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Simulation of thermosphere and ionosphere variations using meteorological reanalysis data

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The upper atmosphere is the region where space weather phenomena have direct impacts on human activities as we increasingly utilize this region through radio propagation from satellites. On the other hand, the ionosphere and thermosphere are observed to change on various temporal and spatial scales, so understanding and providing the information on these changes are important as a part of space weather research. Recent studies of the upper atmosphere have suggested that not only magnetospheric effects, but the lower atmospheric activities could also have large impacts on the upper atmosphere and cause both short and long-term scale changes. Recently, we have developed a whole Earth's atmospheric model (GAIA: Ground-to-topside model of Atmosphere and Ionosphere for Aeronomy) by integrating several global models for different atmospheric regions, a whole atmospheric general circulation model, an ionospheric model and an electrodynamics model. We have shown the usefulness of the model, by reproducing the ionospheric longitudinal structure and day-to-day variations similar to the observations, which can be considered as lower atmospheric effects. Recently, we also started the simulation in which lower atmospheric reanalysis data is assimilated in order to reproduce realistic upper atmospheric variations. In this presentation, we will report recent upgrades of GAIA, and initial results of data-assimilated GAIA simulation.

Keywords: ionosphere, lower atmosphere, thermosphere, simulation, data assimilation, space weather