The development of data assimilation in the ionospheric space weather

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An ionospheric data assimilation forecast model has been developed by ensemble Kalman filter (EnKF) to adjust ionospheric observations into a thermosphere-ionosphere-electrodynamics general circulation model (TIEGCM). Using this assimilation model, the performances of ionospheric forecast during the geomagnetic storm conditions are further evaluated in this study. Results suggest a rapid assimilation-forecast cycling (10-min in this study) can greatly improve the quality of the model forecast. Furthermore, updating the thermospheric state variables in the coupled thermosphere-ionosphere forecast model in the assimilation step is an important factor in improving the trajectory of model forecasting. Different high-latitude ionospheric convection models, Heelis and Weimer, are further evaluated in different latitude regions. Results show the better forecast in the electron density at the low-latitude region during the storm main phase and the recovery phase. The well reproduced eastward electric field at the low-latitude region by the assimilation model reveals that the electric fields may be an important factor to have the contributions on the accuracy of ionospheric forecast.

Keywords: data assimilation, ionospheric forecast model, geomagnetic storm

