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Regional multi-dimensional modeling of the ionospheric electron density from satellite data and IRI

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The accurate knowledge of the electron density is the key point in correcting ionospheric delays of electromagnetic measurements and in studying ionosphere physics. During the last decade satellite missions have become a promising tool for monitoring ionospheric parameters such as the total electron content (TEC), i.e. the integral of the electron density along the ray-path between the transmitting satellite and a receiver.

In this contribution we present a multi-dimensional model of the electron density consisting of a given reference part, computed from the International Reference Ionosphere (IRI), and an unknown correction term expanded in terms of multi-dimensional base functions. The corresponding series coefficients are calculable from the satellite measurements by applying parameter estimation procedures. Here we use data from the FORMOSAT-3/COSMIC (F3/C) mission radio occulation (RO) 6-LEO satellite constellation. Fully deployed in their respective orbital planes and at 72 degree inclination and 800 km altitude, F3/C will be routinely providing global coverage of 2500 daily ionosphere/atmosphere profiles with unprecedented temporal and spatial sampling. Since the data are irregularly sampled, finer structures of the electron density are modelable just in regions with a sufficient number of observation sites. Thus, the COSMIC data can be combined with other available data including observations from dual-frequency radar altimetry (T/P, JASON, ENVISAT). This method can be of particular help in studying and specifying the electron density in the Equatorial Anomaly (EA) region.