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:

We thank the reviewer for their valuable comments. Their suggestions greatly improved the readability of the paper. In particular we have done the following:

- **Reworked Section 4.2 to both be easier to interpret and to ensure that the dataset is properly normalized and that the correlation between rainfall rate and each principal component is being calculated.**

- **We present the PCA results as a cross-covariance matrix between the original radar observable space and the principal component phase space.**

- **In response to other reviewers we have also reworked the introduction to better emphasize that the retrievals in this study are useful for model-observation intercomparsion.**

- **We also corrected many typographical and grammar mistakes.**

We have addressed the reviewer's specific concerns below and provide an annotated version of the manuscript that shows all of the changes that were made.

- 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?

We thank the reviewer for this insightful comment. We have first added a comment regarding the accuracy of the calibration of Zh and Zdr on lines 8-9, page 5:

"*The RCA technique calibrated Zh to 1 dBZ accuracy and for Zdr to 0.2 dB accuracy (Louf et al., 2019).*"

This level of measurement error particularly affects the utility of Zdr in light rain (page 9, lines 10-12):

"Z_{dr} from CPOL is questionable to use for times when R < 10 mm hr^{-1} as it needs to be accurate within 0.1 dB, less than the quoted 0.2 dB accuracy, for providing reasonable estimates of R in light rain (Ryzhkov et al., 2005)."

But in heavier rainfall (p. 10, line 2):

"*In addition, the 0.2 dB accuracy of Z_{dr} from CPOL is adequate for R estimation in heavier rainfall (Ryzhkov et al., 2005).*"

We also thank the reviewer for providing a more concise name "parametric error" for our results in Section 4.1. We have adopted this terminology throughout the paper.

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.

We have reworked this section to ensure that the PCA data are being properly interpreted. In particular, we made the following revisions:

- **Our interpretation of the PCA was only factoring in the variability in the radar observable phase space, but not factoring in how these components also vary with R. We now add the extra step of calculating the correlation of rainfall rate with each principal component.**
- **We standardize our input feature space so that it has zero mean and unit variance to ensure that the differences in units between the variables do not impact the results.**
- **We now show importance matrices, or the absolute value of the cross-covariance matrix between the features in original and PC phase space, in an easier to understand format where higher numbers indicate greater importance of each variable to each principal component.**

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.

We rewrote the conclusion section to better integrate the results from the three sections by summarizing the consistent conclusions obtained from each of the three steps. Details of these edits are visible in the version of the manuscript with the changes shown.

SPECIFIC COMMENTS AND MINOR CORRECTIONS
- Units should be in Roman font (not Italic), e.g. mm/h.

Done as suggested.

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

We have added the "of."

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

Done as suggested.

- 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.

We have changed "underestimate" to now say "overestimate."

- 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?

Due to factors such as smoothing that is inherent in LP based methods, it is difficult to characterize the potential errors in Kdp produced by such methods.

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

Done as suggested.

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

We added a comma in between Darwin and Colorado.

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

We now call the “spread in the p.d.f.” parametric error.

- 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.

We have added a figure in the paper showing the positions of the radar and the VDIS.

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

Done as suggested.

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

Done as suggested.

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

We have fixed the caption to match the figure.

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

Done as suggested.