Atmos. Chem. Phys. Discuss., 9, C1634–C1637, 2009
www.atmos-chem-phys-discuss.net/9/C1634/2009/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Influence of particle size on the ice nucleating ability of mineral dusts" *by* A. Welti et al.

A. Welti

awelti@student.ethz.ch

Received and published: 9 June 2009

General comment

We would like to thank the referee for the helpful comments and suggestions. The error analysis has been made and is now included in the graphs. As the error bars are mostly of the size of the symbols representing the data points they do not change the interpretation of the data. The uncertainties are now mentioned in the figure captions. We reply to the individual suggestion points below.

Specific comments

1. We agree. The comment concerning the paper of Archuleta et al. (2005) has been removed.

2. As there was a significant portion of bigger particles in the 100 nm and 200 nm dust samples, the obtained results are not exact for 100 nm and 200 nm particles. If the bigger, multiple charged particles are accounted for the calculation of an average size, the 100 nm particles are 6-11% bigger, depending on the dust species and the 200 nm particles 14-23% accordingly. The difference is not huge, but therefore we consider the data as not quantitative. Still, we expect the results to be reliable enough that qualitative conclusions can be made. Qualitative in the way that the data is usable for the indicated size ranges and not one specific size.

3. Error bars have been added to figures 5 and 10 and the uncertainty of the data shown in the other graphs is mentioned in the caption. As the calculated contact angles in figure 10 are not sensitive to small changes in RH_i, the corresponding error is mostly not visible. We also changed figure 10 in the way, that now only results which can be clearly assigned to deposition nucleation i.e. data points below water saturation are shown.

4. The sentence has been changed to: "'Depending on the dust species, the corresponding temperature shifts from approximately -50C for 100 nm particles to -35C for 800 nm particles."' The uncertainties in the data is rather small compared to the range of temperature and humidity conditions covered in the presented results.

5. The observed increase in RH_i is probably caused by diffusion limitation i.e. slow growth rates of the particles. Especially for the lowest two experimental temperatures covered. We will mention this in the revised text.

6. We referred to panels where the data for -35C is shown (the two in the second row), especially in the panel where data for illite at -35C is shown. Water satura-

ACPD

9, C1634–C1637, 2009

tion is marked as vertical line. We agree, however, that it is not that pronounced and deleted that statement.

7. The sentence has been removed and we rephrased the statement.

8. This is exactly the point we intended to make here. Surface area explains a lot, but only in a certain temperature range. We reformulated the statement to make it clearer. There is too much data to show it all, therefore we decided to show only this representative selection of data.

9. We will make the remaining plots available as a supplement.

10. As no size selection has been made for the results in those papers, it is not trivial to compare our data with previous investigations. In addition most of the studies that you mention used ESEM to determine the onset of ice nucleation and they also used different thresholds (not 1% activated fraction). Thus, we refer to the overview of data from different studies shown in the work of Eastwood et al. (2008) or Stetzer et al. (2008).

11. Unlike the results of Salam et al. (2006) we do not find a superior nucleation efficiency of montmorillonite compared to kaolinite. We conclude and added in the revised text, that the capacity to undergo H-bondings is not as important as proposed in the Salam et al. (2006) paper.

12. Our data does not correspond to the data of Knopf and Koop (2006). But there is a good agreement to the data of Möhler et al. (2005). We will mention this in the revised paper.

13. The calculated contact angles of this study are slightly smaller, but in the same order of magnitude. We added that.

14. The reference will be added at a suitable position.

ACPD

9, C1634–C1637, 2009

15. It is not consistent with other studies. We now discuss it.

16. Yes, therefore no parametrization for the 100 nm particles is given in the paper. Also the curve fit for the 200 nm data is less reliable. We will mention this in the text.

Technical corrections

-

References

Archuleta, C., DeMott, P., and Kreidenweis, S.: Ice nucleation by surrogates for atmospheric mineral dust and mineral dust/sulfate particles at cirrus temperatures, Atmos. Chem. Phys., 5, 2617–2634, 2005.

Eastwood, M.L., Cremel, S., Gehrke, C., Giard, E., and Bertram, A.K.: Ice nucleation on mineral dust particles: Onset conditions, nucleation rates and contact angles, J. Geophys. Res., 113, 2008.

Knopf, D. and Koop, T.: Heterogeneous nucleation of ice on surrogates of mineral dust, J. Geophys. Res., 111, 2006.

Salam, A., Lohmann, U., Drenna, B., Leisins, G., Klages, P., Rogers, D., Irani, R., MacGillivray, A., and Coffin, M.: Ice Nucleation Studies of Mineral Dust Particles with a New Continuous Diffusion Chamber, Aerosol Sci.Technol., 40, 134–143, 2006.

Stetzer, O., Baschek, B., Lüönd, F., and Lohmann, U.: The Zurich Ice Nucleation Chamber (ZINC) - A new instrument to investigate atmospheric ice formation, Aerosol Sci. Technol., 42, 64–74, 2008.

ACPD

9, C1634–C1637, 2009