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# Instability of charged aerosol flow as a generation mechanism for electron density irregularities in mesosphere

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A dissipative instability of charged aerosol flow is studied as a possible generation mechanism for small-scale irregularities in electron density at mesopause altitudes. In summer periods such irregularities of different scales cause PMSE (polar mesospheric summer echoes), which have been widely investigated for the last 30 years.

Our analysis is carried out taking into account a review of literature, devoted to experimental and theoretical study of PMSE, and the most recent published data concerning atmosphere composition and properties of aerosol particles at corresponding altitudes (80-90 km).

The dissipative instability develops as a result of relative motion of aerosol and ion flows. Different factors influencing this interaction were taken into account, such as aerosol charging processes, the presence of suprathermal photoelectrons, elongate aerosol shape and possible presence of two distinct aerosol fractions, large and small ones.

Dependence of the instability threshold on the medium parameters was investigated, and quantitative estimates of the parameters necessary for this threshold to be reached were made. Criteria of the dissipative instability in mesosphere are formulated as follows:

- the presence of large spherical aerosol particles (typical radii 100-200 nm) or strongly elongate aerosols, which are directed along the flow;
- high ion density with respect to electron density;

- the ion component consisting of heavy ion clusters (typical mass 200-400 a.m.u.)
- aerosol charge about 10-40 electron charges (such large charges can be reached during the diurnal maximum of the photoelectron flux).

Under such parameters at mesopause altitudes the dissipative instability creates electron density irregularities with scales about 10-30 cm, i.e. the irregularities causing PMSE at UHF frequences.

According to experimental data, conditions stated above are not typical for the mesopause region, but can be realized in some cases. So we can conclude that a development of the dissipative instability of charged aerosol flow could provide a generation of irregularities causing PMSE at UHF wavelengths.