Investigation of the ice nucleation properties of dust collected in northwest Greenland

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Atmospheric ice nucleation is an essential process for forming ice-containing clouds and subsequent precipitation. It has long been known that mineral dusts are the most dominant sources of particles that can trigger cloud glaciation under conditions at temperatures warmer than about -36°C (i.e., mixed-phase cloud conditions). So far, much of the focus on the global distribution of dust sources has centered on arid/semi-arid regions in low and mid latitudes (e.g., desert areas in central China and/or North Africa). However, recent studies have indicated that significant dust storms also occur on proglacial foodplains in high latitudes, such as Greenland, Alaska, Patagonia, and Iceland (e.g., Bullard and Austin, 2011; Crusius et al., 2011; Johnson et al., 2011; Prospero et al., 2012), leading to speculation that dust emissions from high-latitudes may occasionally influence cloud glaciation, especially in polar regions. Thus, it is probably important to understand the ice nucleating properties of dusts emitted from high latitudes, as well as low/mid latitudes. To evaluate the ice nucleating properties of certain samples immersed in supercooled water, we have developed an original Stirling Cooler-based Immersion Freezing Instrument (SCIFI). In this presentation, we will introduce the NIPR-SCIFI system and then report preliminary results of freezing experiments with dust samples collected in northwest Greenland under mixed-phase cloud conditions.

References

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