

Atmos. Chem. Phys. Discuss., referee comment RC1
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Review of Tully et al.

Anonymous Referee #2

Referee comment on "Cirrus cloud thinning using a more physically based ice microphysics scheme in the ECHAM-HAM general circulation model" by Colin Tully et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2021-685-RC1>, 2021

This is a well-written manuscript that does a good job of explaining the science, including past studies. Other than needing more description of the ice-nucleation parameterization and aerosol characteristics (see below), I think there are only small corrections needed, as outlined below.

Line 197-199: If you are using the Karcher et al 2006 method to represent ice nucleation, which includes water vapor consumption, why is there a need to add a downdraft to update the water vapor consumption? More explanation is needed here.

Line 219-220: What is the time step in the cirrus scheme that is referred to here? Is it the 7.5 min time step or the sub-stepping time step? The latter would be more accurate.

Lines 221-240: It would be useful to add a table summarizing the different ice nucleating properties, the sizes included, their ice saturation for nucleation and whether the AF treatment is used.

Lines 253-255: Can you explain a bit more here? What is RH_i becomes 100% under a heterogeneous ice simulation?

Lines 265-267: This sentence needs more explanation. As it is now, I cannot understand what is being said.

Line 279: Here you say you have a fractional ice cover scheme, but Lines 253-255 states that there is no fractional cover. When and where do you have fractional ice cover?

Lines 316-318: It appears to me that the model is too high from 190-205K by about the same factor as too high from 230-240. Please correct.

Lines 319-321: Can you explain this statement better? Why do you think the finding is due to the dust immersion freezing rate? What aspect could cause this?

Lines 394-395: How can the change in ICNC (200 / L) be larger than the seeding number of 100?