A study of the damping mechanism of large-scale TIDs and atmospheric gravity waves using observations and models

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The damping mechanism of large-scale traveling ionospheric disturbances (LSTIDs) and atmospheric gravity waves (AGWs) was quantitatively studied using GPS observations and the two-dimensional high-resolution thermosphere-ionosphere model.

Large-scale traveling ionospheric disturbances (LSTIDs) are generally believed as the ionospheric manifestations of the passage of atmospheric garavity waves (AGWs) that are generated at high latitudes by the energy input from the magnetosphere. Although many publications have been devoted to the research of LSTIDs using the observations such as ionosonde networks, HF radars, and GPS networks, and using the ionospheric models, there are few researches that focus on the quantitative comparison between observations and models on the damping rate of LSTIDs. Their damping is important to discuss the energy transportation in the mid-latitude ionosphere during geomagnetic disturbances.

We have developed a high-resolution thermosphere-ionosphere model to calculate the damping rate of LSTIDs/AGWs propagation in the mid-latitudes. Comparing the damping rate of LSTIDs/AGWs derived from the model with that derived from the GPS observations, it was found that the damping rate of model was much less dependent on the background total electron content (TEC) than the observations. The horizontal propagation velocity of LSTIDs in the model had a little dependency on the background TEC, and was larger by 100 m/s than the average velocity of the observational LSTIDs.

In this paper, we will discuss on the differences between the results of observations and models, and the the damping mechanism of LSTIDs/AGWs.