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Simulation of ionospheric variations caused by acoustic waves generated in the lower atmosphere

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[1]NICT

In the lower atmosphere of the earth, acoustic-gravity waves are generated by various kinds of natural and artificial sources, such as cumulus clouds, tornados, typhoons, earthquakes, tsunamis, volcanic eruptions, meteor impacts, nuclear explosions, rocket launches, etc. Previous theoretical and observational studies have suggested that acoustic-gravity waves induced by such sources can propagate up to the upper atmosphere, producing temporal and spatial variations in the thermosphere and in the ionosphere. However, specific mechanisms of upper atmospheric variations caused by the acoustic-gravity waves have not yet been fully understood because the atmosphere-ionosphere system is an extremely complicated and nonlinear, and it is easily disturbed by many other sources in the atmosphere and in space. In order to quantitatively study the ionospheric variations caused by tsunami-driven acoustic-gravity waves of the 2004 Sumatra earthquake and 2011 Tohoku-oki earthquake, we developed a nonhydrostatic compressible atmosphere-ionosphere model. The model successfully reproduced atmospheric waves and large-scale electron density variations that are caused by tsunami-driven acoustic-gravity waves. We are now developing an atmosphere-ionosphere model with higher spatial resolution and more realistic parameters. We expect that the model is able to reproduce atmospheric-ionospheric phenomena associated with infrasonic and gravity waves produced by various kinds of phenomena. We will report previous results and future prospects.

Keywords: acoustic wave, lower atmosphere, upper atmosphere, ionosphere, simulation, model