Magnetospheric Effects in a Whole Atmosphere-Ionosphere Coupled Model and Prediction Analysis

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As more activities of humans expand to the space, our society is more affected by space weather. Today, it is known that communications and navigation using sky-wave radio propagation between ground facilities and trans-ionospheric propagation between ground-to-space are subject to the ionospheric state, and that the orbits and operations of satellites are affected by the thermospheric state. Therefore, accurate nowcast and forecast techniques of the upper atmospheric states are becoming more important.

So far, we have developed a whole atmosphere-ionosphere coupled model, called GAIA, by self-consistently coupling several numerical models. The meteorological reanalysis data is utilized in the model with a simple data assimilation method so the model can reproduce realistic variations which originate from the lower atmosphere.

In this study, we report several improvements of the model we have made recently, especially with regard to magnetospheric inputs. Owing to the updates, the model has become capable of including more realistic polar potential and its electrodynamic coupling to the low latitude ionosphere.

As to the prediction study, we are constrcting a prediction scheme of plasma bubbles using GAIA. We show that inclusion of magnetospheric effects contributes to a better prediction performance in spite that the phenomenon itself is an equatorial irregular disturbance.