

Global ionospheric data assimilation model and its application

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The global data assimilation approach based on the Gauss-Markov Kalman filter to assimilate the total electron content observed from ground-based GPS receivers and space-based radio occultation instrumentations (such as FORMOSAT-3/COSMIC) into the International Reference Ionosphere to reconstruct the temporal continuity three-dimensional (3D) ionospheric structure. Observing System Simulation Experiments show that the data assimilation procedure consisting of the forecast and the measurement update steps can better improve the accuracy of the data assimilation analysis than the assimilation procedure using the measurement update alone. The real data assimilation results are further validated with global ionosphere maps, the global ground-based GPS measurements, and the ionospheric F2 peak height and electron density sounded by ionosondes. Furthermore, the well-resolved electron density structure can be employed to study ionospheric horizontal and vertical variation, even during the severe space weather condition. In this study, the analysis electron density is used to reveal the 3D electron density distribution during the geomagnetic storm.

Keywords: Data Assimilation, Radio Occultation, Kalman Filter