UP 16: Atmosphere - Laboratory Studies

Time: Thursday 16:00–16:30 Location: H41

UP 16.1 Thu 16:00 H41

Heterogeneous ice nucleation and growth on small nanoparticles heated up by light absorption — •Kensei Kitajima[1], Mario Nachbar[2], Denis Duft[3], and Thomas Leisner[2,3] — [1]Kyoto University, Kyoto, Japan — [2]University of Heidelberg, Heidelberg, Germany — [3]KIT, Karlsruhe, Germany

Heterogeneous ice nucleation on sub-2nm meteor smoke particles (MSP) plays an important role on the cloud formation in the mesopause region of Earth at heights of 80-90 km. Noctilucent clouds (NLC) in this region have attracted much attention as a peculiar phenomenon observed only during the polar summer. However, very little is known about the physicochemical formation process of NLC so far. An experimental system is required to clarify the nucleation and growth process on MSPs under realistic mesopause conditions. The TRAPS apparatus at KIT is used to investigate the heterogeneous nucleation process on MSPs by observing the mass growth rate of nanoparticles trapped under controlled H2O temperature and pressure with a time-of-flight mass spectrometer. We have recently developed an additional experimental system allowing us to expose the trapped nanoparticles to laser irradiation to study the heat-up behavior of MSPs by solar light absorption during the polar summer. In this study we compare the amount of adsorbed water molecules on the MSP analogues with and without laser irradiation of different input powers to infer the heat up of the particles and determine their absorption cross section. In addition, we discuss how temperature changes of the nanoparticles affect the ice nucleation and growth process.

UP 16.2 Thu 16:15 H41

Heterogeneous nucleation of ice on mineral surfaces: the effect of crystal microstructure — •Alexei Kiselev and Thomas Leisner — Institute for Meteorology and Climate Research, Karlsruhe Institute of Technology (KIT), Karlsruhe, Germany

Mineral dust have been shown to be the most abundant ice-nucleating particle (INP) type in the Earth's atmosphere. However, the ice nucleating efficacy of mineral dust ranges over orders of magnitude and the question, what property (or combination of properties) is responsible for any particular mineral dust aerosol being bad or good INP, is still under debate. In the recent experiments on the deposition growth of ice on feldspar conducted in an Environmental Scanning Electron Microscope (ESEM), we have noticed that ice crystals preferentially nucleate at sites where ideal crystalline structure of feldspar is distorted due to the twinning or exsolution of different feldspar types: K-rich microcline and Na/Ca-rich albite. At the same time the crystal lattice distortion does not destroy the orientation alignment of ice crystals caused by epitaxial growth of ice with its (110) plane on top of the (010) surface of feldspar. Using the 3D structural models of the crystalline lattices of feldspar and ice, we suggest an interpretation of the observational data and discuss the possible implication of this phenomena for the atmospheric ice nucleation research.