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Interactive comment on "Retrieval of aerosol properties from Airborne Hyper Angular Rainbow Polarimeter (AirHARP) observations during ACEPOL 2017" *by* Anin Puthukkudy et al.

Anonymous Referee #2

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The paper by Puthukkudy et al. applied the GRASP algorithm to retrieve the aerosol properties from AirHARP observations. Following a) an in-depth overview of the GRASP inversion formalism and aerosol/surface models embedded in the inversion and b) an introduction of AirHARP instrument, retrieval tests were carried out using some ACEPOL campaign data AirHARP acquired during the ACEPOL 2017 campaign. Comparison to AERONET reference data via case study shows mean absolute error within 0.017. The paper is generally carefully written and technically correct. I have the following comments for the authors to further consider as improvements:

1. The authors review the airborne polarimeters (SPEX, RSP, AirMSPI). It is also nec-

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Discussion paper

essary to review aerosol retrieval algorithms used by these sensors and published elsewhere.

2. Associated with the comparison of AirHARP AOD results against AERONET reference data in Figure 14, how does the comparison of single scattering albedo and nonspherical particle fraction look like ? Though the AOD loading is low, are we still able to see a trend of improved agreement of these properties as AOD increases.

3. The authors need to be more clear on the adoption of size components in AirHARP retrieval. Table 3 and Table 5 give two different size components in retrieval. If I understand well, size components in Table 3 is default option in GRASP while size components in Table 6 was created for AirHARP retrieval. What the difference in the retrieval based on these two different assumptions ? Which one gives better fit to AERONET AOD and SSA ? As the authors pointed out "This simplified approach significantly drops the complexity of the aerosol model by reducing the number of parameters retrieved in the joint retrieval. It helps in reducing the nonlinearity of the inverse problem and makes the separation of the surface and aerosol signal much less complicated compared to a five-lognormal mode kernel." However, would it also possible that the size components in Table 6 (with fixed refractive index for eat mode) also increase the risk of getting more subjection to pre-determined aerosol modeling errors ? If so, how large is the modeling error ?

4. As the AOD loading during ACEPOL field campaign is low, it provides a very good testbed for surface retrieval. Is there any comparison of surface BRDF and pBRDF as retrieved from AirHARP and other sensors such as SPEX, RSP and AirMSPI ?