

Cirrus cloud thinning using a more physically-based ice microphysics scheme in the ECHAM-HAM GCM (acp-2021-685)

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Author Response

Dear Prof. Liu

Thank you for agreeing to extend the review process for our manuscript. In line with the review process, we prepared this short letter to explain the changes in the manuscript since our previous upload.

Shortly after the previous upload, we found in our reference simulation (Full_D19) that the total in-situ cirrus heterogeneous ice number tracer, that we use in Figures 6 & 9 in the manuscript, was inconsistent with the ice number tracer for in-situ cirrus heterogeneous nucleation on mineral dust particles. After investigating this further, we found this originates from the sub-timestepping process in the P3 ice microphysics scheme. As these quantities are diagnostic tracers, they ultimately do not change the outcome of our study, and we wanted to ensure this before finalizing our manuscript. Our solution in this case is to, instead, use the sum of the heterogeneously nucleated ice number sources in cirrus as the total cirrus heterogeneous ice number:

$$\text{Total HET} = \text{HET on mineral dust} + \text{HET on seeding particles},$$
where the seeding particle signal is equal to zero in our reference cases Full_D19 and Full_S89.

This change is reflected in our revised manuscript in Figures 6 & 9 as well as on Zenodo with a new version of the data analysis and plotting scripts repository. However, as this does not change our results or the conclusions of our paper, the tracked changes do not show any revisions in the text.

Sincerely,
Colin Tully