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Some ice nucleation characteristics of Asian and Saharan desert dust

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Abstract. The large (7 m×4 m cylinder, 84 m³) AIDA (Aerosol Interactions and Dynamics in the Atmosphere) cloud chamber facility at Forschungszentrum, Karlsruhe, Germany was used to test the ice nucleating ability of two desert dust samples from the Sahara and Asia. Aerosol samples were lognormally distributed with a mode diameter of 0.4 (±0.1) μm and geometric standard deviation of ~1.7(±0.2). At temperatures warmer than -40°C droplets were formed before ice crystals formed and there was generally no deposition nucleation observed. At temperatures colder than -40°C both dust samples exhibited dual nucleation events that were observed during the same expansion experiment. The primary nucleation event occurred at ice saturation ratios of 1.1 to 1.3 and is likely to be a deposition nucleation mode. The secondary nucleation event occurred at ice saturation ratios between 1.35 and 1.5. We cannot categorically determine whether this ice nucleation event is via a further deposition mode or a condensation mode, but the presence of some soluble material in the dust samples leads us to favour the latter process. The activated fractions of desert dust ranged from ~5–10% at -20°C to 20–40% at temperatures colder than -40°C. There was no obvious difference between the nucleation behaviour of the two dust samples.

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