

A STUDY OF THE VARIABILITY OF ELECTRON TEMPERATURE AND ELECTRON DENSITY AT ~ 500 KM ALTITUDE OVER INDIAN EQUATORIAL AND LOW LATITUDES

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ABSTRACT

A quantitative analysis of the variability of electron temperature T_e and electron density N_e measured in situ at 500 km and $\pm 30^\circ$ latitude was undertaken and the results are presented in this paper. Variability in T_e is found to be minimum around the magnetic equator and increases towards higher latitudes. T_e variability increases with increase in solar activity at all latitudes. Electron density exhibits higher variability during sunrise and sunset. As in case of T_e variability in N_e increase in solar activity. Latitudinal variation in variability of N_e was also observed.

INTRODUCTION

The structure of the ionosphere and its variability depends on a number of factors viz. levels of solar and geomagnetic activity, solar flux, solar zenith angle, local time and meteorological influences etc. The solar photon radiations, which ionize the atmospheric constituents varies with the 11-year cycle, with the quasi 27-day variation of sun and from one day to another. The variation in the solar zenith angle contributes to the well-known diurnal, annual and semiannual variation in the ionosphere. In addition, solar flux induced variations in neutral composition, neutral temperatures and winds and conductivities are also manifested in ionospheric plasma densities and consequently in plasma temperatures. Further, ionospheric condition often includes a few magnetically disturbed days (storm days) during a month in which the plasma density and temperature differ significantly from its quiet day levels.

DATA SET AND METHOD OF ANALYSIS

The base data set are obtained from SROSS C2 RPA measurements within the latitude belt of -31° to 34° and longitude range of 40° to 100° for years 1995 to 1998. The electron temperature and density measured by the SROSS C2 satellite over the Indian equatorial and low latitudes were found to exhibit significant variability at all local times and in all latitudes [1]. Median and quartiles are used to derive the variability of each parameter. The medians (M) is the value at the midpoint of the monthly data at particular local times, upper quartiles (UQ) and lower quartiles (LQ) are defined as the values that are above $1/3^{\text{rd}}$ and $2/3^{\text{rd}}$ respectively of data values. The monthly medians are taken as the representative value for the month and the parameter. The parameter variability V is then defined as, according to Bilitza [2]

$$V = (\text{upper quartiles} - \text{lower quartiles}) / \text{median} * 100\%$$

as the measure of monthly variability [2]. The difference between two quartiles i.e. Inter Quartile Difference (IQ) also analyzed at four local time periods 05:00-7:00, 10:00-14:00, 18:00-20:00 and 22:00-02:00 shows that IQ is high during 05:00-7:00 local time period.

RESULTS

The electron temperature variation

LQ, UQ and IQ variations

Diurnal variation of IQ, UQ and LQ at the magnetic equator for three seasons of the years 1995, 1996, 1997, 1998 is shown in fig. 1. We have seen that during the pre sunrise time the LQ and UQ of electron temperature is high, and a secondary enhancement is observed during pre sunset time. But the secondary enhancement is not clear in winter season. Behaviour of IQ is similar to that of LQ and UQ. The variability V of electron temperature is high during morning and a secondary minimum at sunset time. The average variability is ~ 0.4

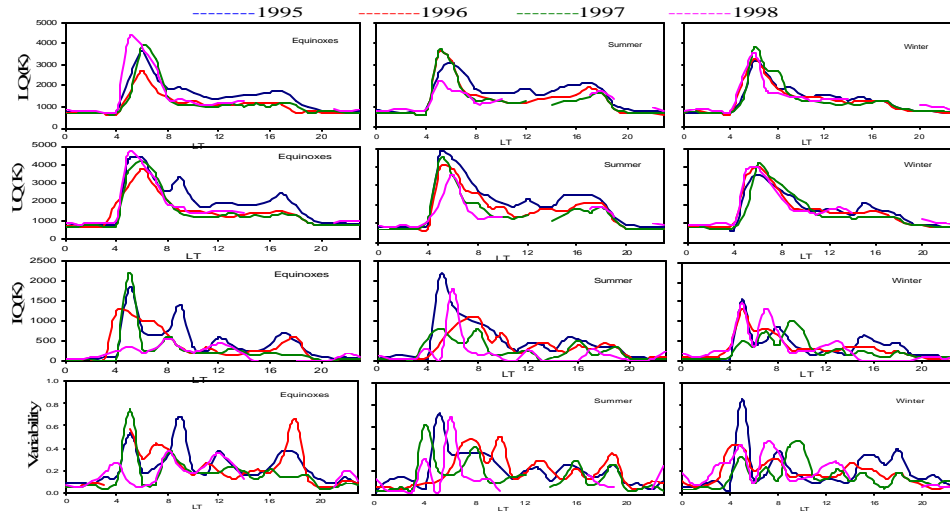


Fig. 1 Electron Temperature variation (LQ, UQ, IQ, V) for all seasons at 0° magnetic latitude from year 1995 to 1998

The electron density variation

LQ, UQ and IQ variations

Diurnal variation of IQ, UQ and LQ at the magnetic equator for three seasons of the years 1995, 1996, 1997, 1998 is shown in fig. 2. We have seen the LQ and UQ of electron density are high during daytime. The IQ has same behaviour as LQ and UQ. The LQ and UQ is in general high in the year 1998 a year of medial solar activity. The variability V of electron density is high during morning and nighttime. The average variability is ~ 150 .

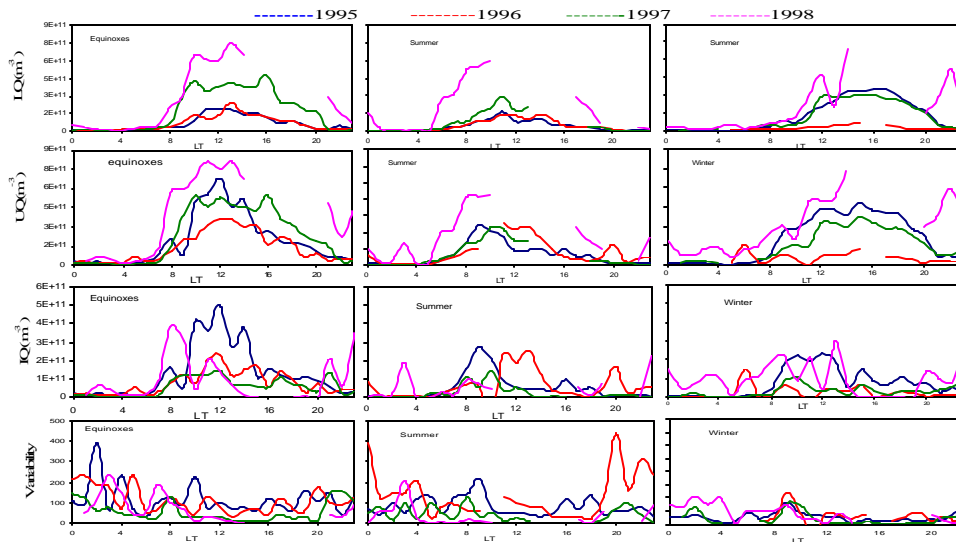


Fig. 2 Electron Density variation (LQ, UQ, IQ, V) for all seasons at 0° magnetic latitude from year 1995 to 1998

Inter Quartile Difference at 4 periods

Inter Quartiles Difference variation of electron temperature and electron density for four time periods (05:00-7:00, 10:00-14:00, 18:00-20:00 and 22:00-02:00) at seasons of the years 1995 to 1998 is shown in Fig. 3 and Fig. 3. From the figures it can be seen that the IQ is high during 05:00-7:00 for electron temperature in all seasons. For the case of electron density the IQ is high during 10:00-14:00 in all seasons.

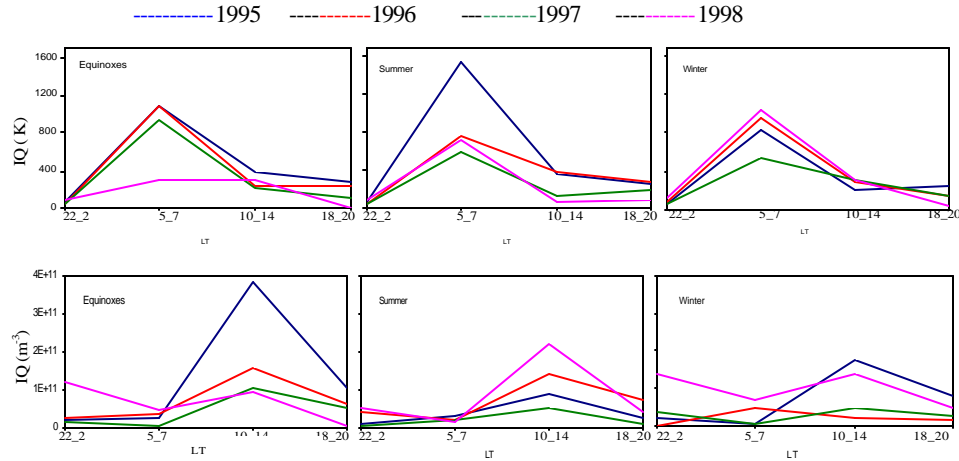


Fig. 4 IQ difference of Electron Temperature and Electron Density for all seasons at 4 periods in the magnetic equator from year 1995 to 1998.

REFERENCES

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