

Data assimilation of GAIA model using TEC and satellite ionospheric observations

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Prediction of the earth's upper atmosphere is one of the important issues in the space weather research. Variations of ionospheric electron density and thermospheric mass density have significant impacts on the use of GNSS applications, the stable operation of satellites in low earth orbits, and so on.

For the upper atmospheric prediction, we are developing a data assimilative model using a whole atmosphere-ionosphere model called GAIA (Ground-to-topside model of Atmosphere and Ionosphere for Aeronomy). So far, we have introduced meteorological reanalysis into the lower part of GAIA with a simple data assimilation technique (nudging), which enables the model to reproduce effects from realistic lower atmospheric states on the upper atmosphere. However, it is not sufficient for accurate reproduction of the upper atmospheric states. Therefore, we also need to add the upper atmospheric observations in the data assimilation. Currently, we have introduced the global observation of total electron content, and we have found the assimilative model can reproduce the ionospheric states more accurately. But, since the global TEC observation is not available real-time, we are also adapting the satellite ionospheric observations.

In this study, we will introduce initial results from the data assimilation of GAIA using electron density observations from COSMIC2/FORMOSAT7 satellites, and compare with the results from the data assimilation of global TEC. We also discuss which model parameters used in the assimilation result in better performance.

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