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Model study of the influence of meteorological processes on the state of the upper atmosphere and ionosphere

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Acoustic-gravity waves (AGW), propagating from the lower atmosphere can reach the heights of the upper atmosphere and due to the dissipation processes significantly affect the characteristics of variations of environmental parameters. The excitation source of AGW in the lower atmosphere can be meteorological disturbances (storms). The observations of the dynamics of ionospheric parameters, performed in a weather storms time in the Kaliningrad region (22º E, 53º N), have shown that in variations of the total electron content (TEC) and the critical frequency of F2 layer of the ionosphere (foF2) marked decrease in the values of these parameters in relation to meteorological calm days. We can suppose that rapid changes in meteorological conditions during a storm favor excitation of AGWs over a wide range of periods. Propagation of AGWs to the upper atmosphere and their dissipation there result in the observed ionospheric disturbances. Theoretical studies of AGW propagation from sources in the lower atmosphere suggest that waves of this range can quickly reach the upper atmosphere and due to dissipation can give rise to large-scale disturbances, specifically to local heating regions.
Numerical experiment was made to test the hypothesis using global self-consistent model of the thermosphere, ionosphere and protonosphere (GSM TIP). As thermospheric source of disturbance was defined spatially localized moving heat source, simulating the effect of AGW dissipation, extending the field of meteorological storm. The calculation results demonstrate the dynamics of perturbations of the upper atmosphere and ionosphere parameters caused by the source model. The physical processes that determine the resulting ionospheric disturbances are discussed.