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Validation of COSMIC radio occultation electron density profiles by incoherent scatter radar and ionosonde data

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Various Radio Occultation space missions have proved successful in addressing a broad range of scientific questions on climate change analysis, operational weather prediction, ionospheric research and space weather forecasting, calibrating other observing systems (e.g., radiosonde and other satellite observations), ionosphere studies (layered structures of the F and E layers and global distribution of the Sporadic Es layers), and Geodesy. The FORMOSAT-3/COSMIC is a joint Taiwan - US mission that provides a constellation of six micro-satellites. Each satellite carries three atmospheric science payloads: (1) a GPS RO receiver for ionospheric and neutral atmospheric profiling and precision orbit determination; (2) a Tiny Ionospheric Photometer (TIP) for monitoring the electron density via nadir radiance measurements along the sub-satellite track; and (3) a Tri-Band Beacon (TBB) transmitter for ionospheric tomography and scintillation studies. So, this mission provides the unprecedented opportunities for global observations of the ionosphere and space weather research.

In the given paper we used the measurements provided by IS radar located near Kharkiv, Ukraine (geographic coordinates: 49.6oN, 36.3oE, geomagnetic coordinates: 45.7oN, 117.8oE) for the cases of winter and summer seasons (2007 and 2008) during quiet geomagnetic conditions and compare these ground measured data with the GPS COSMIC radio occultation ionospheric profiles. We also used data provided by Pruhonice ionosonde, that located at same latitude with Kharkiv ISR and Juliusruch ionosonde located at same longitude with Pruhonice ionosonde.

The comparison of RO indicates that usually COSMIC RO profiles are in a good agreement with IS radar's profiles both in the F2 layer peak electron density (NmF2) and the bottom side part of the profiles and a good agreement with ionosonde profiles below the F2 layer peak. The coincidence of profiles is better in the cases when projection of the ray path of tangent points is closer to the ground based facility location.

This result is important to validate the reliability of the COSMIC ionospheric observations using the radio occultation technique.

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