

Review of  
revised version of  
**Rare temperature histories and cirrus ice number density in a parcel and one-dimensional model**  
by D. Murphy

**General comment:**

The manuscript has improved, most comments were addressed. However, there are some issues left, which were addressed neither in the author's response, nor in the revised manuscript. Therefore, I recommend to address these open issues before the manuscript can be accepted for publication in ACP.

Open issues:

• Major point 1 - quantitative investigation:

It was recommended to investigate the impact of few weak ice nucleation events in more details. This detailed investigation is still lacking, the reference to figure 1 is not satisfactory, since here just one specific temperature (frost point 197.4 K) is represented.

However, I was asking for an analysis of the occurrence of these rare events of weak ice nucleation; it is not clear how often these events occur, e.g. for different temperature intervals, and how large the difference to the "standard nucleation events" would be. This kind of analysis is still missing.

• Minor point 2 - ice nucleation:

It was recommended to discuss the representativity of very high heterogeneous IN concentrations, since the typical background values are in order of  $\leq 10 L^{-1}$  (DeMott et al., 2003); this issue is still missing in the discussion. In addition, it was recommended to mention that it is not clear if the measurements by Cziczo et al. (2013) are representative for ice crystal measurements in the extratropics. Also this discussion is missing in the revised version.

## References

Cziczo, D.J., K. D. Froyd, C. Hoose, E. J. Jensen, M. Diao, M. A. Zondlo, J. B. Smith, C. H. Twohy, D. M. Murphy, 2013: Clarifying the Dominant Sources and Mechanisms of Cirrus Cloud Formation. *Science*, 340, 1320-1324, doi: 10.1126/science.1234145

DeMott, P., D. Cziczo, A. Prenni, D. Murphy, S. Kreidenweis, D. Thomson, R. Borys, D. Rogers, 2003: Measurements of the concentration and composition of nuclei for cirrus formation. *Proc. Nat. Acad. Sciences*, 100, 14655–14660.