hartmann, 1976) such as shown on Figure 2. The data are quite good for detailed investigation of the diurnal development as well as the day to day variability of the equatorial anomaly near the equatorial anomaly crest (Huang et al., 1987).

Using these daily contour plots of TEC for the period from September 1, 1986 to October 31, 1987, the day to day and seasonal variations of the appearance and development of the equatorial anomaly; and the location and the magnitude of the daily maximum development of the equatorial anomaly crest have been systematically analyzed. The followings are major findings of the present study:

(1)The daily development cycle of the equatorial anomaly can be studied by use of TEC vs. latitude plots obtained for each passage of NNSS satellite. The behaviour of the diurnal development cycle can be seen more clearly by constructing daily contour chart of TEC in latitude vs. local time coordinate.

(2)The daily development cycle of the equatorial anomaly shows quite a large day to day variabilites not only in geomagnetically dis-disturbed days but also in geomagnetically calm days. This leads to a very large day to day variabilities in the spatial variation of TEC near the anomaly crest even on geomagnetically calm days.

(3)The location (latitude, Lc, and local time, Tc) as well as the

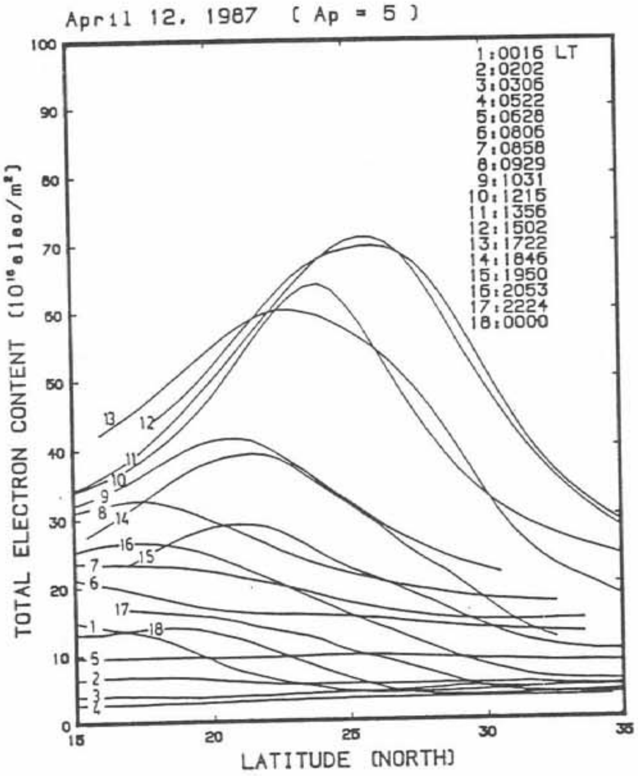

Fig.1 Latitudinal variation of total electron content for all passages of NNSS satellite on April 12, 1987. The number attached on each curve shows the time sequence.

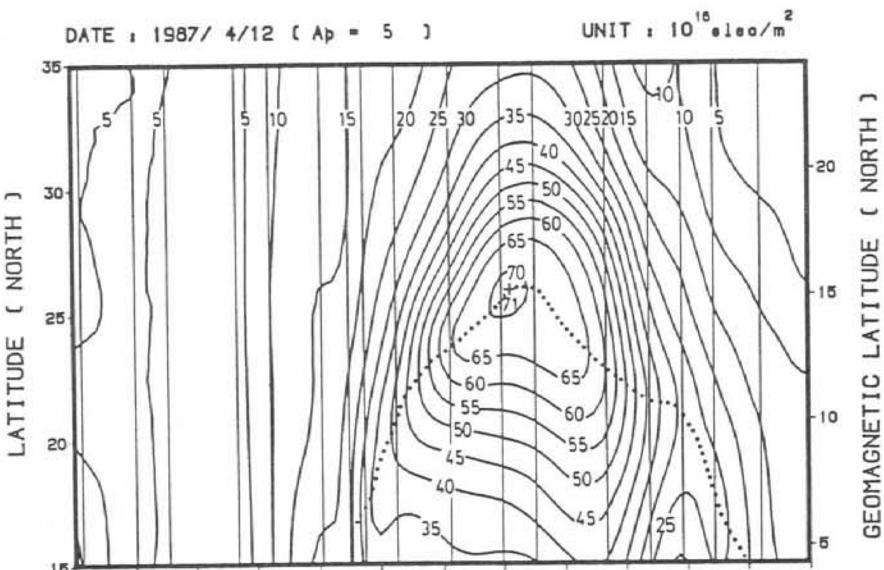

Fig.2 Contour plot of total electron content on April 12, 1987, in a latitude versus local time system.
Isolines are in a unit of 10^{16} elec/m^2. The vertical thin line represents the local time of the passage of an NNSS satellite.

magnitude, I(Tc) , of the daily most developed anomaly crest shows quite a large day to day variability in an irregular way as shown in Figure 3. As a consequence, both Lc and Tc of the daily most developed equatorial anomaly crest scatters in quite a large range in a given month.

(4)An approximately linear relationship, with a mean correlation coefficient of 0.53, has been found between Lc and I(Tc). This means that as the magnitude of the daily most developed anomaly crest increases, the anomaly crest moves northward. However, no significant relationship has been found between Tc and I(Tc).

(5)The relationship between the daily geomagnetic activity and the daily Lc, Tc and I(Tc) are quite irregular, No statically significant relationships have been found.

(6)The monthly mean contour chart of TEC obtained for each month, as shown in Figure 4, shows a remarkable seasonal variation of the diurnal development cycle of the equatorial anomaly. The anomaly starts to develop; reaches its most developed condition; and finally disappears at respective different times in different season.

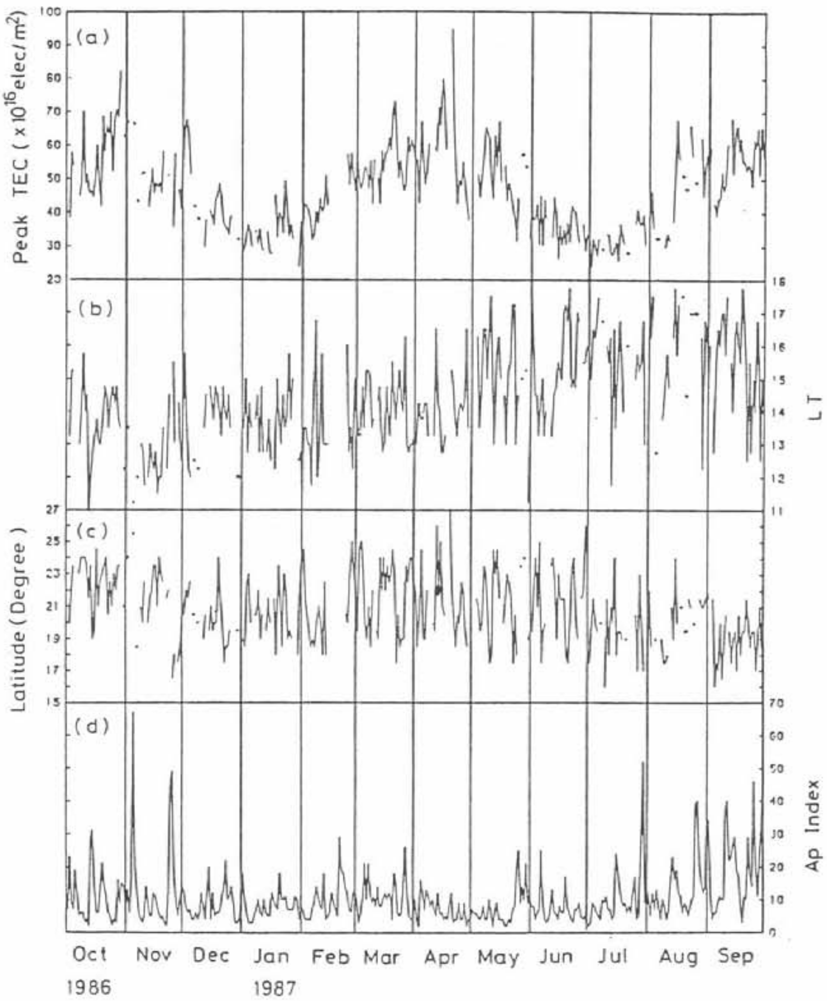

Fig.3 Day to day variation of (a) peak TEC, (b) occurrence time, (c) latitude of the occurrence of the daily most developed anomaly crest from October, 1986 to September 1987. The day to day variation of Ap index is also shown in panel (d).

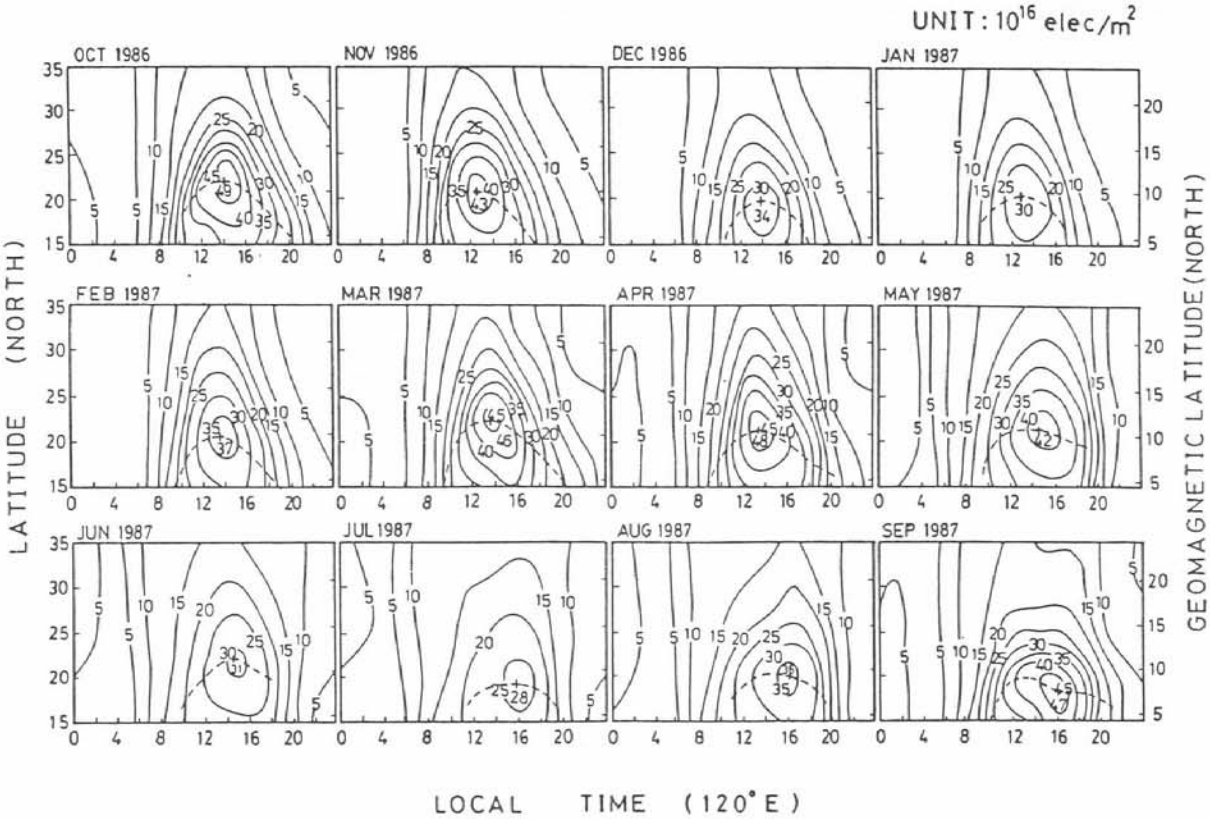

Fig.4 Monthly mean contour charts of TEC for each month from October 1986 to September 1987.

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