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Propagation of infrasound and internal gravity waves from a land source up to the thermosphere

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By means of numerical simulation of hydrodynamic equations, the influence of stratification on propagation of infrasonic and internal gravity waves from the Earth surface up to the height of 500 km is investigated. The modelling localised source generates waves at the Earth surface with frequencies close to Vaisala-Brendt frequency. It is shown that acoustic waves and internal gravity waves are divided at vertical propagation of waves. Infrasonic waves propagate mainly upward over a source, and gravitational waves propagate under some angle. However, the standard theoretical formula for calculating the angle of gravity wave propagation appears inapplicable. The explanation of this inapplicability of the standard formula is based on the fact that generated internal gravity waves are short enough, but the known theoretical formula are derived in long wave approximation. In our calculations, waves successfully overcome «the forbidden zones» (usually calculated within the limits of geometrical optics approach). Internal gravity waves overcome areas with high Vaisala-Brent frequency, and infrasonic low-frequency waves successfully overcome areas of atmosphere with low limiting acoustic frequency. Nonlinear effects depend on amplitude, and can lead to wave breaking. Often waves break at turbopause heights, and they generate a current. Above the turbopause, waves are restored, but the effect of wind producing is present.