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Atmospheric Chemistry and Physics Discussions



# *Interactive comment on* "Factors controlling contrail cirrus optical depth" *by* B. Kärcher et al.

**Anonymous Referee #1**

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General comments

The paper describes a novel approach of developing an analytical model describing the key influences on cirrus evolving from the post-vortex period up to 4 hours. The model solves for the size distribution and moments accounting for influences such as shear and turbulence on the microphysics. The solution describes the effects on the microphysics through the size distribution as well as macrophysical effects (e.g. contrail width). A wide range of key cloud controlling factors are considered such as temp, ice saturation, shear, vertical extension of ice super-saturated layer, and initial number and mean radius of particles. Realistic variations in pdfs and their influence on contrail/cirrus are assessed.

The work has important findings. To highlight a few, 1) it illustrates that almost 50%

of line-shaped contrails of all optical depths are missed from satellite observations. 2) the work creates a new model (CCSIM) that is fast and reasonably accurate and can be used to study contrail/cirrus evolution in a statistical manner. And 3) the work has sampled widely from the phase space of contrail evolution and illustrated numerous findings relevant for contrail to cirrus evolution.

It is very high quality work and appropriate for ACP and I recommend this paper for publication with the typos corrected. The minor points raised below are optional.

Some minor comments: The paper is well written and thorough. I don't have any major criticisms of the paper.

1) Comparing the results of the LES to the CCSIM in figure 1, the LES plot looks like it has stronger sedimentation acting. Is the same sedimentation used in the LES the same as in the CCSIM? Is there an influence showing through of using the constant scaling factor of 0.1 for supersaturation on the growth?

2) A fixed value of delta=0.65 on line 16 of page 11599. It wasn't mentioned why this value was chosen.

Typos:

1) Line 17 on page 11599 spelling of 'accommodated'.

2) Concluding remark point 8 (line 15 on page 11632) 'th' should be 'the'.

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Interactive comment on Atmos. Chem. Phys. Discuss., 9, 11589, 2009.