Atmospheric Measurement Techniques Discussions

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Comment on amt-2022-8

Anonymous Referee #2

Referee comment on "Sensitivity analysis of attenuation in convective rainfall at X-band frequency using the mountain reference technique" by Guy Delrieu et al., Atmos. Meas. Tech. Discuss., https://doi.org/10.5194/amt-2022-8-RC2, 2022

In this study, the authors address the impact of attenuation in rain on the radial profiles of radar reflectivity at X band. Five different equations parameterized by the radar miscalibration error dC, radome attenuation PIA_0, the error in the path-integrated attenuation PIA_m estimated from the mountain radar signal, and the multipliers a_{AZ} and a_{AK} in the power-law A – Z and A – K_{DP} relations are used to retrieve the unbiased radial profile of Z. Four of these equations are nonpolarimetric and three of them are constrained by PIA_m whereas the fourth is a classic Hitschfeld-Bordan solution which is very unstable for higher values of PIA_m. The four unknown parameters are varied in different combinations within certain ranges and the combination which yields the best match between 5 radial profiles of retrieved Z is considered a solution for all four parameters. The authors found that the estimated values of a_{AZ} and a_{AK} using their approach are consistent with the corresponding values derived from the simulations based on the DSD measurements and claimed this as a feasibility test of the method.

It is difficult to read this manuscript. There are too many parameters and equations. For example, I had hard time to realize that PIA_0 and PIA_m are identical to $AF(r_0)$ and $AF(r_m)$ expressed in a logarithmic scale. Equation (3.1) for the cost function is not understandable and requires more explanation. I guess that most of the readers (including myself) may not be familiar with the LHS technique and the Nash-Sutcliffe Efficiency (NSF) measure of the difference between two radial profiles of Z. These have to be defined and explained in a more detail as well as the terms OPS and NOPS.

It is not clear what is the ultimate purpose of the effort – more accurate QPE in the mountainous areas? Is there intention to estimate rain rate from corrected radial profiles of Z? It is well known that Z-based rainfall algorithms are not optimal and the methodologies based on K_{DP} and A demonstrate much better performance, particularly at X band. It looks like using ZPHI-like retrievals of the radial profile of specific attenuation A and the R(A) relations is a more efficient and economic way to quantify rainfall. Moreover, the authors have benefit of determining the variable parameter $\alpha = A/K_{DP}$ because they can directly measure the path-integrated attenuation PIA_m using radar echoes form the

mountains in their area along with a total span of differential phase $\Delta\Phi_{DP}$ over the propagation path.