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The effect of coating layers on the heterogeneous ice nucleation efficiency of mineral particles

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In numerous laboratory and field studies mineral dust particles have been recognized as efficient heterogeneous ice nuclei. In mixed-phase clouds, which exist at temperatures above 238 K and are composed of both supercooled liquid water droplets and ice particles, mineral particles contribute to the initiation of ice formation and thereby affect the cloud life cycle as well as precipitation events. At temperatures below 238 K the competition between efficient heterogeneous ice nucleation on mineral particles, homogeneous freezing of pure solution droplets, and immersion freezing on particles immersed in solution droplets affects the microphysical and optical properties of cirrus clouds and thereby the climate.

This poster addresses the important question how the ice nucleation efficiency of mineral particles changes upon immersion in anorganic and organic coatings. The ice formation rates on untreated and coated mineral dust aerosol particles were compared to each other in subsequent cloud simulation experiment in the AIDA (aerosol interaction and dynamics in the atmosphere) cloud chamber of Forschungszentrum Karlsruhe. Arizona test dust was used as a reference material for these studies. The dust aerosol was coated with either sulphuric acid or secondary organic aerosol mass. Two series of experiments were carried out at mixed-phase and cirrus cloud temperatures. During these experiments the AIDA facility was equipped with a comprehensive instrumentation for aerosol, ice nuclei, and ice particle characterisation which included important contributions from external partners like an aerosol mass spectrometer (AMS)

from the Max Planck Institute for Chemistry in Mainz, Germany, the single particle mass spectrometer PALMS and a counterflow virtual impactor for selective ice particle sampling form the NOAA lab in Boulder, Colorado, the small ice detector (SID-2) from the University of Hertfordshire and the Met Office, UK, and two ice imaging instruments, a cloud particle imager (CPI) and a video imaging particle spectrometer (VIPS), from NCAR in Boulder, Colorado. The poster will summarize the experimental methods and show first results.