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Atmospheric Chemistry and Physics Discussions

Interactive comment on "A microphysics guide to cirrus clouds – Part 1: Cirrus types" *by* M. Krämer et al.

Anonymous Referee #2

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This work combines a comprehensive set of observations and trajectory model simulations to categorize cirrus clouds. The manuscript contributes to advancing our understanding of cirrus clouds, and it is suitable for ACP. I recommend publication of the manuscript, and suggest a few revisions that the authors may wish to consider to improve the manuscript:

- The trajectory parcel simulations cannot capture dynamical processes such as shear, entrainment, and cloud radiation-dynamics interactions. It would be helpful to mention these limitations of the parcel modeling approach compared with cloud-resolving model simulations. In fact, these dynamical processes tend to reduce the ice number concentrations below the initial values obtained by nucleation (Dinh et al., 2012, 2014). This could explain why N_{ice} obtained by MAID

can be higher than observations as seen in Fig. 5.

- The ice water content and ice number concentration have been categorized based on temperature. Is altitude an equivalent independent parameter for cirrus categorization? Specifically, do liquid-origin cirrus clouds occur at higher temperatures and equivalently lower altitudes, and in-situ cirrus clouds occur at lower temperatures and equivalently higher altitudes?
- The manuscript focuses only on cirrus microphysics, but could potentially have a broader impact if the authors provide calculations of the cloud radiative properties. For example, it would be useful to have an additional panel/figure that shows the cloud radiative heating rate (K/day) based on the ice number concentration, ice crystal radius, and cloud extinction in Fig. 12.

References

T. Dinh, D. R. Durran, and T. Ackerman. Cirrus and water vapor transport in the tropical tropopause layer – Part 1: A specific case modeling study. *Atmos. Chem. Phys.*, 12(20): 9799–9815, 2012. doi: 10.5194/acp-12-9799-2012.

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