

Atmos. Meas. Tech. Discuss., referee comment RC1
<https://doi.org/10.5194/amt-2021-227-RC1>, 2021
© Author(s) 2021. This work is distributed under
the Creative Commons Attribution 4.0 License.

Comment on amt-2021-227

Anonymous Referee #1

Referee comment on "Triple-frequency radar retrieval of microphysical properties of snow"
by Kamil Mroz et al., Atmos. Meas. Tech. Discuss.,
<https://doi.org/10.5194/amt-2021-227-RC1>, 2021

This manuscript describes an approach for triple frequency radar retrievals of precipitating ice microphysical parameters. It is overall an interesting study worth of publishing after the authors address comments below.

Comments.

- Equation (2): m-D relations. Usually, size of particles is defined in terms their major dimension. Since you define it here differently, it would be useful if you briefly discuss what typical differences can be expected between your size definition and that which uses the major dimension. You are suggesting on line 68 that your relation agrees with the one from Leinonen and Szyrmer (2015) but these authors (unlike you) use maximum size for D, so discussion about differences in size definition would be helpful. Also, it appears that your relation $m=0.015D^{2.05}$ [SI units] provides particle mass values, which are quite a bit different than many existing relations for aggregates (see for example, Mitchell JAS 1996, p.1716, relations from Heymsfield et al. JAS 2010, p.3303 and many others). Again, Fig. 1 shows mass dependence on Dmax not the size you use according the statement on line 61. Can you address these issues?
- Do you account for particle orientations and shapes? Observations show that DWR depends quite strongly on particle shape and orientation (e.g., Matrosov et al. JAMC 2019 p. 2005). For vertical beam measurements, more spherical particles produce larger DWR than less spherical particles.
- I think the NRC aircraft can also provide measurements with side view radar beams. Did you compare side and vertical measurements?
- From what I know, the NRC aircraft microphysical suite has two Nevzorov probes (at least it was the case with the flights I know about). The IWC estimates from the two probes can differ. Did the flights, which you analyzed, have measurement from two Nevzorov probes? If yes, what were the differences?
- Did you try to calculate X, Ka, and W reflectivities using your scattering data base and compare them to the radar observed values?
- Please clarify in more details how the "truth" in Fig. 4c was obtained.
- Line 229: what are the uncertainties of estimating Doppler velocity from a moving

aircraft?

Editorial comments:

- Line 10 and elsewhere: provide units for D_m and IWC to better understand RMSE values here and statistical metrics results given in terms of logarithmical values.
- Equation (1): provide integration limits.
- Line 270: If only one frequency (W) has non-Rayleigh scattering it is already dual-frequency not triple-frequency approach.