

Atmos. Meas. Tech. Discuss., referee comment RC2
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Comment on amt-2021-227

Anonymous Referee #2

Referee comment on "Triple-frequency radar retrieval of microphysical properties of snow"
by Kamil Mroz et al., Atmos. Meas. Tech. Discuss.,
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This manuscript describes microphysical retrievals using multi-frequency radar. Retrievals of ice water content, mean mass diameter, and degree of riming are demonstrated. The manuscript shows the difficulty in retrieving the degree of riming, particularly from a single-wavelength. The authors conclude by demonstrating the retrievals from single, multi-frequency and multi-frequency with Doppler velocity in a research flight. The single frequency has little information content in the degree of riming or in volumes with large drops. The multi-frequency retrievals improve upon the single frequency, but still struggle with degree of riming. By adding a Doppler velocity to multi-frequency, the retrievals are in better agreement with the measured quantities.

Overall this manuscript is straightforward and shows interesting results for a difficult problem. I have a few main comments as well as some smaller things I noticed.

- It seems one of the main take-aways the authors would like the reader to have is the improvement to the microphysical retrievals, particularly the degree of riming, when a Doppler velocity is included. However, it was unclear to me how this is used in the retrieval and seems to come out of nowhere when Fig. 4 is introduced. Is it from nadir or zenith (or some interpolated mean like reflectivity)? Does the Doppler velocity include air motions? How is it included in the actual retrieval?
- Figure 2 is important but I had a hard time interpreting it. What is the difference between the top row and the bottom row? Please clarify.
- Figure 3: I'm confused about how the uncertainties are presented in this figure. If I am interpreting this correctly the retrieval of degree of riming has very little uncertainty middle of the flight leg (~1950 – 2110 UTC) (i.e. no black bars), and similarly the measured IWC in panel b (very small green bars)?

Minor comments:

Ln 98: Remove or expand '(REF)'.

Ln 145: Which WC is this – IWC or LWC?

Section 3: It is odd to have "3.0.1" etc. for the sections—remove the .0. and make 3.1, etc.

Figure 3: I'm curious why the IWC are presented in kg/m³? In the text this is stated in g/m³ (such as the uncertainty in Ln 210). Similar comment for all plots of IWC.

Figure 4: panel b is misaligned compared to the other 2 panels.

Ln 241: Please check the sentence beginning "For negligible DWRs, multi-frequency information is reduced so the difference between the algorithms." This is not a complete sentence.

Ln 255: "estimates is available" should be "estimates are available".