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Spectrum of the neutral atmospheric waces derived from a numerical simulation of an earthquake

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It is important to examine the ionospheric disturbances excited by earthquakes, since this contributes to monitoring tsunamis from satellites. There are many reports of ionospheric disturbances occurred by giant earthquakes, such as the 2011 off the Pacific coast of Tohoku Earthquake. But characteristics of atmospheric disturbances, connecting the ionospheric disturbances with the ground and the sea surface, is not clarified because broad observation of the atmosphere in high resolution is difficult. In this study, calculating the spectra from the temporal variations of neutral atmospheric waves determined by a numerical simulation, we derived the features of the propagation of the atmospheric waves.

In this simulation, two dimensional model is used. The atmospheric perturbation is created by a vertical velocity assuming an upward motion of the sea surface or ground surface. Calculating the temporal variations of neutral density, we derived their spectra.

As a result, it is shown that behavior of atmospheric waves is different for the frequency. For a notable example, variations around 1 mHz propagate to high altitudes 450 km ~500 km and long distance 800 km. On the other hand, variations around 10 mHz propagate almost the same distance in lower altitude of 300 km or less. In addition, variation at 4 mHz are located above the epicenter at 350 km. This causes the variation of GPS-TEC at 4 mHz associated with earthquakes that have ever been reported.

Keywords: ionosphere, earthquake, acoustic wave, gravity wave