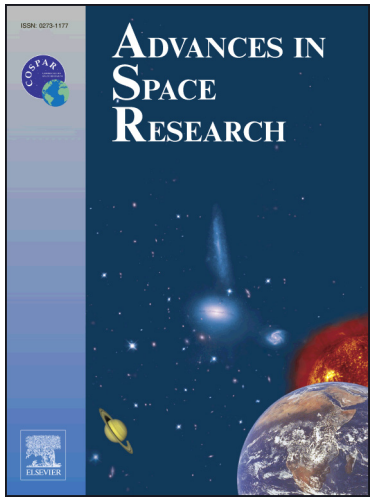

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Variability of ionospheric parameters during solar minimum and maximum activity and assessment of IRI model

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Abstract

The ionospheric parameters (electron and ion plasma temperatures (Te and Ti) and total ion density, Ni) as obtained by the Indian SROSS-C2 satellite (altitude ~500 km) have been investigated during low (year 1995, $F_{10.7}$ ~ 77 sfu) and high (year 2000, $F_{10.7}$ ~ 177 sfu) solar activity periods. The region under study spans over 5°S-30°N geomag. latitude and 60°-100°E geog. longitude over the Indian sector. The observations are compared with the modelled values using IRI-2007 and IRI-2012 versions to assess model predictability. We found that minimum plasma temperatures (Te and Ti) in nighttime gets twice hotter whereas maximum temperatures in early morning gets reduced by half (cooler) when the solar flux gets doubled indicating a direct relation of Te and Ti with solar flux, F10.7 in nighttime but inverse in the morning hours. The ion density (Ni) exhibits solar activity dependence throughout the day and increases by one order when solar activity gets doubled. The modelled Te and Ti are found in agreement to the observed values for high solar activity over both the regions. Whereas the discrepancy exists during low solar activity period over both the regions with over-/under-estimated values in nighttime/morning and noontime respectively. The latest IRI-2012 model improves the nighttime Te and Ti whereas the modelled Ni is found in complete agreement to the observations.

Keywords: Electron temperature, Ion temperature, Ion density, SROSS-C2 satellite, IRI – 2007, IRI-2012 model

1. Introduction

The F2 region (>150 km) of the Earth's ionosphere is a complex and important region owing to the society's technological dependence on satellite's communication and navigation systems. Thus, understanding, forecasting and monitoring of the changes in the ionosphere has become extremely important to suggest the corrections for precise measurements. It is also well known that the ionosphere responds in a complex manner to the geophysical conditions like solar flux, electro-dynamic drifts, etc., with a lot of variability and hence various ionospheric parameters (like electron/ion densities, total electron content (TEC), electron and ion temperatures) behave partly in regular and irregular manner exhibiting daily, seasonal, annual, latitudinal and solar cycle variations (e.g. *Kawamura et al., 2002; Sharma et al., 2005, 2010, Aggarwal et al., 2007, 2009* and more). Thus understanding of its complexity and forecasting has become an important field of present day research to suggest improvements also in the existing ionospheric models.

Most of the ionospheric studies are mainly based on the electron density and TEC observations whereas lesser exists for ionospheric plasma temperatures which is because of a fewer ground (radar)- and satellite-based measurements (Hinotori, OGO–2,AE–C, AE–E and