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IN ability investigations of ambient desert dust and urban aerosol samples by environmental scanning electron microscopy

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The effects of aerosol particles on heterogeneous ice formation are currently insufficiently understood. Modelling studies have shown that the type and quantity of atmospheric aerosol particles acting as ice nuclei can influence ice cloud microphysical and radiative properties as well as precipitation. Therefore, a quantitative description of the ice nucleation processes is crucial for a better understanding of formation, life cycles, and the optical properties of clouds as well as for the numerical precipitation forecast.

We report in-situ measurements (deposition and condensation freezing) of the ice nuclei ability of ambient desert dust and urban aerosol samples. All samples are analyzed in an environmental scanning electron microscopy (ESEM), which enables in-situ observation of interactions between water vapour and aerosol particles in the sub-micrometer range.

The temperature – supersaturation curve (1 – 3 % activation) for two ambient desert dust samples from Saudi-Arabia, collected in Israel, were determined. The IN ability of the total ambient samples is almost identical with the values of the mineral with best IN capability (illite or palygroskite), which were present at low concentrations. This clearly shows that ice nucleation of the total aerosol sample can be dominated by a minor component.

To study the influence of anthropogenic emissions on the IN-ability of ambient aerosols, aerosol sampling at different metereological situations at Mt. Kleiner Feldberg (825 m above sea level), about 25 km north of Frankfurt/M (Germany) was performed. First ESEM-results show that clean air masses always yield more ice crystals than polluted air masses. This can be explained by the enhanced presence of sulphate, nitrate or organic particle coatings on the surface of particles in polluted air masses, leading to droplet formation instead of ice nucleation.