Geophysical Research Abstracts
Vol. 21, EGU2019-5388-2, 2019
EGU General Assembly 2019

Dust charging under variable conditions of the polar mesosphere

Ingrid Mann, Margaretha Myrvang, and Dorota Jozwicki
UiT the Arctic University of Norway, Department of Physics and Technology, Tromsø, Norway (ingrid.b.mann@uit.no)

The upper mesosphere contains dust particles of different origin: meteoric smoke that condenses from the vapor of meteoroids that enter the tmosphere, and ice particles that form by condensation of water vapor and presumably also contain smaller meteoric smoke particles. The electric surface charge of the dust is an important parameter. It influences the growth of the particles and it plays a role in atmospheric chemistry e.g. through its link to the amounts of free electrons. We investigate the dust charging in the variable conditions of the polar mesosphere. In the absence of photon fluxes the charging is determined by ambient electron and ion fluxes. Charge number densities are typically similar, but the electrons move faster than the ions at same temperature. The electron flux exceeds the ion flux and the dust charges negatively until the electric potential is sufficiently large to repel the electrons and reach a balance of positive and negative fluxes. The Maxwellian velocity distributions of the charging particles underlying this picture is only an approximation and a number of other effects come into play so that fractions of the dust are neutral and positively charged and the average dust charge is size-dependent. Photoelectron emission or photo detachment of electrons are caused by short-wavelength photons from Sun, aurora and geo-corona. The solar x-ray, EUV and UV fluxes are notably variable. Auroral precipitation reaches the mesosphere typically with electrons of energy >10 keV. Secondary electron and ion emission are enhanced by small particle effects for particles of sub-micrometer sizes. For dust of sizes few nm induced mirror charges play a role and charging is stochastic. We discuss the influence of the ionospheric variability on the dust charge, possible paths of deriving the dust charge from observations, and observational phenomena that are possibly influenced by dust charge variation.