DISSIPATIVE INSTABILITIES IN MESOSPHERIC DUSTY PLASMA: INFLUENCE OF CHARGING PROCESSES.

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We present the detailed study of two types of dissipative instabilities of charged aerosol flow as a possible generation mechanism for small-scale irregularities in electron density at mesopause altitudes.
The dissipative instability of dust acoustic wave (DAW) develops as a result of relative motion of aerosol and ion flows. Different factors influencing this interaction are taken into account, such as aerosol charging processes and the presence of suprathermal photoelectrons.
The dispersion relation for the electrostatic waves is obtained and analyzed. It is shown that the inertia of aerosol charging in the presence of sufficiently large stationary electric field E_0 leads to an instability of an additional low-frequency mode ($\omega_Q << \omega_{DAW}$). The growth rate of this instability increases linearly with E_0.
The excitation conditions and growth rates are obtained for both instabilities under the typical mesospheric conditions. The results can be formulated as follows.
The dissipative instability of DAW can be excited in mesospheric aerosol plasma in the presence of stationary electric field 0.02 V/cm < E_0<0.03 V/cm for aerosols with radii 25-50 nm and charges 2-6 e. Such charges can be provided by high-energy (T_{ph} >> 110 K) photoelectrons. The maximum growth rates are about 0.1-0.5 s^{-1}. The DAW instability, if develops, generates electron density irregularities with scales about 10-20 cm; such irregularities can cause Polar Mesospheric Summer Echo (PMSE) at UHF wavelengths.
The instability of the additional low-frequency mode is excited in the mesosphere if the stationary electric field E_0 exceeds 0.005 V/cm and aerosol charges are provided by background thermal electrons T_e~110 K. For the electric field 0.01<E_0<0.03 growth rates are about 0.01-0.2 s^{-1}. Such values of the electric field were measured in the region of noctilucent clouds. This instability generates electron density irregularities with scales about 0.4-3 m, which cause PMSE at VHF wavelengths.
Thus, if the sufficiently large stationary electric field exists in the mesosphere region, then the dissipative instability can develop and generate the irregularities causing PMSE either at VHF or at UHF frequencies. In this case, the PMSE frequency depends on the values of the stationary electric field and photoelectron flux.

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