Atmos. Chem. Phys. Discuss., 6, S6321–S6322, 2007
www.atmos-chem-phys-discuss.net/6/S6321/2007/

Atmospheric Chemistry and Physics Discussions

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

Anonymous Referee #2

Received and published: 17 January 2007

The paper presents a model study of the potential for nucleation in cirrus clouds. An aerosol parcel model containing a description of neutral and charged H_2SO_4/H_2O processes is combined with a 1-D cirrus model. Particle formation is found to be possible within cirrus, but is dependent on gas phase concentrations of sulfur dioxide, the surface area of pre-existing aerosol and the size and number of cirrus ice crystals. The properties of cirrus ice crystals are largely dependent on updraft velocities. In particular it is demonstrated that the diffusion limited condensation of gas phase species onto large cirrus ice crystals allows gas phase sulfuric acid to build up and nucleation to take place.

The manuscript describes a useful addition to knowledge of upper-tropospheric nucleation. It is well written and clearly presented. I recommend publication in ACP.

Specific comments

1) P12187 The concept of condensation sink is used to explain the diffusion limited rate of condensation onto large ice crystals and for the importance of pre-existing aerosol surface area. It would be useful to define condensation sink.

2) Is it possible to comment on whether cirrus clouds enhance or reduce nucleation?

3) A useful addition to the paper might be a comment on whether it requires anthropogenic SO_2 for nucleation to occur in cirrus.

4) Given some typical pre-existing aerosol surface areas and cirrus ice crystal sizes what is the threshold SO_2 concentration at which cirrus nucleation is possible. This would help indicate how widespread globally cirrus nucleation is given predictions of upper tropospheric SO_2 from global sulfur models.

Technical corrections

1) Figure 1. Define RH_i and RH_w either in the figure caption or text.

2) Figure 2(a) appears to be Figure 1(b) repeated.

3) P12182, l1 and in Equations (1) and (2). Replace RH with RH_w to be consistent with figure 1.

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

ACPD

6, S6321–S6322, 2007

Interactive Comment