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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Some ice nucleation characteristics of Asian and Saharan desert dust" *by* P. R. Field et al.

Anonymous Referee #1

Received and published: 9 April 2006

General Comments:

This manuscript looks at the ice nucleation characteristics of Asian and Saharan Desert dust. This is an important topic as these aerosol particles are believed to play a role in ice cloud formation in the atmosphere. The manuscript provides several new pieces of information. For example, the manuscript shows that these dust particles do not nucleate ice below liquid water saturation at temperatures above -35 C. This was somewhat unexpected based on previous measurements on kaolinite particles by Roberts and Hallet, as well as others. Also the manuscript shows that at temperatures below -35 C, these dust particles exhibit dual nucleation events. This illustrates that the onset of nucleation clearly cannot be used to represent the ice nucleation properties of the

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entire population of mineral dust particles. I expect this manuscript will be the seed for several additional laboratory studies.

This manuscript represents a substantial contribution to scientific progress and presents new ideas and data. Also, the scientific quality is very good/excellent. Hence, I suggest publication after the authors have addressed the following minor comments:

Specific Comments:

Comment 1. Page 1511, line 25: “Previous laboratory work on the ice nucleating ability of kaolinite has been carried out by Roberts and Hallet (1968).”

The authors may also want to reference the work by Bailey and Hallet[1] and Dymarska et al.,[2] which also report IN measurements of kaolinite.

Comment 2. Page 1517, line 23: "using the Af $>$ 12 criteria the activated fraction is underestimated by a factor of 1.6 compared to the fraction greater than 3 microns. Consequently we have multiplied the Af $>$ 12 activated fraction by 1.4.”

Should this be “1.6” rather than “1.4”?

Comment 3. It would be beneficial to discuss in more detail how the activated fraction varies with cooling rate?

Comment 4. Page 1519, line 15: “although the coldest temperature attained during this experiment was only -32C, therefore they may be some other type of polycrystal habit.”

Could the authors please elaborate on this point? Discuss briefly the connection between temperature and the polycrystalline habit and please include references to support this statement.

Comment 5. Page 1521, line 18: “not because cooling rate is expected to affect the cooling rate.”

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This sentence is confusing to me. Please clarify. It sounds like the cooling rate does not affect the cooling rate?

Comment 6. Figure 1-4: I think that the order of Si and Sw should be reversed on the y-axis (Si corresponds to the top plot in panel b).

Comment 7. Figure 6: I think it would be beneficial to include on this figure the ice saturation ratio required for homogeneous nucleation predicted by the Koop parameterization.[3] Also it would be beneficial to include the ice saturation ratio at which Zuberi et al. observed crystallization, since the authors are comparing their results directly with Zuberi et al.[4] If the figure becomes too congested, perhaps they could include a new figure with this information.

Comment 8. Could contact freezing play a role in the experiments when water droplets were activated?

References:

(1) Bailey, M.; Hallett, J. Q. J. R. Meteorol. Soc. 2002, 128, 1461. (2) Dymarska, M.et al. Journal of Geophysical Research 2005, 111, doi:10.1029/2005JD006627. (3) Koop, T.et al. Nature 2000, 406, 611. (4) Zuberi, B.et al. Geophys. Res. Lett. 2002, 29, Art. No. 1504.

Interactive comment on Atmos. Chem. Phys. Discuss., 6, 1509, 2006.