Atmospheric Measurement Techniques Discussions

Atmos. Meas. Tech. Discuss., referee comment RC2
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Comment on amt-2022-92

Anonymous Referee #2

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-RC2, 2022

The paper fundamentally assumes a mu-lambda relationship which is not necessarily correct. But it can be accepted for publication in AMT after revision. The authors need to consider the following comments and revise the manuscript accordingly.

Abstract

Line 4: There is no term used in the statistical gamma family of distributions that has the term "constrained gamma". The mu-lambda relation is an empirically derived based on measured DSDs. Since the measured DSDs are statistical (i.e. the parameters such as Dm can be treated as statistical) the mu-lambda is not a deterministic relation.

Line 12: Sentence beginning 'The most difficult ..' This is true of all retrievals of the DSD and R. It is not surprising that NT which is 0th moment of the DSD cannot be estimated accurately using higher order moments like Z=f(M6) and Dm=M4/M3.

Abstract, Last sentence: this increase in correlation from 0.12 to 0.24 is not a meaningful increase...the scatter still looks "random"

Line 33: Surely by now the entire DSD community is aware that N0-mu relation is not physical.

Line 46: I do not agree that calibration offsets in Zh and Zdr are often overlooked. The US Nexrad system has done extensie work to reduce the uncertainty of Zdr to within -+0.1 dB. To this, one can add the German DWD, and MeteoFrance as well.

Line 71: The instrument does not possess the resolution to measure the drizzle and very small drops. This is also termed as truncation of the DSD and the shape factor will be biased to strongly positive values with convex down shape at the small drop end.

Line 85: "comparable" is not the correct description…. you are only sampling in time to get 30 s sampling.

Line 98: fig 1 does not appear to have a clear melting layer....what is mean by clear? the vertical streaks of Z above the BB indicates vertical air motion.

Line 112: the BB does not look steady, rather the vertical streaks in Z well above the BB depict some vertical air motion.

Eq. 1: the use of NT was introduced by Chandrasekar and Bringi to emphasie that NT = 0th moment =total number density which makes this form similar to what statisticians would use.

Line 154: "empirical" or "statistical"?

Eq. 7: is there any physical basis for this power law?

Line 163: Dmax is approximately 3*Dm...see Carey and Petersen

Line 195: The critical aspect is that Parsivel cannot measure the drizzle or smalll dops with sufficient resolution causing truncation. This causes Dm to increase as well a tdecrease in the ahe spectral width sigma_m ..casing mu to decease.

Also, the stability of mu-lambda relation itself is not in question since it can be stable for the wrong reason.

Line 235: The NT is the same as M0 ie the total number density. It is not possible to estimate it from the higher order moments such as Nw or Dm. In fact the variability in NT of the DSD is larger than that of Dm or mu. This is termed as number controlled DSDs.

Last sentence in 5.1.3: this is known as the point-to-area or non-uniform beam filling problem. This is very well known and has been addressed by several publications

Last sentence, 5.2: This is not surprising since NT is the M0th moment whereas Nw, Dm are of much higher order.

Line 405: no surprise here...unless one can measure M1, M2, there is no way to improve the estimate NT.

Line 447: The method of improving the correlation coeff especially for NT does not improve at al ...the corr~ 0.