Investigating measurement accuracy and precision of a commercial ice nuclei counter SPIN with a series of mineral dust experiments

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INTRODUCTION

This abstract presents the key results from a series of mineral dust experiments which were performed using a commercial ice nuclei (IN) counter SPIN (**SP**ectrometer for **I**ce **N**uclei), manufactured by Droplet Measurement Technologies.

THE EXPERIMENTS

The set of samples used includes four different mineral dust proxies that are commonly used in IN experiments: Arizona Test Dust (ATD) by Powder Technology Inc., Kaolinite by Sigma-Aldrich, Montmorillonite K-10 by Sigma-Aldrich and NX-illite by Arginotec. The samples were atomized from water suspension and dried prior to entering the IN chamber of the instrument. Three sample sizes, 200 nm, 300 nm and 400 nm in electrical mobility, were studied under subsaturated and supersaturated (with respect to water) freezing conditions. Each sample species, size and mode included three experiments, 72 independent experiments in total. The experiments were carried out after the temperature regulation of the instrument was upgraded by the manufacturer.

RESULTS

The activated fraction α, i.e. the fraction of detected ice crystals from total sample concentration, was calculated for each experiment and the results were compared to ones in literature. Figure 1 shows the results for ATD as averages of three repeated experiments for 300 nm and 400 nm samples. Comparison to Koehler et al. (2010), who used a different design of same measurement technique, indicates that the results are in relatively good agreement. In general comparison to literature the results by SPIN indicated a larger RH_{ice} for 1 % activated fraction on all samples and sizes, which is likely due to technical differences between IN counter instruments used in various studies.

In addition, instrument precision was studied to validate the repeatability of experiments. We found that the deviation of observed α:s was within ±0.5 % from the average under conditions when the 1 % onset was reached. This indicates a good repeatability of experiments.

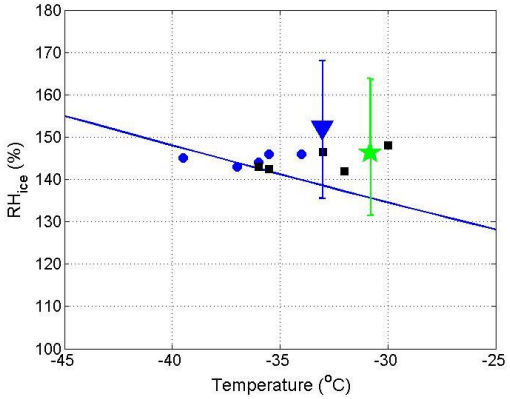

Figure 1: The 1 % activated fraction onset of ATD for sample sizes of 300 nm (blue triangle) and 400 nm (green star), compared to results by Koehler et al. (2010) for 300 nm (blue circles) and 400 nm (black squares). The solid line represents 100 % RH on water and error bars the effect of 1 K change in temperature to RH_{ice}.

CONCLUSIONS

The experiments on clay minerals show that reproducible results can be acquired via SPIN experimentation. Comparison to literature indicates a systematic behaviour of differences between our results and previous studies, which is likely due to technical differences between IN counter instruments.

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