Geophysical Research Abstracts
Vol. 16, EGU2014-4868, 2014
EGU General Assembly 2014

Acoustic-gravity waves in the nonisothermal atmosphere and its influence on the magnetospheric quasi-periodic vlf emissions

Olga Savina (1), Peter Bespalov (2), Vera Misonova (3), and Kiril Petrov (3)

(1) National Research University Higher School of Economics, Nizhny Novgorod, Russian Federation (onsavina@mail.ru), (2) Institute of Applied Physics, Russian Academy of Sciences, Nizhny Novgorod, Russia, (3) State Technical University, Nizhny Novgorod, Russia

We examine two mutually complementing tasks related to the theoretical analysis of acoustic-gravity disturbances in the Earth's atmosphere and its influence on magnetosphere processes. Our research is based on modern atmospherical models. We study waves propagation, absorption, and filtration. The atmospheric nonisothermicity is taken into account, for example, by introduction of a two-layered atmosphere temperature model. For a study of more delicate effects, a piecewise-linear model, for which the analytical solution is written by the hypergeometric functions, is employed. Also we consider an influence of acoustic-gravity waves on VLF electromagnetic wave excitation in the magnetosphere. This influence occurs as a result of the following processes: a modulation of the plasma density by acoustic-gravity waves in the ionosphere, a modulation of reflection from the ionosphere for VLF waves, and a modification of the magnetospheric resonator Q-factor for VLF waves. Variation of the magnetospheric resonator Q-factor has an influence on the operation of the plasma magnetospheric maser, where the active substances are radiation belts particles and the working modes are electromagnetic VLF waves (whistler-type waves). The plasma magnetospheric maser can be responsible for an excitation of self-oscillations. These self-oscillations are frequently characterized by alternating stages of accumulation and precipitation of energetic particles into the ionosphere during a pulse of whistler emissions. Numerical and analytical investigations of the response of self-oscillations to harmonic oscillations of the whistler reflection coefficient shows that even a small modulation rate can significantly changes the magnetospheric VLF emissions. Our results can explain the causes of the modulation of energetic electron fluxes and whistler wave intensity with a time scale from 10 to 150 seconds in the day-side magnetosphere. Such quasi-periodic VLF emissions are often observed in the sub-auroral and auroral magnetosphere and have a noticeable effect on the formation of the space weather phenomena.