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Characterization of the Micro-Orifice Uniform Deposit Impactor-droplet freezing technique (MOUDI-DFT) for size-resolved quantitative measurements of ice nuclei

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Ice formation within a cloud system can significantly modify its lifetime and radiative forcing. Many current instruments for measuring atmospheric concentrations of ice nuclei (IN) are not capable of providing size-resolved information. Such knowledge is useful in identifying the sources of IN and predicting their transport in the atmosphere. Furthermore, those that use size-discrimination to identify IN typically exclude particles with an aerodynamic diameter greater than 2.5 μm from analysis. Several studies have indicated this may be an important size regime for IN, particularly with those activating at warmer temperatures.

The recently developed Micro-Orifice Uniform Deposit Impactor-droplet freezing technique (MOUDI-DFT) addresses these limitations through combining sample collection by a model of cascade impactor with an established immersion freezing apparatus. Here we present a characterization of the MOUDI-DFT and the development of a modified technique which address experimental uncertainties arising from sample deposit inhomogeneity and the droplet freezing method. An intercomparison with a continuous-flow diffusion chamber (CFDC) was performed.

We also show preliminary results from a campaign undertaken in a remote coastal region of western Canada. Correlations between atmospheric IN concentrations and the abundance of suspended submicron and supermicron particles, biological aerosols, carbonaceous aerosols, and prevailing meteorological conditions were investigated.