The electric field and density anomalies in the equator-low-latitude upper E region induced by the acoustic gravity wave of tropospheric origin

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Abstract

In this work, the acoustic gravity wave (AGWs) induced electric field and density anomalies in the upper E region is investigated. The acoustic gravity waves are launched to the thermosphere during intense tropospheric convection. Their dynamics is examined using three dimensional fully time-dependent nonlinear simulation model of AGW that solves the wave equation for the wind associated with the AGW. This model is coupled with the three dimensional ionopsheric model that solves the continuity equation for the ionospheric number density and the current continuity equation for the electrostatic potential.

The AGW of tropospheric origin are found to be trapped within the thermal/density ducts in the 90-110 km altitude region and attains very large amplitude therein. The duting region is found to oscillate with the relaxation time which is close to the Brunt-Vaisala period in this region. As a consequence, the ducting region launches amplified wave packets into the thermosphere with this relaxation time scale leading to the quasi-periodic kind of wind anomalies in the thermosphere. These amplified waves are found to have pronounced effects on the ionosphere that is coexisted with the thermosphere. The present study focus on the upper E region of the ionosphere within 110-150 km altitude region and estimates the density and electric field anomalies caused by these amplified quasi-periodic acoustic gravity waves.

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