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Interactive comment on "Joint Cloud Water Path and Rain Water Path Retrievals from ORACLES Observations" *by* Andrew M. Dzambo et al.

Anonymous Referee #2

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The authors have developed an algorithm to joint retrieve cloud water path and rain water path, using W-band reflectivity measurements from aircraft-borne radar, radiometric cloud optical depth, and cloud effect radius from Research Scanning Polarimeter during ORACLES.

Atmospheric Chemistry and Physics (ACP) is a scientific journal dedicated to public discussion of studies investigating the Earth's atmosphere and the underlying chemical and physical processes. In the manuscript, there is no process level discussion. This retrieval algorithm manuscript definitely fits better into the scope of "Atmospheric Measurement Techniques". It is noticed that several retrieval-based papers published in ACP, so a decision would be made by the editor.

The manuscript is well written overall, but more clarifications are greatly needed es-

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Discussion paper

pecially in the retrieval methodology. How to estimate the cloud effective radius profile is critical in your retrieval. Your assumption for the estimation is not clear. Are you suggesting the cloud top effective radius from RSP is representative of the whole cloud column? Due to cloud-top entrainment, an effective radius at the cloud top can be substantially different from re in the cloud (say, the middle of the cloud layer), see aircraft measurements in Wood (2005). As you will show results for individual cases, it is important to quantify cloud-top entrainment strength and the resulting errors in your retrieval case by case. Otherwise, I see limited values in the retrieval product for detailed case analysis or process analysis. Although the retrievals may be useful for statistic-based study from ORACLES, please prove the values of your retrieval product in process aerosol-cloud interaction study. If these issues are addressed well, the paper might be suitable for publication.

Comments:

I did not see the feasibility of the application of the current retrieval algorithm in the manuscript. If there is no direct observations from aircraft or RSP, how would you apply this algorithm? Further clarification is needed.

Page 7 lines 1-4: When the V channel data was available, are droplet properties similar from 2DS H and V channels? What are the differences in rain droplet size, concentration, and water content from the two channels?

Page 7 lines 8-12: how do you determine if drizzle presents? 2DS can record valid values even in drizzle free regions.

Page 8 line 12: Please briefly describe the parameterization.

Page 10 Eq 10. Should you include the effect of uncertainties of cloud effective radius?

Will Ka-band see part of the cloud with some overlapping regions from W-band observation? Would the different Ka-W band measurements add more information in your retrieval?

Interactive comment on Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2020-849, 2020.