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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Chemical characteristics of ice residual nuclei in anvil cirrusclouds: evidence for homogeneous and heterogeneous ice formation" *by* C. H. Twohy and M. R. Poellot

Anonymous Referee #3

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Overview: Overall the paper is well written and well-suited for ACP. It is an important contribution to the general field of ice nucleation. There has been much discussion in the literature on the degree of ice nucleation by homegeneous and heterogeneous mechanisms, and this manuscript provides important in-situ information to clarify some of the earlier claims. The paper is suitable for publication with minor changes.

1. There is a difficulty in understanding if the reported temperatures are sampling temperatures or nucleation tempratures. The two are not the same and the discrepancy can be quite large for heterogeneous nucleation events where the ice nucleating effi-

ciency of various insoluble nuclei are quite different. The data should contain an error bar indicating the difference between the smapling temprature (which has been identified here as the nucleating temperature), and the actual ice nucleation temperature.

2. Several lab studies have shown that certain insoluble material in the troposphere are excellent ice nuclei, e.g. mineral dust, recrystallized salt cores, and soot [Zuberi et al., J. Phys. Chem. A 105, 6458-6464 (2001) and Zuberi et al. Geophys. Res. Letts. 29, No. 10, 1421-1424 (2002)]. These laboratory studies should also be referenced for the readers to understand the context within which these field results need to be viewed.

3. Authors note that there is a significant change in the particle collection efficiency as a function of the particle size. Ice crystals formed via heterogeneous nucleation (at low temperatures) are expected to grow in size by mass transfer as temepratures decrease. How does this change in initial particle size affect the ratio and identification of the homogeneous-heterogeneous boundary? It should be explicitly indicated if the data is biased towards larger particles which may be formed via heterogeneous nucleation or coagulation.

4. It is unclear why data on mixed phase cloud is included in the manuscript.

In general, authors should indicate that due to poor collection efficiency and uncertainty in the measurmeent of actual nucleation temperatures, the results have a wider error margin. In the light of such uncertainty, the homogeneous to heterogeneous transition is at best an indication of the presence of such a transition regime. Conclusion more certain than that, as currently included by the authors, can be misleading.

Interactive comment on Atmos. Chem. Phys. Discuss., 5, 3723, 2005.