



Global Three-Dimensional Ionospheric Data Assimilation Model Using Ground-based GPS and Radio Occultation Total Electron Content

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An ionospheric data assimilation approach presented here is based on the Gauss-Markov Kalman filter with International Reference Ionosphere (IRI) as the background model and designed to assimilate the total electron content (TEC) observed from ground-based GPS receivers and space-based radio occultation (RO) of FORMOSAT-3/COSMIC (F3/C) or FORMOSAT-7/COSMIC-2 (F7/C2). The Kalman filter consists of the forecast step according to Gauss-Markov process and measurement update step. Observing System Simulation Experiments (OSSEs) show that the Gauss-Markov Kalman filter procedure can increase the accuracy of the data assimilation analysis over the procedure consisting of the measurement update step alone. Moreover, in comparing to F3/C, the dense F7/C2 RO observation can further increase the model accuracy significantly. Validating the data assimilation results with the vertical TEC in Global Ionosphere Maps and that derived from ground-based GPS measurements, as well as the ionospheric F2-peak height and electron density sounded by ionosondes is also carried out. Both the OSSE results and the observation validations confirm that the developed data assimilation model can be used to reconstruct the three-dimensional electron density in the ionosphere satisfactorily.