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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Is aerosol formation in cirrus clouds possible?" *by* J. Kazil et al.

Anonymous Referee #1

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The paper describes a model study on the nucleation of aerosol particles in cirrus clouds. The study shows that such nucleation can actually be expected to occur in the atmosphere, but depends strongly on the specific properties of the cirrus ice crystals such as their size, number concentration and surface area concentration, as well as on the properties of the preexisting aerosol distribution. The properties of the cirrus ice crystals are strongly dependent on the updraft velocities.

The occurrence of nucleation in clouds is counterintuitive at first glance. One would expect that the increased surface area depletes the condensable vapors from the gas phase efficiently and nucleation should therefore be suppressed. In this manuscript it is convincingly shown that - depending on the specific properties of the cirrus - nucleation still can take place, especially in situations when updraft velocities are slow and when the preexisting aerosol surface area is small. This is due to the fact that the removal of condensable gases is diffusion limited and the large surface area of the ice particles is

not determining the condensation.

To achieve their results a kinetic aerosol model based on measured thermochemistry data is combined with a detailed 1-D cirrus model.

The paper is interesting and it presents valuable and new results for nucleation research of the upper troposphere. The scientific approach is sound and the paper is concise and clearly written. I recommend the paper for publication in ACP.

Minor comments:

Section 2, 1st paragraph.: This paragraph deals with the modification of the model by Lovejoy et al. (2004) by inclusion of new thermodynamic data for the neutral nucleation. It is stated that the model predicts more stable neutral clusters when the new thermodynamic data is used. It would be interesting to elucidate this in a little more detail: by how much are the results of Lovejoy et al. changed? In how far/where is ion induced nucleation still a relevant process in the atmosphere. But this could of course also be the subject of a separate paper.

p. 12187, l. 22: here it would be interesting to present the average surface area of the cirrus ice as well, to clearly demonstrate the difference between condensational sink and surface area and to make it comparable to surface area and condensational sink of the preexisiting aerosol.

Because the calculation of the condensational sink is quite important for this paper a reference to the concept should be given. A short description on how it was determined could be helpful as well.

For most of the figures, but especially for the cyan lines in Fig 5, increased line thickness and/or different coloring would be helpful.

Interactive comment on Atmos. Chem. Phys. Discuss., 6, 12179, 2006.

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