Atmos. Chem. Phys. Discuss., 13, C5519–C5520, 2013
www.atmos-chem-phys-discuss.net/13/C5519/2013/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Feldspar minerals as efficient deposition ice nuclei" *by* J. D. Yakobi-Hancock et al.

H. Grothe

grothe@tuwien.ac.at

Received and published: 5 August 2013

Congratulations to the authors for this very nice paper. Their study investigates the ice nucleation activity of a broad set of atmospheric-relevant mineral samples in the deposition mode. The results support the hypothesis that the ice nucleation activity of natural dust is determined by the activity of single minerals such as minerals of the feldspar group. The results fit very well to results of the recent paper of Atkinson et al. (2013) who have investigated a similar set of minerals in the immersion freezing mode.

Actually we have obtained almost the same result as Atkinson et al. (2013) by oil emulsion experiments partly presented at the ESF workshop "Atmospheric Ice Nucleation" and the EGU General Assembly 2013. We think it is interesting to point out

that higher activity of potassium feldspar is found for both phases (microcline and orthoclase). Actually, this indicates that the crystallographic structure is not the crucial factor determining the ice nucleation activity. Instead, the surface properties (ionicity) are the decisive factors as pointed by the authors. Our results even show that additional nucleation activity can be created by mechanical grinding. This supports the hypothesis that ice nucleation is initiated by ensembles of functional groups, which certainly need particular arrangements to be active. Another surface particularity is the difference between K- and Na-feldspar, which in principle should have a very similar surface structure as pointed out by the authors. However, all the experiments show very different ice nucleation activities e.g. in our study we find higher median freezing temperatures for microcline than for the other feldspars (andesine/Na-Ca feldspar = 240K; albite/Na-feldspar = 240K; microcline/K-feldspar = 249K). We believe that this difference can be only explained by different arrangements of water molecules in the vicinity of these cations. We think that the question, what triggers ice nucleation on a molecular level deserves more attention. Is it a particular site being responsible or is it the surface with a stochastic arrangement of functional groups structuring the first layers of water over a certain area, which is decisive?

References Atkinson, J. D., Murray, B. J., Woodhouse, M. T., Whale, T. F., Baustian, K. J., Carslaw, K. S., Dobbie, S., O'Sullivan, D., and Malkin, T. L. (2013). The importance of feldspar for ice nucleation by mineral dust in mixed-phase clouds, Nature, 498, 355–358.

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 17299, 2013.