IRI model analysis during disturbed periods

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The ionosphere is the major source of error for single frequency GPS receivers. The behavior of the GPS signals, in the ionosphere, is a function of the local refractive index and gradients. The electron density varies with latitude, longitude, altitude, solar cycle, season, and geomagnetic field activity, making this evaluation a difficult task. Since these data are not directly available the Total Electron Content (TEC) was used to estimate the electron density variation with height, latitude and longitude. The Vertical Total Electron Content (VTEC) values are evaluate from IONEX (Ionosphere Map Exchange) data provided by CODE (Centre for Orbit Determination) which compiles more than 200 sites with GPS dual frequency. From these data the TEC are evaluated by a simple trigonometric transformation.

Using IONEX data the ionospheric effects on the GPS signals can be studied at any place in the world with an interval of 2 hours for any day since January, 1999.

Typical days of high solar activity are analyzed shown values of TEC above 120 TEC Units (TECU) corresponding to errors, due to the ionosphere, above 20 meters over southern regions of Europe and Japan.

In days of strong geomagnetic storm, like the ones occurred in the last days of October 2003, regions such California, USA may be affected. Large values of EC results large effects on the GPS signal propagation, such as large delays, refraction, and Doppler due to ionosphere.

A comparison between the IRI model and the VTEC data during critical situations (geomagnetic storms) it was made, and in this way some results can be used to improve the IRI model.

More detail studies over Brazil (Ionospheric Equatorial Anomaly) was possible analyzing data obtained from stations of the “Rede Brasileira de Monitoramento Contínuo” [Brazilian’s Continuously Monitoring Network] (RBMC) in RINEX (Receiver Independent Exchange) format.