Atmospheric
Measurement
Techniques

Discussions

Interactive comment on "The development of rainfall retrievals from radar at Darwin" *by* Robert Jackson et al.

Anonymous Referee #2

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GENERAL COMMENT

This paper presents an analysis of the applicability of dual-polarization rainfall relations for C-band radars. Although in general well written, with adequate reference to previous works and (mostly) clear illustrations, I found the approach presents some flaws, specifically:

- Simulations (section 3.2): the measurement uncertainty is not considered in these simulations. Therefore, these results only show the parametric error. For actual applications, the measurement errors should be included in the simulations. For example, a two-parameter relation like R(Zh,Zdr) has lower parametric error than R(Zh), but may have a larger total error depending on the measurement accuracy of Zdr. Have the actual measurement errors of CPOL been considered somehow?

- PCA analysis (section 4.2): this technique is used in this paper as an original contribution for application to dual-polarization radar rainfall estimation. The physical meaning of the results is not always clear. For example, in fig. 5 (panel b) it is not clear if all three lines are the same or something is missing. In panel a) it is a bit confusing to see the first component of Ah close to 0, after having seen an excellent correlation in fig. 3... Although I recognize that this can be related to a lack of familiarity with PCA analysis, I encourage to authors to provide more details about the analysis performed and better discussion of the results presented in fig. 5 and 6.

I encourage the authors to revise the manuscript, in particular the simulation and PCA analysis sections. Also, the three parts (simulation, PCA analysis, comparison with disdrometer) are treated quite independently and there is little comprehensive discussion in the final section. I would expect in the Conclusions a more in-depth discussion of the key findings and eventually contrasting results obtained with the different methods. As a specific example, I found the conclusion about Ah (it is said that it has little predictive capability) not enough supported by compelling arguments, nor it is considered the fact that several estimators exist for the estimation of Ah (and for Kdp) with quite different behavior.

SPECIFIC COMMENTS AND MINOR CORRECTIONS

- Units should be in Roman font (not Italic), e.g. mm/h.

- P2, L4: "...magnitude OF the diurnal cycle.."

- P3, L25: ".. were developed and using data.." change to ".. were developed using data.."?

- P4, L28-29: "In addition, Zh and Zdr at C-band are prone to (differential) attenuation from heavy rainfall which may bias (underestimate) R". This sentence needs to be reformulated because underestimation of Zdr causes overestimation (not underestimation) of R. In the use of R(Zh,Zdr) estimator, the underestimation of Zh and Zdr due to

attenuation tend to (at least partially) compensate because of the opposite sign of the exponents.

- P4, L32: linear programming is used to estimate Kdp. More discussion on this specific estimation method may be needed, especially considering plots like in fig. 8: may the positive biased estimates R(Kdp) at low rain rates may be attributed to the specific behavior of the linear programming algorithm which always produces nonnegative Kdp values?

- P5, L3: "Waldovel" -> "Waldvogel"

- P6, L7: "Darwin Colorado"?? Should it read "Darwin (Australia)"?

- P8, L6: normally "PDF" should read better than "p.d.f."

- P10, L21: What is the distance between the radar and the VDIS? A map may be useful. It is mentioned that measurements may be affected by attenuation, so it is important to know the range from the radar.

- P12, L6: "based off of limited.." -> "based on"?

- P12, L7: "retrieving rainfall retrievals". May read better: "retrieving rainfall estimates".

- P21, fig.1: panels b) and c) swapped

- P25, fig.5: replace "S-band" with "C-band"?