EGU2020-14064, updated on 23 Oct 2020
https://doi.org/10.5194/egusphere-egu2020-14064
EGU General Assembly 2020

Ice-nucleating properties of Icelandic dust in mixed-phase cloud conditions

Nsikanabasi Umo[1], Caroline Schuapp[1], Pavla Dagsson Waldhauserová[2,3], Peter G. Weidler[4], Kristina Höhler[1], Olafur Arnalds[2], and Ottmar Möhler[1]

[1]Karlsruhe Institute of Technology, Institute of Meteorology and Climate Research, Atmospheric Aerosol Research, Eggenstein-Leopoldshafen, Germany (nsilason@gmail.com)

[2]University of Iceland & Agricultural University of Iceland, Keldnaholt, Iceland

[3]Czech University of Life Sciences Prague, Faculty of Environmental Sciences, Department of Ecology, Prague, 16000, Czech Republic

[4]Institute of Functional Interfaces, Karlsruhe Institute of Technology, Germany

The emission of natural dust particles into the atmosphere from the high-latitude/cold regions is fast-becoming more important than previously thought. Due to land use and climate changes, a vast expanse of land surface previously covered by ice is getting exposed; hence, leading to an increase in dust emissions from these regions. Currently, an estimated 500,000 km^2 land surface area is contributing up to 100 Tg of dust annually[1]. Aside from the direct impact of this dust on the air quality and direct solar radiation budget, it can also influence the cloud glaciation processes. Many studies have clearly established that mineral dust aerosol particles are generally good ice-nucleating particles[2]. However, most of these ice nucleation studies have been conducted on dust from deserts and mid-latitude regions. At present, our understanding of the ice-nucleating abilities of dust from high-latitude regions is highly limited. Here, we report the first comprehensive quantification of ice-nucleating properties of dust obtained from a typical high-latitude region – Iceland. We engaged two laboratory set-ups for this investigation – the Aerosol Interactions and Dynamics in the Atmosphere (AIDA) cloud simulation chamber, and the Ice Nucleation Spectrum of Karlsruhe Institute of Technology (INSEKT). Based on the INAS density calculations which we adopted in quantifying the Icelandic dust ice-nucleating efficiencies, our current results show that dust from Iceland nucleates ice effectively in the range of ~ 10^3 – 10^{12} m^{-2} in the temperature range studied (266 K - 238 K). A preliminary assessment shows that from ~ 250 K its ice-nucleating abilities can compete with that of desert dust and agricultural soil dust. Currently, work is ongoing to understand the role that mineral composition plays in ice nucleation behaviour. Potentially, our new results suggest that the high-latitude dust source could contribute to the INP budget of clouds in the region and may influence precipitation and the climate conditions in high-latitude regions.

- Bullard, J. E. et al. High-latitude dust in the Earth system. Reviews of Geophysics **54,** 447–485 (2016).
- Hoose, C. & Möhler, O. Heterogeneous ice nucleation on atmospheric aerosols: a review of results from laboratory experiments. Atmos. Chem. Phys. **12,** 9817–9854 (2012).