

## **The Leipzig Ice Nucleation chamber Comparison (LINC): An overview of ice nucleation measurements observed with four on-line ice nucleation devices**

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Mixed-phase clouds (MPCs) are found to be the most relevant cloud type leading to precipitation in mid-latitudes. The formation of ice crystals in MPCs is not completely understood. To estimate the effect of aerosol particles on the radiative properties of clouds and to describe ice nucleation in models, the specific properties of aerosol particles acting as ice nucleating particles (INPs) still need to be identified. A number of devices are able to measure INPs in the lab and in the field. However, methods can be very different and need to be tested under controlled conditions with respect to aerosol generation and properties in order to standardize measurement and data analysis approaches for subsequent ambient measurements.

Here, we present an overview of the LINC campaign hosted at TROPOS in September 2015. We compare four ice nucleation devices: PINC (Portable Ice Nucleation Chamber, Chou et al., 2011) and SPIN (SPectrometer for Ice Nuclei) are operated in deposition nucleation and condensation freezing mode. LACIS (Leipzig Aerosol Cloud Interaction Simulator, Hartmann et al., 2011) and PIMCA (Portable Immersion Mode Cooling chamber) measure in the immersion freezing mode. PIMCA is used as a vertical extension to PINC and allows activation and droplet growth prior to exposure to the investigated ice nucleation temperature. Size-resolved measurements of multiple aerosol types were performed including pure mineral dust (K-feldspar, kaolinite) and biological particles (Birch pollen washing waters) as well as some of them after treatment with sulfuric or nitric acid prior to experiments.

LACIS and PIMCA-PINC operated in the immersion freezing mode showed very good agreement in the measured frozen fraction ( $FF$ ). For the comparison between PINC and SPIN, which were scanning relative humidity from below to above water vapor saturation, an agreement was found for the obtained INP concentration. However, some differences were observed, which may result from ice detection and data treatment. A difference was observed between  $FF$  from LACIS and PIMCA-PINC compared to the ice activated fractions ( $AF$ ) from PINC and SPIN. This requires further investigations.

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### **References**

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