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Discussions

Interactive comment on "An empirical method to improve rainfall estimation of dual polarization radar using ground measurements" *by* Jungsoo Yoon et al.

Anonymous Referee #2

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The authors suggest tweaking the measured values of Z, Zdr, and Kdp to match the average expected dependencies of Zdr and Kdp on Z or the bivariate distributions obtained from the disdrometer-based simulations. The "reference" dependencies are specified in Eqs 1 and 2. The major problem with such approach is that there are no universal reference dependencies valid for all rain types. For example, the Z – Zdr average dependency for tropical rain generated by a warm rain process is quite different from the one for continental rain which mostly originates from the ice aloft. For a given Z, Zdr in tropical rain is significantly lower than in continental rain, particularly at higher rain rates. A similar rule holds for the Z – Kdp dependency. In fact, using the suggested methodology, the authors deny the impact of the DSD variability on

the performance of radar rainfall algorithms. I guess that the improvement in the QPE performance caused by the recommended adjustment is mainly due to mitigation of the measurement biases in Z and Zdr. The description of the adjustment routine in section 3.2 is very brief and insufficient for understanding or reproducing the methodology. The adjustment of Zdr or Kdp for a given Z looks straightforward but the procedure for Z adjustment is totally unclear. Obvious underestimation of rainfall, say, by using the R(Z) relation illustrated in Fig. 6a could be caused by either negative bias in the Z measurements or by the very nature of the observed rain (e.g., tropical) for which a power-law R(Z) relation with higher intercept is required. How to distinguish between these two sources of error? A range of needed adjustment (likely attributed to negative Z bias) between 3 and 10 dB shown in Table 5 is quite disturbing because it may point to a serious problem with radar calibration. The magnitude of such bias is too high for operational weather radars. Moreover, the magnitude of the Z adjustment for a single rain event can vary by as much as 3 dB depending on the algorithm choice. To me this is an indication that both Z bias and the DSD variability (which differently affects the performance of various rainfall relations) may come into play. The English usage has to be improved dramatically since even the meaning of several sentences is "lost in translation". There is inaccurate statement regarding the methodology of Seliga and Bringi for DSD retrieval and rainfall estimation (first paragraph in Introduction). It is not a single Zdr but the combination of Z and Zdr which was proposed to address these problems. The concept of the suggested methodology is flawed and its description is insufficient and hard to understand. Therefore I recommend rejection.

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