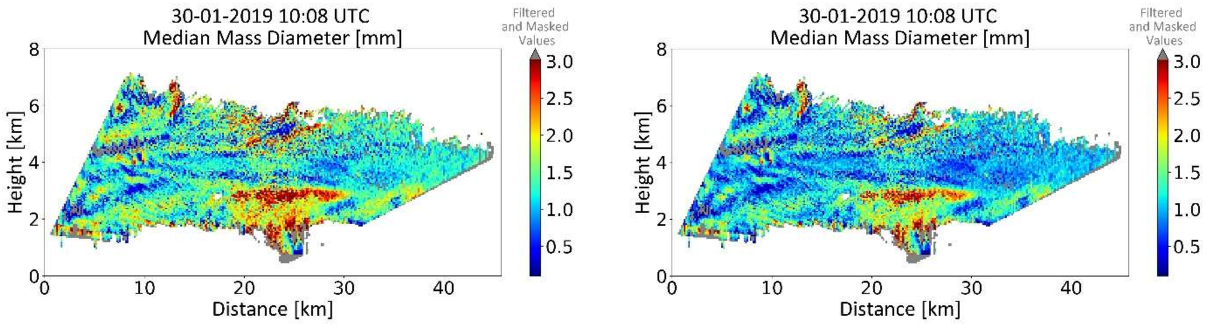
Answers to Reviewer 1

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 of the gamma distribution μ used in this study, μ = 4. That is very high for aggregated snow – it is usually close to 0 (hence gamma μ 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 regarding previous studies. See the specific comment.

Thank you for this comment. We acknowledge your point also justified by literature and have revised the parameter $\mu = 4$ to $\mu = 0$ in our pre-defined PSD throughout the study and updated our calculations and plots. Consequently, some retrieval results show significant differences in the retrieved D_m between the two shape parameter values. In the following figures, the retrieved D_m is larger when the PSD shape parameter is assumed 4 (left figure) instead of 0 (right figure). In both figures, the ice hydrometeors are assumed to be represented by oblate spheroids and the $m(D_{max})$ relationship is chosen to be analog to the aggregates of Yang et al. (2000).



Specific comments:
Line 31: Comma is missing after the "incoming solar radiation".

Thank you for pointing this out. A comma is now added after the "*incoming solar radiation*" phrase.

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.

Thank you for this comment. We have now added a sentence clarifying that the described definition of reflectivity factor Z refers to melted ice particles.

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

The sentence is now rephrased as "*the signal ZDR_{mean} exceeds the noise ZDR_{stdv} by one order of magnitude*".

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

Considering the aforementioned literature in your major comments, μ is now set to 0, a characteristic value for snow aggregates. Moreover, the affected Fig. 7, Fig. 8 and Fig. 9 are now reproduced.

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.

Thank you for this comment. In the latest version of LUTs we changed the AR values so that we include 1.67 for oblates (corresponding to the typical 0.6 from Hogan et al., 2012) in our LUTs. This is also changed in the text as well as in the affected plots. As for reference, the use of AR = 1.67 instead of AR = 1.6 results 5.03 dB instead of 5.06 dB for DWR and 0.36 dB instead of 0.31 dB for ZDR. Moreover, when we assume AR = 1.67 instead of the previous AR = 1.6 we obtain 9.76 dBZ instead of 9.72 dBZ for Z_{eC} and 3.06 dBZ instead of 3.03 dBZ for Z_{eKa}. These values are calculated for PSD D_m = 1 mm, IWC = 0.01 g m^{-3} and both radar beams are simulated to be emitted horizontally.

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.

A panel for the initial effective density of Yang et al. (2000) is now added in Fig. 17 and indeed helps the reader to directly have a look on the differences of the retrieved parameters. Moreover, RMSE results for DWR, ZDR and Ze using the initial aggregates m(Dmax) are added in Table 4. Thank you a lot for suggesting this.

References:
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