

Atmos. Meas. Tech. Discuss., referee comment RC2  
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## Comment on amt-2021-168

Anonymous Referee #2

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Referee comment on "Retrieving microphysical properties of concurrent pristine ice and snow using polarimetric radar observations" by Nicholas J. Kedzuf et al., Atmos. Meas. Tech. Discuss., <https://doi.org/10.5194/amt-2021-168-RC2>, 2021

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Review of "Retrieving microphysical properties of concurrent pristine ice and snow using polarimetric radar observations" by N. J. Kedzuf, J. Christine Chiu, Venkatachalam Chandrasekar, Sounak Biswas, Shashank S. Joshil, Yinghui Lu, Peter Jan van Leeuwen, Christopher Westbrook, Yann Blanchard, and Sebastian O'Shea.

Microphysical retrievals of radar volumes containing a mixture of pristine ice particles and aggregates are challenging, since larger particles tend to dominate the signal. The manuscript presents a method for retrieving PSD parameters separately for crystals and aggregates from polarimetric radar observables based on an ensemble retrieval framework. The framework is constructed using a prior PSD parameter distribution and forward modeled radar observables from the assumed PSD based on scattering database results of a number of different kinds of pristine crystals and aggregates. The method is evaluated first with synthetic observations and then against in-situ aircraft measurements. The in-situ comparisons show an overall improvement over existing methods.

The text is generally well written and structured. It involves adequate analysis and discussion of related uncertainties and the figures are clear and demonstrative. I expect the presented method to help advance the use of radar polarimetry in studying snow microphysics. I recommend the manuscript to be accepted for publication with minor revisions.

My only general comment is that I would have liked to see some discussion related to the possibility of taking rimed particles in to account in similar retrievals. Riming may have great significance depending on climate and is expected to have a very similar polarimetric radar fingerprint as aggregation. Do you expect that riming could have affected your evaluation results?

### Specific comments

77: Instead of "spheroidal morphology" did you mean to make a statement on the aspect ratios of aggregates?

86: Did you mean that these variables are simply less widely adopted or that there is more work to be done connecting characteristics in the retrievals of these variables to snow processes? Please rephrase.

451-452: It is not evident to the reader what kind of temperature dip we are talking about since it seems to be excluded from the figure and not described here.

510: I'm not sure if I understood this sentence. Did you mean that these radar signatures might represent only a subset of the aircraft-collected sample? Or that there might be a spatial mismatch? Please rephrase and discuss the possible implications.

### **Technical comments**

424-426: This could be rephrased to avoid repetition.

483: (f) should be (d).

512: particles