Comment on amt-2022-92

Anonymous Referee #3

Referee comment on "Sensitivity analysis of DSD retrievals from polarimetric radar in stratiform rain based on μ-Λ relationship" by Christos Gatidis et al., Atmos. Meas. Tech. Discuss., https://doi.org/10.5194/amt-2022-92-RC3, 2022

This manuscript estimates variability of Lamba-mu relations of the assumed gamma-function DSD in observed liquid precipitation. The results obtained in this study may be useful for better understanding of uncertainties in these relations. I recommend a major revision of the manuscript having in mind comments below.

Main comments.

- The authors should clarify their retrieval method described in section 3.3. They describe how they estimate mu (steps 2 and 3). How the corresponding Lambda value is then obtained? They state that they impose a fixed Lambda – mu relation with fixed coefficients (i.e., relation (7)). If they use this fixed relation then how different prefactors and exponents (alpha and beta in Table 1) are obtained?
- Please provide a better description of the geometry of measurements. What are relative locations of the disdrometer and the radar? At what heights radar measurements are made? Is the disdrometer directly below the radar resolution volume? In other words, what are horizontal and vertical distance separations between the radar and disdrometer.
- Are coefficients in (7) simple mean values or are they some kind of weighted mean values? (for example, weighted by event durations, etc.).
- Equations (1) through (5) assume untruncated distributions. Do you have any estimates how truncation to Dmax in (9) and (10) would affect the results? I assume that this effect is mu-dependent.
- Line 164: Eq.(3) from Unal (2015) shows only horizontal polarization backscatter cross section. Do you account for the elevation angle for the vertical polarization cross section? What were assumed drop orientations?
- What are your estimates of uncertainties in the Lambda-mu estimates? Given the retrieval/measurement uncertainties, are the results for different events shown in Fig.3 really statistically different?
- The correlation coefficients of 0.12 - 0.24 for retrieved Nt (as mentioned in the

abstract) actually indicate no reliable correlation.

- I suggest calculating a power-law correlation coefficient between Lambda and mu for each event and also RMSD between individual Lambda – mu points and the best fit. Showing these statistical metrics in in Table 1 would be beneficial.
- Why not to use lower elevation angle for radar measurements to increase ZDR?

Minor comments

- Since you use binned DSD information, you should probably use summations in (9) and (10) rather than integrals.
- Equations (7) and (11) are repetitive.
- The first line after (9): here capital Lambda size parameter and small lambda -wavelength are mixed up.
- Add Zdr frame to Fig. 2.
- Line 296 says: see Section 3a, but there is no section 3a in the paper. Is it 3.1 ? Also you are referring to section 3c in line 340 (and in other parts of the paper), but it probably should be section 3.3. Check the entire manuscript for consistency in referencing different sections.
- Are sigma' and sigma in lines 302-304 the same parameter?