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An overview of the Ice Nuclei Research Unit Jungfraujoch/Cloud and Aerosol Characterization Experiment 2013 (INUIT-JFJ/CLACE-2013)

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Ice formation in mixed phase tropospheric clouds is an essential prerequisite for the formation of precipitation at mid-latitudes. Ice formation at temperatures warmer than -35°C is only possible via heterogeneous ice nucleation, but up to now the exact pathways of heterogeneous ice formation are not sufficiently well understood. The research unit INUIT (Ice NUcleation research unIT), funded by the Deutsche Forschungsgemeinschaft (DFG FOR 1525) has been established in 2012 with the objective to investigate heterogeneous ice nucleation by combination of laboratory studies, model calculation and field experiments. The main field campaign of the INUIT project (INUIT-JFJ) was conducted at the High Alpine Research Station Jungfraujoch (Swiss Alps, 3580 m asl) during January and February 2013, in collaboration with several international partners in the framework of CLACE2013. The instrumentation included a large set of aerosol chemical and physical analysis instruments (particle counters, particle sizers, particle mass spectrometers, cloud condensation nuclei counters, ice nucleus counters etc.), that were operated inside the Sphinx laboratory and sampled in mixed phase clouds through two ice selective inlets (Ice-CVI, ISI) as well as through a total aerosol inlet that was used for out-of-cloud aerosol measurements. Besides the on-line measurements, also samples for off-line analysis (ESEM, STXM) have been taken in and out of clouds. Furthermore, several cloud microphysics instruments were operated outside the Sphinx laboratory.
First results indicate that a large fraction of ice residues sampled from mixed phase clouds contain organic material, but also mineral dust. Soot and lead were not found to be enriched in ice residues. The concentration of heterogeneous ice nuclei was found to be variable (ranging between < 1 and > 100 per liter) and to be strongly dependent on the operating conditions of the respective IN counter. The number size distribution of ice residues appears to show a bimodal distribution with a smaller mode having a modal diameter around 200 nm and a coarse mode at around 2 μm. During the cloud events evaluated so far, agreement between the number concentration of ice residues sampled through the Ice-CVI and the measured concentration of small ice crystals measured outside the laboratory could be achieved. The shape of small ice crystals was found to be mainly irregular.

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