Available online at www.elixirpublishers.com (Elixir International Journal)

Space Science

Elixir Space Sci. 84 (2015) 33867-33873

ISSN: 2229-712X

Study of Ionospheric TEC Variability over Low, Mid and High Latitudes during Solar Maximum

Roshni Atulkar[1], Azad A. Mansoori[2], Parvaiz A Khan[3] and P. K. Purohit[1]

[1]National Institute of Technical Teachers, Training and Research, Bhopal – 462002, MP, India.

[2]Department of Electronics, Space Science Laboratory, Barkatullah University, Bhopal – 462026, MP, India.

[3]Department of Electronics and Communication Engineering, Islamic University of Science and Technology, Pulwama, J & K, India.

ARTICLE INFO

Article history:

Received: 17 June 2015;

Received in revised form:

15 July 2015;

Accepted: 22 July 2015;

Keywords

Ionosphere,

Total Electron content,

Geomagnetic Storm,

GPS.

ABSTRACT

Total electron content (TEC) is a key ionospheric parameter that describes the major impact of the ionosphere on the propagation of radio waves which is crucial for terrestrial and space communication. The present investigation is dedicated to study the latitudinal variability of ionosphere. The study is carried out by taking three stations one each in low, mid and high latitude regions namely IISC, Bangalore, India (13.02^0 N, 77.57^{0}E), GUAO, Urumqi, China (43.82^{0}N, 87.60^{0}E) and NYAL, NY-Alesund, Norway (78.92^{0}N, 11.86^{0}E) respectively. To study the changes in the ionosphere at three selected station we have considered the GPS observations. The GPS derived TEC values have been collected from the SOPAC (Scripps Orbits and Permanent Array Center) data archive of the IGS (International GPS service). The study is carried out during the high solar activity period of 24th solar cycle i.e. during January 2012 to December 2012. We also studied the behaviour of ionospheric Total Electron Content (TEC) during the geomagnetic storms. We have selected 5 intense geomagnetic storms (Dst ≤ -100nT) that were observed during the year 2012. From our analysis we observed that TEC achieves its highest values during the months of October and March at low latitude, during the month of April and May at mid latitude and during the September and March at high latitude while the lowest values of TEC were recorded at all the station in December month. Similarly, the highest values of TEC are recorded during the equinox season while the lowest values are recorded in winter season.

Introduction

The ionosphere is just the one percent of the atmosphere above 100 km, it is very important because of its influence on the passage of radio waves. The propagation of the radio waves throughout the ionosphere is strongly influenced by its regular variations (diurnal, seasonal, solar cycle, latitudinal) as well as by different short and long term changes. . A number of studies conducted in the past have revealed some important similarities and differences between the high, mid and low latitude ionosphere. It is believed that the ionospheric variability at low, mid, and high latitudes is caused by variations in the external forces that originate from the thermosphere, the magnetosphere, and the lower atmosphere [1]. The polar ionosphere is directly connected to the outer space by the geomagnetic field lines configuration and then particularly sensitive to the perturbation events. The variability of the low latitude ionosphere is due to the large scale electrodynamics associated with the equatorial electrojet (EEJ), equatorial ionization anomaly (EIA), Plasma fountain, Equatorial wind and temperature anomaly etc. [2] Studied the latitudinal variations of the day to day TEC variability at five stations in the northern hemisphere during the solar maximum years 1981 and 1989 respectively of the 21 and 22nd solar cycles and also during the common solar minimum year 1985. The effect of solar phase change in the variability is found to be the least for the mid latitude station of Boulder and most during the nighttime for the high latitude station of Goose bay. TEC variability reveals narrowing of the spectrum from low to high latitudes during the solar minimum phase while the reverse seems to be the case during the solar maximum. [3] Studied the diurnal, seasonal and annual behaviour of ionospheric total electron content. They investigated the variation of TEC during high solar active period in Malaysian region and they observed that the amplitude of the seasonal variation of TEC is directly proportional to the solar activity and the pattern of seasonal variation of TEC is solar activity dependent. [4] Studied the diurnal variability of TEC at Waltair (India) and they observed many characteristics typical to low latitude ionosphere such as short lived pre dawn minimum, a steep post sunset fall. [5] also presented the temporal and spatial variability of TEC derived from temporal simultaneous and continuous measurement for the first time using the GPS network of 18 receiver located from the equator to the northern crest of the equatorial ionization anomaly region and beyond, covering a geomagnetic latitude range 1 degree to 24 degree North. [6] Studied the variability in TEC with different solar indices i.e EUV, F10.7, solar flux and smoothed sunspot number (SSN) for summer, winter and equinoxes. They concluded that TEC exhibited nonlinear relationship with smoothed sunspot number (SSN) in general and linear variations with EUV and F10.7 solar flux. [7] studied the long term variability of ionospheric TEC with different solar indices like CME Occurrence, Solar EUV Flux, Solar Radio Flux F10.7cm, Flare Index and Sunspot Number (Rz) and they revealed that the variation of ionospheric TEC has more close agreement with solar radiation fluxes (EUV Flux, Solar Radio Flux F10.7cm and

Tele:

E-mail addresses: purohit_pk2004@yahoo.com