Atmospheric Measurement Techniques Discussions

Atmos. Meas. Tech. Discuss., referee comment RC3
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Comment on amt-2022-8

Anonymous Referee #3

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-RC3, 2022

This manuscript describes a combined QPE algorithm based on polarimetric X-band radar measurements as applied in the mountainous terrain. I suggest that the authors revise the manuscript having in mind comments below.

Comments

- It would be beneficial for this paper if you can provide some quantitative information on how the results of your algorithm developments and attenuation estimates would benefit the accuracy of QPE retrievals compared to existing algorithms.
- Would a simple R-Kdp based QPE method still have important advantages? This method is insensitive to attenuation and to the radar absolute calibration errors and may be preferential for moderate and heavier rainfall.
- Mountain references are available only for a fraction of the radar beams. Please be more specific about how these limitations influence you approach.
- Does mountain reflectivity depend on the wetness of the ground targets? If yes, then "dry environment" reference measurements are not exactly applicable to rainy conditions.
- What is natural variability of the coefficients in A-Z and A-Kdp relations (eg, due the rain type – convective vs stratiform)?
- There has been a significant number of studies deriving X-band A-Kdp relations using different approaches including model calculations and also the direct use of observational data (e.g., Bringi and Chandrasekar 2001 book, https://doi.org/10.1175/JTECH1763.1 https://doi.org/10.1175/JTECH1804.1 https://doi.org/10.1175/JTECH-D-13-00231.1 to name a few). It would be appropriate to compare (at least briefly) your relations with previous ones and also to provide a measure of uncertainty in the coefficients of these relations.
- Line 591: I believe it is "backscatter phase shift" not "phase shift on propagation". Also, non-uniform beam filling affects other approaches not only a polarimetric one.
- Fig.2: There is a wedge of the high Phidp increase indicating heavier rainfall (17:00 UTC). However, (unlike for the Phidp wedge at 16:05 UTC) there is no corresponding high reflectivity areas (even in the closest to the radar range gates within the high

intensity cell, where total attenuation is expected to be not yet significant). Please explain. Also, adding SNR frames can help to better interpret Fig. 2 data.

- It appears that there are pixels (and clusters of pixels) of high rhohv values (at 14:00 UTC), which are not associated neither with rain cells in the Zm graph nor with the mountain slope echos. Please explain.
- Figs. 1 and 2: Please, increase the font size of numbers in the graph axes and color bars (currently the numbers are impossible to read) and show units on the color bar (e.g., dBZ in Fig. 1, right frame).