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Ambient *in-situ* immersion freezing measurements – findings from the ZAMBIS 2014 field campaign for three ice nucleation techniques

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To estimate the influence of clouds on the Earth's radiation budget, it is crucial to understand cloud formation processes in the atmosphere. A key process, which significantly affects cloud microphysical properties and the initiation of precipitation thus contributing to the hydrological cycle, is the prevailing type of ice nucleation mechanism. In mixed-phase clouds immersion freezing is the dominant ice crystal forming mechanism, whereby ice nucleating particles (INP) first act as cloud condensation nuclei (CCN) and are activated to cloud droplets followed by freezing upon supercooling.

There are a number of experimental methods and techniques to investigate the ice nucleating ability in the immersion mode, however most techniques are offline for field sampling or only suitable for laboratory measurements. *In-situ* atmospheric studies are needed to understand the ice formation processes of 'real world' particles. Laboratory experiments simulate conditions of atmospheric processes like ageing or coating but are still idealized. Our method is able to measure ambient *in-situ* immersion freezing on single immersed aerosol particles. The instrumental setup consists of the recently developed portable immersion mode cooling chamber (PIMCA) as a vertical extension to the portable ice nucleation chamber (PINC, [1]), where the frozen fraction of activated aerosol particles are detected by the ice optical depolarization detector (IODE, [2]). Two additional immersion freezing techniques based on a droplet freezing array [3,4] are used to sample ambient aerosol particles either in a suspension (fraction larger $\sim$0.6 μm) or on PM_{10}-filters to compare different ice nucleation techniques.

Here, we present ambient *in-situ* measurements at an urban forest site in Zurich, Switzerland held during the Zurich ambient immersion freezing study (ZAMBIS) in spring 2014. We investigated the ice nucleating ability of natural atmospheric aerosol with the PIMCA/PINC immersion freezing setup as well as a droplet freezing method on aerosol particles either collected in a suspension or on PM_{10}-filters to obtain atmospheric IN concentrations based on the measured ambient aerosol. Investigation of physical properties (number and size distribution) and chemical composition as well as the meteorological conditions provide supplementary information that help to understand the nature of particles and air masses that contribute to immersion freezing.

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References

[1] Chou et al. (2011), *Atmos. Chem. Phys.*, **11**, 4725-4738.

[2] Nicolet et al. (2010), *Atmos. Chem. Phys.*, **10**, 313-325.

[3] Conen et al. (2012), *Atmos. Meas. Tech.*, **5**, 321-327.

[4] Stopelli et al. (2014), *Atmos. Meas. Tech.*, **7**, 129-134.