Geophysical Research Abstracts
Vol. 12, EGU2010-13341, 2010
EGU General Assembly 2010

Heterogeneous freezing of water droplets containing kaolinite and montmorillonite particles

Benjamin J. Murray, Sarah Broadley, Theodore Wilson, Sophia Bull, and Rebecca Wills
University of Leeds, School of Chemistry, Leeds, United Kingdom (b.j.murray@leeds.ac.uk)

Clouds composed of both ice particles and supercooled liquid water droplets, known as mixed phase clouds, exist at temperatures above $\sim$236 K. These clouds, which strongly impact climate, are very sensitive to the presence of particles that can catalyse ice particle formation. In this paper we describe experiments to determine at which temperatures water droplets containing clay mineral particles froze. Water droplets containing a known amount of clay mineral were supported on a hydrophobic surface and the temperatures at which individual droplets froze, as they were cooled down, was determined by optical microscopy. The hydrophobic substrate does not significantly catalyse ice formation in droplets and pure water droplets freeze around 236 K. Droplets containing kaolinite and montmorillonite nucleate ice at warmer temperatures. The mean nucleation temperature increases from close to or at the homogeneous nucleation limit (236 K) to 240.8 $\pm$ 0.6 K as the kaolinite concentration is increased from 0.005 wt% to 1 wt%. In contrast, ice always nucleates at 245.8 $\pm$ 0.6 K when water droplets are contaminated with montmorillonite independent of mineral concentration. These results highlight the importance of understanding the ice nucleating properties of individual minerals rather than complex mixtures of minerals found in natural dusts and so-called test dusts. In addition we parameterise the results in a form suitable for modelling studies and also derive contact angles for kaolinite.