

Investigation of the Bottomside / Topside Contribution to the Total Electron Content at European Mid-latitudes

Irina E. Zakharenkova¹, Irk I. Shagimuratov¹, Iurii V. Cherniak¹, Andrzej Krankowski² and Anna Krypiak-Gregorczyk²

¹West Department of IZMIRAN, 41 Av. Pobeda, Kaliningrad, 236010, Russia, e-mail: zakharenkova@mail.ru

²Geodynamics Research Laboratory, University of Warmia and Mazury, 1 Oczapowski St., 10-957, Olsztyn, Poland, e-mail: kand@uwm.edu.pl

Abstract

Different radio sounding techniques are used to the study of the ionosphere state. In the given paper analysis of ionospheric electron density and contribution of different parts of the ionosphere to the total electron content (TEC) was carried out on the base of measurements provided by GPS transionospheric sounding, vertical ionospheric sounding and radio occultation (RO). It was considered the region of the European mid-latitudes with 2 closely located ionosonde stations – Pruhonice (50.0 N, 14.6 E) and Juliusruh (54.6 N, 13.4 E). Ionosonde data viz., ionograms, critical frequency of F2 layer (foF2) values and electron density profiles, were provided by European Digital Upper Atmosphere Server (DIAS). To obtain the bottomside ionospheric electron content (IECb) we integrate the bottomside Ne profile derived from digisonde. Topside ionosonde profile, obtained by fitting a model to the peak electron density value, was used to estimate the topside ionospheric electron content (IECt). Also the electron density profiles, derived from FormoSat-3/COSMIC RO measurements, were involved into analysis. The numerical integration was done in order to obtain COSMIC-derived IECb and IECt estimates. Therefore, for the present study the upper limit of the ionosphere has been taken to be at 750-800 km (altitude of COSMIC satellites). The total electron content values were calculated using the observations of the ground-based GPS stations located close to ionosondes. The vertical GPS TEC estimates can be split into two contributions, one part due to the bottomside ionosphere and other part due to the topside ionosphere. The topside part of TEC contains IECt and PEC (plasmaspheric electron content). So, comparison of GPS TEC, F3/C IEC and ionosonde IEC was carried out for different seasonal conditions during period of low solar activity. Special attention was focused on the differences in topside and bottomside parts contribution to TEC for night and daytime hours.