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Quantifying the ice-nucleating activity of Icelandic dust in mixed-phase clouds

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Dust emission from Iceland is one of the dust sources in high-latitude regions. High-latitude dust emission is estimated to contribute up to 100 Tg of dust, that is, about 5 % of the global dust budget (1). It has been clearly established that mineral dust particles can influence the solar radiation budget directly or indirectly by impacting the cloud microphysical properties (2). The ice-nucleation behaviours of desert dusts are relatively well studied but information on the ice-nucleating activity of high-latitude dust is currently unavailable. In our current research, we investigated the ice-nucleating properties of dust obtained from a typical high-latitude region – Iceland. We employed two laboratory set-ups for this investigation – the Aerosol Interactions and Dynamics in the Atmosphere (AIDA) aerosol and cloud simulation chamber, and the Ice Nucleation Spectrometer of the Karlsruhe Institute of Technology (INSEKT). To quantify the ice-nucleating efficiencies of the Icelandic dust, we calculated their ice nucleation active site (INAS) density from the combined experimental results of both approaches. Our current results show that dust from Iceland nucleates ice effectively with INAS densities in the range of $\sim 10^{3}$ – 10^{12} m^{-2} in the temperature range studied (266 K - 238 K). A preliminary assessment shows that from $\sim$ 250 K, its ice-nucleating abilities can compete with that of desert dust and agricultural soil dust. It will be interesting to understand how its ice-nucleating abilities relate with their mineral compositions. Our current results show that high-latitude dust particles have the potential to contribute to the primary ice formation in the region, which in turn may influence the precipitation and the climate conditions in high-latitude regions.

(1) Bullard, J. E. et al. High-latitude dust in the Earth system. Reviews of Geophysics 54, 447–485 (2016).
(2) Boucher, O. et al. Clouds and Aerosols. Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia], (2013).