METEORIC AEROSOLS IN THE MIDDLE ATMOSPHERE

LINDA MEGNER 1, Jörg Gumbel 2

1. Canadian Space Agency, Saint-Hubert, Canada
   linda.megner@asc-csa.gc.ca
2. Department of Meteorology, Stockholm University, Sweden
   currently at LASP, University of Colorado, USA
   gumbel@misu.su.se

Meteoroids entering the atmosphere experience strong deceleration and ablate, whereupon the resulting material is believed to re-condense as nanometre-size smoke particles. These particles are thought to play a major role in mesospheric processes, effecting charge balance, ice nucleation and chemistry. In particular, they have long been considered the favorite candidate as a condensation nucleus for noctilucent clouds (NLC).
However, result of recent multidimensional model simulations show that the atmospheric circulation efficiently transports the particles to the winter hemisphere, and down into the polar vortex. In particular, the meteoric smoke particles are transported away from the polar region before they grow large enough to efficiently act as ice condensation nuclei. Here we examine the assumptions involved in these models and look for solutions to this problem. In particular we note that charging of meteoric smoke, which generally is not included in ice nucleation models, in combination with small deviations from the mean thermal state, may solve the dilemma by significantly altering the ice nucleation properties of smoke. The ionospheric charge density, the presence of energetic radiation and, not the least, measurements of charged particles are all evidence that a significant fraction of the meteoric smoke particles is charged and, hence, that charging effects on ice nucleation must be considered. However, limited knowledge about charging processes in this region, and about charging of sub-nanometre particles in general, makes charged nucleation in the mesosphere a difficult topic. Nevertheless, reasonable assumptions yield number densities of charged condensation nuclei that are consistent with what is expected for mesospheric ice phenomena. Though other possibilities exist, charged meteoric smoke thus proves a promising candidate to explain mesospheric ice phenomena as we observe them.

meteoric aerosols, middle atmosphere, ice nucleation, NLC, PMC

Linda Megner, 6767 Route de l'Aéroport, Saint-Hubert, Quebec J3Y 8Y9, Canada
linda.megner@asc-csa.gc.ca, +1 647 686 9560