



Global ionospheric electron density estimation based on multisource TEC data assimilation

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We developed a three-dimensional parameterized ionospheric electron density model based on the IRI-2012 model, which was analyzed by spherical harmonic (SH) expansions in the horizontal and empirical orthogonal functions (EOFs) in the vertical. Then, after assimilating the monthly total electron content (TEC) data from multisource observations during magnetically quiet time into the model, including ground-based GPS, LEO radio occultation (RO) and the oceanic altimeter, we reanalyzed the monthly global ionospheric parameters, such as electron density, TEC, the F2-peak density (NmF2) and critical frequency (foF2). We also compared the reanalyzed and IRI-2012 modeled results with the following “measurements”: (1) the global TEC map from Center for Orbit Determination in Europe (CODE), (2) the monthly median foF2 in a middle-latitude ionosonde station, and (3) the retrieved maps of HmF2, NmF2, and TEC from Formosa Satellite Mission 3 / Constellation Observing System for Meteorology, Ionosphere and Climate (FORMOSAT-3/COSMIC) RO observations. The comparisons showed that both the reanalyzed and IRI results are consistent with those measurements and the reanalyzed results perform better than the IRI model. In summary, our method can reanalyze the global ionospheric electron density with multisource TEC data assimilation into our model and improve the performance of IRI-2012 model.