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Interactive comment on “Understanding cirrus ice crystal number variability for different heterogeneous ice nucleation spectra” by S. C. Sullivan et al.

Anonymous Referee #1

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This is an interesting study of the sensitivities of different ice crystal parametrizations used in global models to their input parameters. The paper is clearly within ACP's subject area, and provides interesting information. I suggest that the authors consider the following comments while revising the paper.

1. The experimental envelope shown in Fig. 2 looks very different from what is shown in Krämer et al. (2009), and it took me a while to figure out why. Looking at Krämer's Fig. 9, it appears to me that if one wants to plot some kind of central number for $N(\text{ice})$ as a function of temperature, it should probably increase quite monotonously. The wiggles up and down shown in Fig. 2 of the present paper are most probably artefacts

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due to unequal sampling from different geographic areas. I suggest replotting, using some smoothing method.

2. Why is there no model data below about 202 K in Fig. 2?
3. What do the upper and lower limits of the model envelopes represent in Fig. 2? Would comparing the envelope widths between model and data provide any additional information beside the comparison of the central number?
4. Regarding the low temperature sensitivity regime discussed on p. 21692-21693. Hoose and Möhler refer to data that show constant activated fractions in lab experiments. These experiments should (at least in principle) give threshold supersaturations that do not depend on vapor diffusivity or on latent heat of sublimation. Furthermore, there are no solution droplets to nucleate homogeneously in the experiments. I think that the low temperature sensitivities seen in the lab and in the model are coincidental, and most probably due to different reasons.
5. It is not clear from the summaries of the different parametrizations to what extent do they include deposition nucleation and to what extent immersion freezing. Some discussion would be welcome.

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 21671, 2015.

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