

Ionospheric Data Assimilation Model by Using Radio Occultation and Ground-based GPS Observations

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Ionospheric data assimilation is a powerful approach to reconstruct the three-dimensional distribution of ionospheric electron density from various types of observations. The ionospheric data assimilation model based on the Gauss-Markov Kalman filter with the International Reference Ionosphere as the background model is used to assimilate two different types of total electron content (TEC) observations from ground-based GPS and space-based FORMOSAT-3/COSMIC (F3/C) radio occultation (RO). The new satellite mission FORMOSAT-7/COSMIC-2 (F7/C2) will place 12 micro satellites in orbits with two launches in 2016 and 2018, the satellite mission is expected to yield more than 8,000 RO observation per day. The Observing System Simulation Experiments (OSSEs) of assimilating FORMOSAT-7/COSMIC-2 (F7/C2) RO and ground-based GPS data in the data assimilation model are implemented in the study, the OSSEs results demonstrate that the F7/C2 RO data can increase model accuracy more than assimilating F3/C RO data. The new ionospheric data assimilation model that employs the location-dependent background model error covariance, Kalman filter forecast step, and Kalman filter measurement update step could reconstruct the three-dimensional ionospheric electron density distribution satisfactorily from both ground- and space-based GPS observations.

Keywords: Ionosphere, Data Assimilation, FORMOSAT-3/COSMIC