IRS2012-6
International Radiation Symposium 2012
Dahlem Cube, Berlin, Germany, 06 – 10 August 2012

Analysis of the parameters of the upper atmosphere and ionosphere based on radio occultation, ionosonde measurements, IRI and NeQuick model data

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In April 2006, a new satellite system FormoSat-3/COSMIC (Taiwan's Formosa Satellite Mission #3 and Constellation Observing System for Meteorology, Ionosphere and Climate) was put into operation. The system consists of 6 low-orbital satellites with an orbital altitude of the order of 800 km. FormoSat-3/COSMIC satellites are capable of receiving radio signals transmitted from GPS navigation system. The Formosat-3/COSMIC radio occultation measurements provide, on average, 1800 electron density profiles of the ionosphere worldwide per day. We present the results of verifying the FormoSat-3/COSMIC radio occultation electron density profiles with the measurements by ionosondes in different regions of the world during 2006-2008. The F2-layer critical frequencies yielded by radio occultation profiles are in fairly good agreement with those measured by the ionosondes for quiet geomagnetic conditions. The discrepancy in the F2-layer critical frequencies from radio occultation profiles and ionosondes data increases as the ionospheric storminess increases.
In many cases, the necessary (or missing) information on the ionosphere is derived from global empirical ionospheric models, the IRI (International Reference Ionosphere), and NeQuick. The aim of our work is to compare the data provided by the IRI-2001, IRI-2007 and NeQuick models with the radio occultation electron density profiles from the data of FormoSat-3/COSMIC system. The results of this comparison are valuable for the elaboration and improvement of ionospheric models, as well as for many radiophysical and geophysical applications. The results of comparisons of the IRI-2001, IRI-2007, NeQuick models with the radio occultation profiles for different geomagnetic conditions are reported. Our analysis showed that, almost regardless of the particular geophysical conditions, the models NeQuick, IRI-2001, IRI-2007 rather well reproduce the maximum values of electron density. However, the electron density profiles are reproduced much worse. Thus, radio occultation profiles of the weakly disturbed (Kp<4) mid-latitude and subauroral ionosphere can be used for different geophysical and radio physical applications. They can also serve an additional projection in the ionospheric radio tomography.