Review of amt_2021_216

The manuscript “Retrievals of ice microphysics using dual-wavelength polarimetric radar observations during stratiform precipitation events” is substantially improved from its previous version. However, the authors need to address the issue regarding the gamma distribution shape factor before the final publication. A major revision is recommended.

Major comments:

A major issue that remains unaddressed is the value of the shape factor μ of the gamma distribution used in this study, $\mu = 4$. That is very high for aggregated snow – it is usually close to 0 (hence gamma PSD is practically reduced to exponential), as numerous previous studies suggest (Gunn and Marshal, 1958; Sekhon and Srivastava, 1970; Lo and Passarelli, 1982; Mitchell et al. 1990; Field and Heymsfield, 2003; Tiira et al. 2016; Matrosov and Heymsfield, 2017). The authors need to explain why there is such a large discrepancy in μ regarding previous studies. See the specific comment.

Specific comments:

Line 31: Comma is missing after the “incoming solar radiation”.

Line 70-71: Reflectivity factor Z is close to the 4th PSD moment in low-density snow, where the snow density is inversely proportional to particle diameter; it is proportional to the 6th DSD/PSD moment in rain. The authors should briefly comment on this.

Lines 274-275: There is a typo in the sentence: “...exceeds the noise ZDRstdv by on magnitude”.

Lines 365-366: The shape parameter $\mu = 4$ seems too high for the aggregates, it is usually close to 0. Why is the value $\mu = 4$ chosen? Explain the rationale and provide some evidence why $\mu = 4$ works for your cases. Is this because you are using Dmelted in PSD calculations? Do other parameters need adjustments to be used with Dmelted?

Lines 460-465: You did not take into account how the usage of AR=1.60 instead of AR=1.67 affects your results. Briefly comment on this, provide some estimates.

Figure 17: You should add a panel for sphericity, median mass diameter, and ice water content retrieved with the initial aggregate density (for easier comparison) and reflect the results in Table 4.

References:

Gunn, K. L. S., and J. S. Marshall, 1958: The distribution with size of aggregate snowflakes. *J. Meteor.*, **15**, 452–461.

Sekhon, R. S., and R. C. Srivastava, 1970: Snow size spectra and radar reflectivity. *J. Atmos. Sci.*, **27**, 299–307.

Lo, K. K., and R. E. Passarelli Jr., 1982: Growth of snow in winter storms: An airborne observational study. *J. Atmos. Sci*., **39**, 697–706.

Mitchell, D. L., R. Zhang, and R. Pitter, 1990: Mass-dimensional relationship for ice particles and the influence of riming on snowfall rates. *J. Appl. Meteor*., **29**, 153–163.

Field, P. R., and A. J. Heymsfield, 2003: Aggregation and scaling of ice crystal size distributions. *J. Atmos. Sci*., **60**, 544–560.

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Matrosov, S., and A. Heymsfield, 2017: Empirical relations between size parameters of ice hydrometeor populations and radar reflectivity. *J. Appl. Meteor. Climatol*., **56**, 2479–2488.