Geophysical Research Abstracts
Vol. 19, EGU2017-12885, 2017
EGU General Assembly 2017

Differences in ice nucleation behavior of arable and desert soil dust in deposition nucleation regime

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Soil dust from arid and semi-arid regions is one of the most abundant aerosol types in the atmosphere with emission rates of about 1600 Tg per year (Andreae et al. (2009)). Therewith, soil dust plays an important role for the atmospheric radiative transfer and also for the formation of clouds.
Soil dust refers to dust sampled from agricultural used areas, to dust from bare soil as well as to dust from desert regions. By mass-spectrometric measurements of the chemical composition of ice residuals, mineral dust as component of soil dust was found to be the major heterogeneous ice nucleating particle (INP) type (e.g. Cziczo et al. (2013)), in particular in the upper troposphere. Also in laboratory studies the ice nucleation efficiency of the different soil dusts was investigated. It was shown that desert dusts (Ullrich et al. (2017)) as well as soil dusts from arable regions (O'Sullivan et al. (2014), Tobo et al. (2014)) are efficient INP. However, there is still a lack of data for ice nucleation on soil dusts for temperatures below about 220 K.
With the AIDA (Aerosol Interactions and Dynamics in the Atmosphere) cloud chamber, we are able to characterize the ice nucleation efficiency for different aerosol types to temperatures down to 180 K and high ice supersaturations. In order to extend the already existing AIDA data base for deposition nucleation on desert dusts and agricultural soil dusts, new experiments were done in the upper tropospheric temperature regime.

This contribution will show the results of the new experiments with desert dust in comparison to existing data for higher temperatures. The first data analysis confirms the temperature dependent trend of the ice nucleation activity as discussed and parameterized in a recent paper by Ullrich et al. (2017). Furthermore, the update and extension of the recently published parameterization of deposition nucleation for desert dust to lower temperatures will be discussed. The experiments with agricultural soil dust will be compared to existing AIDA experiments at higher temperatures published by Steinke et al. (2016). Finally, the ice nucleation activity of both desert dust and agricultural soil dust will be compared for the upper tropospheric temperature regime.

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