

Single-particle characterization of ice-nucleating particles and ice particles residuals sampled by three different techniques

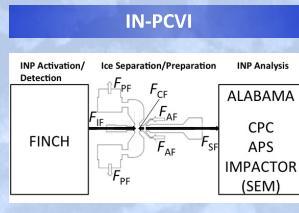
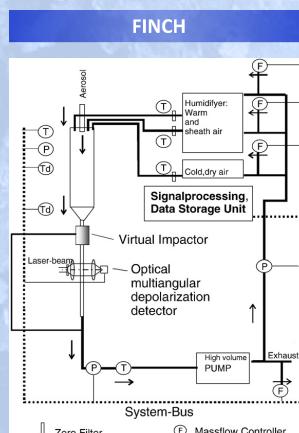
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INUIT
Ice Nuclei Research Unit

Introduction

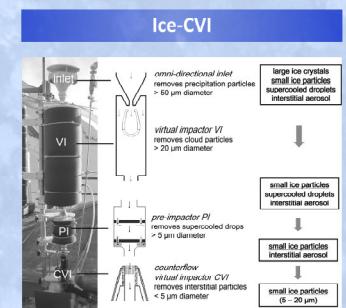
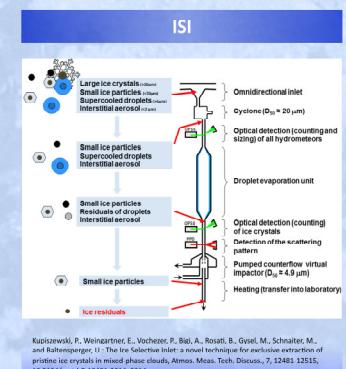
During January/February 2013, at the High Alpine Research Station Jungfraujoch a measurement campaign was carried out, which was centered on atmospheric ice-nucleating particles (INP) and ice particle residuals (IPR). Three different techniques for separation of INP and IPR from the non-ice-active particles are compared. The Ice Selective Inlet (ISI) and the Ice Counterflow Virtual Impactor (Ice-CVI) sample ice particles from mixed phase clouds and allow for the analysis of the residuals. The combination of the Fast Ice Nucleus Chamber (FINCH) and the Ice Nuclei Pumped Counterflow Virtual Impactor (IN-PCVI) provides ice-activating conditions to aerosol particles and extracts the activated INP for analysis. Collected particles were analyzed by scanning electron microscopy and energy-dispersive X-ray microanalysis as well as single-particle laser ablation mass spectrometry to determine size, chemical composition and mixing state.

Techniques



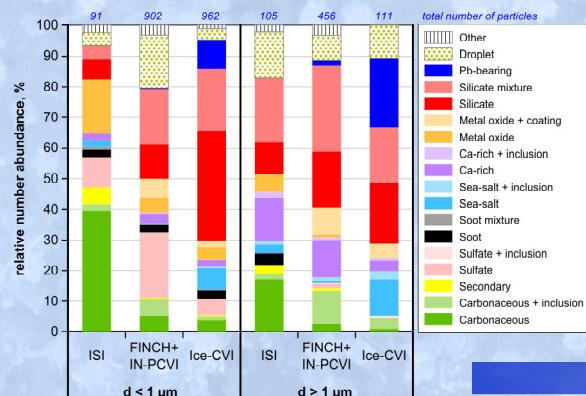
Bundke, U., Nillius, B., Jaenicke, R., Wetter, T., Klein, H., and Bingerer, H.: The fast ice Nucleus chamber FINCH, *Atmos. Res.*, 90, 180–186, 10.1016/j.atmosres.2004.07.008, 2008.

Schenk, L., Mertes, S., Göttsche, U., Frank, U., Nillius, B., Bundke, U., Rose, D., Schmidt, S., Schneider, J., Worringen, A., Kandler, K., Weingartner, E., Curtius, J., and Strömann, F.: Characterization and first results of ice nucleating particle measurement system based on counterflow virtual impactor technique, *Atmos. Meas. Tech. Discuss.*, 7, 10549–10561, 10.5194/amt-7-10549-2014, 2014.

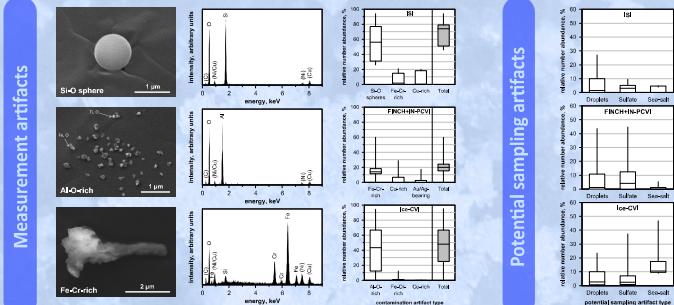


Results

Average composition of atmospheric INP/IPR

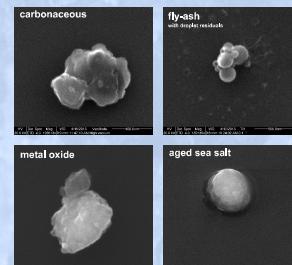


Artifacts of INP/IPR measurement

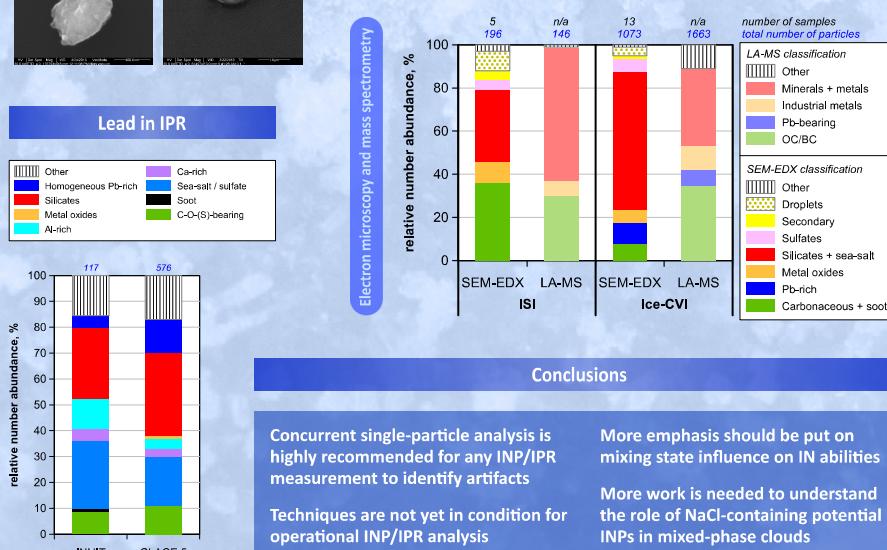


Measurement artifacts

Typical INP/IPR



Comparison of online and offline chemical analysis



Conclusions

Concurrent single-particle analysis is highly recommended for any INP/IPR measurement to identify artifacts

Techniques are not yet in condition for operational INP/IPR analysis

More emphasis should be put on mixing state influence on IN abilities

More work is needed to understand the role of NaCl-containing potential INPs in mixed-phase clouds

Poster and further reading



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