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DYNAMICS OF THE IONOSPHERIC IRREGULARITIES DURING THE ST. PATRICK'S DAY STORM BY GROUND-BASED GPS MEASUREMENTS

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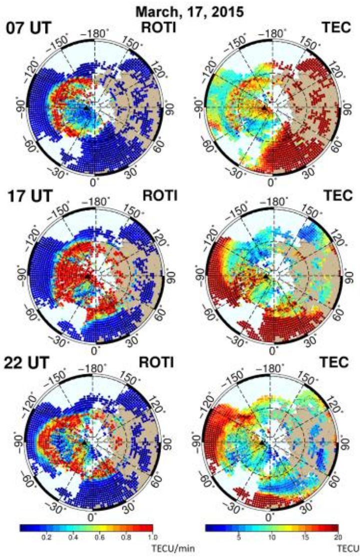
We report first results on the study of the high-latitude ionospheric irregularities observed in worldwide GPS data during the St. Patrick's Day geomagnetic storm [Cherniak et al, 2015]. Multi-site GPS observations from more than 2500 ground-based GPS stations were used to analyze the dynamics of the ionospheric irregularities in the Northern and Southern Hemispheres. We conclude that current fast-growing networks of GPS receivers can provide much more information about the ionospheric irregularities than it was possible for the past super-storms in the years 2003-2004. Few types of the GPS data processing were implemented to analyze the dynamics of the high-latitude ionospheric irregularities produced by the St. Patrick's Day geomagnetic storm. It was constructed the diurnal and hourly Rate of TEC (ROTI) maps, hourly TEC maps as well as derived a high-resolution ROT variability for selected GPS station chains. The diurnal and hourly ROTI maps are constructed for both Northern and Southern Hemispheres. The most intense ionospheric irregularities lasted for more than 24 hours starting at 07 UT of March 17. The period of the most intense irregularities occurrence was strongly correlated with changes in the auroral Hemispheric Power index and it was associated with processes related to enhanced auroral particle precipitation. We find hemispheric asymmetries in the intensity and spatial structure of the ionospheric irregularities, this asymmetry can be related to the IMF orientation, which can lead to a hemispheric asymmetry in the Region 1 FACs. Over North America the ionospheric irregularities zone expanded equatorward below ~45°N geographic latitude. Additionally, the strong mid- and high-latitude GPS phase irregularities in the auroral oval were found. Formation and further evolution of storm enhanced density and a polar tongue of ionization structures caused the storm-induced plasma density gradients and the appearance of the strong GPS phase irregularities at the mid- and high-latitudes of the Northern Hemisphere (See Fig. 1).

Significant increases in the intensity of irregularities within the polar cap were observed in both hemispheres associated with the formation and evolution of a polar tongue of ionization and polar cap patches. Further studies of the high-latitude ionosphere response to the St. Patrick's Day storm with the use of satellite and ground-based observations will be valuable for understanding processes within the ionosphere-magnetosphere system during geomagnetic storms.



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Cherniak Iu, Zakharenkova I., Redmon R. Dynamics of the high-latitude ionospheric irregularities during the March 17, 2015 St. Patrick's Day storm: Ground-based GPS measurements, Submitted to Space Weather, 2015.

Figure 1. The GPS ROTI and GPS TEC maps over the Northern Hemisphere for selected moments of time on March 17, 2015