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Interactive comment on “Impacts from ice-nucleating bacteria on deepconvection: implications for the biosphere-atmosphere interaction in climatechange” by V. T. J. Phillips et al.

Anonymous Referee #2

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General comments:

I very much agree with Gabor Vali's comment that the paper does not live up to its promise. The title suggests that general conclusions regarding the impact of ice-nucleating bacteria on biosphere-atmosphere-interactions and climate change can be drawn. While reading the paper, one discovers that the knowledge of ice-nucleating bacteria is in its infancy and that only one case study has been looked at. Even if the cloud-resolving model simulates many clouds, it remains a single case study. In that regard, I am glad that the authors suggest significant modifications to their paper by

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looking at two different ARM cases and modifying the title. However, as the impacts on biosphere-atmosphere interactions are only touched upon briefly, I would drop that from the title and change it to something like: "Numerical modeling of impacts of ice-nucleating bacteria on mid-latitude continental deep convective clouds". This captures what has been done in the study and that is the purpose of a title.

In addition to Gabor Vali's comment, I have another general comment, which is that there is no validation against observations whatsoever. Thus, all we learn in this paper is how one particular cloud scheme responds to INA bacteria. Thus, my recommendation for a revised paper is the addition of the other two ARM case studies AND a thorough evaluation against observations.

Detailed comments:

1) Seeing that you report preliminary simulations in a journal paper bothers me. Preliminary results are fine to present at a conference but in a journal publication, the simulations should be final ones. What is preliminary about them? Please change them so that the results are final results.

2) I also agree with Gabor Vali that the reader needs to know more about the case study, please add that information.

3) Section 5.1: Define a visible cloud. Given that you divide your analysis into a part that affects the cloud in the absence of the cirrus shield, you need to explain how that distinction is made. Do you analyze the cloud in its early stage before it develops a cirrus shield or is your cloud one that never reaches the homogeneous freezing level even in its mature stage?

4) What have we learned from this paper? The conclusions that you draw would hold for any increase in IN but are not restricted to an increase in INA bacteria. In essence what we learned is not different from the conclusions that one draws when increasing CCN and cloud droplet number concentration in warm clouds. Also there the downward

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shortwave flux and the surface precipitation are reduced. Maybe your study would be more useful if you compared the uncertainty in radiative fluxes and precipitation of IN stemming from INA bacteria with uncertainties in radiative effects of anthropogenic CCN. Then, the reader would get some idea if the effect that you are studying is comparable to an aerosol effect on warm clouds or if it is some fraction of that. Please consider adding such a comparison.

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