

## ***Interactive comment on “Sensitivity of mixed-phase moderately deep convective clouds to parameterisations of ice formation – An ensemble perspective” by Annette K. Miltenberger and Paul R. Field***

**Anonymous Referee #3**

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The paper addresses an issue of interest, and I believe it deserves to reach out the scientific community working on modelling of ice formation in clouds.

Overall, I share the same doubts and reserves as the other reviewer as long as the readability of the current paper is concerned. The authors need to make the paper self consistent and easier to read. Please explain all the assumptions taken and describe the parameterizations with some level of details. Just referencing to existing works is not enough! I'm not familiar with the work of Miltenberger et al., don't expect that other readers will be.

C1

Please consider adding a table showing the main features of each parameterization, guiding the reader through your methodology. The commonalities and differences of each scheme is functional to discuss the spread of the ensemble. Without providing info about the diversity/commonality of the underlying assumptions of each scheme, how is possible to interpret if the spread of the ensemble reflects true physical uncertainty? Perhaps all schemes descend from the same physical assumptions, in that case I would expect an overconfident ensemble spread. As the paper stands at this stage, it cannot be deduced.

Another obscure point to me is the use (or not use) of 'observational data'. At the beginning of section 2 the COPE campaign is mentioned. What about using the data collected there to shed some light on the bias/error of the modelling results? if this is part of the baseline simulation it needs to be clarified. Maybe I'm missing something, but I believe that the use of measurements could enormously add value to the current findings (at least, if possible, for one variable; I believe it'd be very important if you did).

On a less general note:

- consider adding a description of Hallet-Mossop process (and maybe acronym it to H-M);
- consider give percentage of the values in table 1, absolute magnitude alone doesn't say much about variability;
- line 8: perhaps you meant 'changes' rather than 'change'?

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Interactive comment on Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2020-253>, 2020.

C2