AOGS 2006

The Large-Scale Traveling Atmospheric Disturbances Simulated by a Whole Atmosphere General Circulation Model

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In order to investigate coupling processes between the upper and lower atmospheres, a general circulation model (GCM) from the ground to the exobase was developed by Miyoshi and Fujiwara [2003]. For example, tidal variations from the troposphere to the thermosphere have been investigated using this GCM. In addition, this GCM successfully simulates the generation and propagation of the large-scale traveling atmospheric disturbances (LS-TADs) in the thermosphere. Since it is well-known that the ionospheric disturbances are generated in association with passage of the LS-TADs, the large-scale traveling ionospheric disturbances (LS-TIDs) have been observed to monitor the activities of the LS-TADs. In particular, the globally propagating LS-TADs/TIDs generated by high-latitude energy and/or momentum inputs have been investigated from observations and numerical simulations. While the observed LS-TADs/TIDs show variety in their propagation velocities and spatial extents, the causes of the variety are still unknown. Furthermore, the LS-TADs/TIDs are occasionally observed even when a geomagnetically quiet period. In order to investigate the characteristics of the LS-TADs generated in the geomagnetically disturbed and quiet periods, we have performed numerical simulations for both two cases. The simulation results show that the LS-TADs are generated in the regions where large pressure gradients are produced by the solar and Joule heating even when a geomagnetically quiet period. The simulations also suggest the importance of coupling the upper and lower atmospheres to produce the small-scale structures of disturbances in the upper thermosphere. The simulated LS-TADs generated when a geomagnetically quiet period dissipate soon after propagation of about 1000 - 2000 km, while the LS-TADs generated when a geomagnetically disturbed period propagate from the polar region to the equator. In this study, we will show some characteristics of TADs generated in both the geomagnetically quiet and disturbed periods.