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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Chemical composition and mixing-state of ice residuals sampled within mixed phase clouds" *by* M. Ebert et al.

Anonymous Referee #2

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The topic of this paper, the composition and mixing state of ice residuals, is an important one and few measurements of this nature have been made in field studies. However, this paper is sparely written, and I find some crucial experimental details missing. Also the results need to be discussed in light of sampling conditions, including cloud type, temperature, and supersaturation. Ice nucleation mechanisms are mentioned in the introduction, but are not discussed with regard to these experiments.

Details which need clarification:

It is not mentioned but not explained how droplets are separated and removed. Since sampling is occurring in mixed phase clouds, potential contamination from droplets getting counted as ICE is a major concern. Based on the information provided, there is no way to assess the degree to which this is a problem in this experiment.

The IR/IN abbreviations are confusing. In this experiment, isn't the assumption that there is one IN in the center of every IR? I strongly recommended writing at least one of these out in full.

How did the authors determine that the clouds were, in fact, mixed phase?

What are the ambient temperature and ice saturation during collection? Since heterogeneous ice nucleation mechanisms vary with these, it is important to report them. Also, better analysis of the results could include sorting the compositions according to ambient conditions at the time of collection. Ideally this would provide insight into the possible mechanisms responsible for formation of these specific ice crystals.

Why were the largest ice crystals removed? These also contain ice nuclei. In fact, smaller ice crystals are likely to be fragments, rather than original ice crystals, so one could argue that you are removing the only clearly pristine ice crystals in your sample.

The authors mention the mixing state of IN but provide only quality results. What are the implications of these results?

The introduction needs a better synthesis. References are missing, and some concepts are not clear: The authors state that most ice nucleation experiments have not been done in mixed phase clouds. I agree with this statement. However, they fail to cite those experiments which have been done in the mixed phase clouds. Results from SHEBA, AIRS-II and M-PACE, for example.

pg. 3 line 66. "For a given IN, each mode is characterized... " It would be noted that this statement is based on a modeling assumption, not actual particles. Also, it is incorrect physically because some particles of some compositions are active as immersion IN while others are active as deposition IN. Thus assigning all particles thresholds for each mechanism, regardless of their composition defies the underlying physics.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 23865, 2010.