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Study of GPS Derived Total Electron Content and Scintillation Index Variations over Indian Arctic and Antarctic Stations

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Abstract

In the present study we have investigated the monthly and seasonal variability of TEC and amplitude scintillation index (S_4) over two Indian polar stations Maitri (Antarctic) and Ny-Alesund (Arctic), during the low solar activity period 2008. We have used the Novatel's dual frequency GPS receiver GSV4004A to accomplish this study. From our analysis we observed that TEC achieves its highest values during the months of November and December while during the month of May and June the lowest values of TEC were recorded at Maitri station. Similarly during summer season the highest values of TEC are recorded while in winter season lowest values of TEC are observed. The scintillations that occurred during the year 2008 at Maitri as well as at Ny-Alesund were generally found to be of weak type ($S_4 \geq 0.1$), although few cases of moderate ($S_4 \geq 0.3$) and strong ($S_4 \geq 0.5$) scintillation were also observed. The occurrence characteristics of scintillations showed that maximum scintillations at Maitri occur during the month of July and August while least scintillations occur during the month of January and February. This type of ionospheric variability can be explained on the basis of solar irradiance at Polar Regions.

Keywords: Total electron content; Scintillation index; Polar ionosphere.

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1. Introduction

The variability and behavior of high latitude and polar ionosphere is very much different from that of equatorial and low latitude ionosphere. The energy transferred from solar wind to magnetosphere during solar wind magnetosphere interaction is being deposited at the Polar Regions which produces several types of disturbances in the auroral ionosphere. High latitude regions are directly affected by the entry of charged solar particles which on dissipating their energy cause auroras and thus make the ionosphere asymmetrical. One of the most interesting characteristic feature of the solar wind magnetospheric interaction occurring at Polar Regions is seen in the form of auroras.

The auroral ionosphere is subjected to adverse space weather conditions which cause significant temporal and spatial variations of electron density and density gradients resulting in highly variable (TEC) [1] and fluctuation in amplitude and phase of radio

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