Iurii
Cherniak
UCAR/COSMIC
Irina Zakharenkova, SRRC UWM and WD IZMIRAN
Oral
The correct representation of the topside ionosphere is still an open question for the empirical ionospheric models. We present new results of the concurrent analysis of the topside electron content values derived from the GPS measurements on board the GOCE and TerraSAR-X satellites with two empirical ionospheric models: NeQuick 2 and IRI-Plas. Additionally to the topside total electron content (TEC) for estimation of the both models performance below 500 km we used COSMIC RO derived ionospheric profiles of electron density (ionPrf) product available on http://cdaac- www.cosmic.ucar.edu/.

Two periods of low (2009/2010) and moderate (2012) solar activities were analyzed. We obtain that IRI-Plas and NeQuick 2 model demonstrates a good result for the bottom ionosphere specification. Also it is found that the IRI-Plas model overestimates the electron content in the 250–500 km altitude interval for low solar activity and the topside total electron content (TEC) for the 500–20,000 km altitude range during daytime local time at low and moderate solar activities. The NeQuick 2 model demonstrates very similar to the IRI-Plas results for the 250–500 km region and the opposite behavior for the region above 500 km with underestimated values for all considered seasons and local time. The most important region for the model/model differences was found to be within the altitude range of 500–2000 km. The observed understatement in the NeQuick 2 topside TEC results can be related to the simplified extension of the electron density profile toward the GPS orbit altitude without adjustment of the specific plasmasphere model. However, the plasmasphere model included into the IRI-Plas leads to the noticeable overestimation of the TEC values derived from the spaceborne GPS measurements. We conclude that both IRI-Plas and NeQuick 2 needs to be essentially improved in order to be able specify ionosphere plasmasphere above F2 layer peak.
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