# The Fifth International Ice Nucleation (FIN) Workshops: Overview and Selected Results

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The role of aerosol particles for ice formation in clouds contributes one of the largest uncertainties in understanding the Earth's weather and climate systems, which is related to the poor knowledge of ice nucleation microphysics or of the nature and atmospheric abundance of ice nucleating particles (INPs). During the recent years, new mobile instruments were developed for measuring the concentration, size and chemical composition of INPs, which were tested during the three-part Fifth International Ice Nucleation (FIN) workshop (Table 1).

This activity continued the series of international collaborative workshops of ice nucleation research (Figure 1), the last one conducted in 2007 (DeMott et al., 2011). The FIN activities not only focused on instrument issues, but also addressed important science topics like the nature of atmospheric INP and cloud ice residuals, the ice nucleation activity of relevant atmospheric aerosols, or the parameterization of ice formation in atmospheric weather and climate models.

Table 1: Date and location of the FIN activities. FIN-1 and FIN-2 were conducted at the AIDA facility, KIT Karlsruhe, FIN-3 at the Desert Research Institute's Storm Peak Laboratory, Steamboat Springs, CO.

| Activity | Date | Location | Topic |
|---|---|---|---|
| FIN-1 | Nov 2014 | AIDA | Aerosol MS |
| FIN-2 | Mar 2015 | AIDA | INP instruments |
| FIN-3 | Sep 2015 | SPL | Field site |

The first activity FIN-1 was conducted during November 2014 at the AIDA (Aerosol Interaction and Dynamics in the Atmosphere) cloud chamber. It involved co-locating nine single particle mass spectrometers (Aerosol MS) to evaluate how well they resolve the INP and ice residual composition and how spectra from different instruments compare for relevant atmospheric aerosols. We conducted about 90 experiments with mineral, carbonaceous and biological aerosol types, some also coated with organic and inorganic compounds.

The second activity FIN-2 was conducted during March 2015 at the AIDA facility. A total of nine mobile INP instruments directly sampled from the AIDA aerosol chambers. Wet suspension and filter samples were also taken for offline INP processing. A refereed blind inter-comparison was conducted during two days of the FIN-2 activity.

The third activity FIN-3 took place at the Desert Research Institute's Storm Peak Laboratory (SPL), Steamboat Springs, CO. A selected number of INP instrument was combined with aerosol characterisation instruments to study the performance of INP instruments at a remote mountain station field site.

This contribution will introduce the FIN activities, summarize first results from the formal part of FIN-2, and discuss selected results, mainly from FIN-1 for the effect of coating on the ice nucleation by mineral aerosols. The coating with both secondary organic compounds and sulphuric acid was conducted in the AIDA chamber at relevant temperatures and precursor concentrations and was monitored with the particle mass spectrometers. Already very thin, atmospherically relevant coatings reduced deposition IN, but had little effect on immersion freezing.

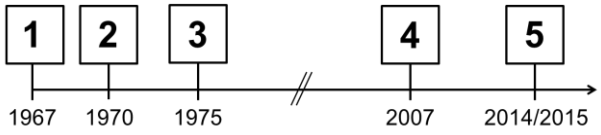


Figure 1: Series of international ice nucleation workshop activities since 1967.

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