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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Aerosol and cloud properties in the Namibian region during AEROCLO-sA field campaign: 3MI airborne simulator and sun-photometer measurements" *by* Aurélien Chauvigné et al.

Anonymous Referee #2

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In this study, the authors document imager and sun-photometer retrievals of above-cloud aerosol depth, single-scattering albedo, Angstrom exponent, refractive index, and size distribution made during the AEROCLO-sA aircraft field campaign over the south-eastern Atlantic. Retrievals are compared to similar measurements by similar aircraft instruments and ground-based sun-photometers. Estimates of cloud optical depth and column water vapour are also discussed.

The paper is straightforward, discussing each variable in turn with a few supporting figures, with brief, often speculative, explanations for differences between flights and

instruments. The paper would therefore be a useful citation for future users of the data. But the paper reads too much like a data description document and does not align with the ACP scope of publishing "studies with general implications for atmospheric science". However, I think it is possible for the paper to actually tell a story that would make it a valuable contribution to ACP. I also find that several conclusions are insufficiently supported by the analysis. For these reasons, which are detailed below, I recommend major revisions to improve the discussion.

1 Main comments

- The paper covers a succession of aerosol and cloud variables, without a clear scientific question to answer. That makes it a frustrating read. One solution would be to make the calculation of the direct radiative effect (section 4.6) the objective of the paper. To do that calculation, one needs to characterise aerosols, clouds, etc., which motivates the need for sections 4.1 to 4.5. Note that an analysis of uncertainties in direct radiative effect, propagated from the retrieved optical properties, would be required.
- The paper opens with a tantalising description of a new instrument, 3MI (lines 83-92), and concludes that 3MI improves the "definition" (unclear what is meant by that word) of above-cloud aerosol properties (lines 449-451). But the discussion does not clearly identify what new abilities 3MI brings compared to its predecessor, POLDER, and how the AEROCLO-sA field campaign helps demonstrate these new capabilities. The discussion needs to support that conclusion. What did the authors do that could not be done before? What has been done better?
- The abstract reads that "Combination between water vapour and the strong positive aerosol forcing over the region explains possible feedbacks on cloud development." (lines 40-41) What does that mean? Which part of the discussion

supports that statement?

- The authors find a consistent 10% disagreement between aerosol optical depth from OSIRIS and PLASMA (lines 246, 259, 411). But the implications of that disagreement are never discussed. Is that something to worry about? Is that a systematic bias? What causes it?

2 Other comments

- Lines 49-50: Need a reference for that statement. Note that the conclusions of Bond et al. (2013 doi:10.1002/jgrd.50171) have been challenged, see the discussion in section 5 of Bellouin et al. (2020 doi: 10.1029/2019RG000660)
- Line 117: I would not call a 35% reduction in data amount slight!
- Lines 177-181 and Figure 3: I understand that Figure 3 is there to illustrate the retrieval process, but it would be useful to have an idea of the outcome. Which "model" fits the data best? With what optical parameters?
- Lines 184 and 191: Does PLASMA2 onboard the aircraft performs the almucantar scans used by the AERONET inversion algorithm? Or are the size distributions derived in other ways?
- Lines 189-191: This statement is confusing. What do the authors mean by "low-level flight" in this context? Near the ocean surface or near the cloud top?
- Line 252: "robust independently on the aerosol loading." Too strong a statement considering the limited range of aerosol optical depth shown in Table 1.
- Line 355: What do the authors mean by "wood moisture"? The moisture emitted by evapotranspiration of forests?

- Line 359: "This particularity" – what does it refer to? The absence of correlation, or the low water content? It is unclear whether the different behaviour seen in Figure 10 for flight 1209 F2 is in fact understood.
- Line 383: " DRE calculations are performed online". What does that mean?
- Line 408: " extreme environment". In what sense? Having a large aerosol loading probably makes retrieving their optical properties easier.
- Line 419: " significantly impacts the climate". This conclusion is outside the scope of the study, so should either be supported by references, or made conditional.

3 Technical comments

- Line 17: analyse of -> analyse
- Abstract: Some acronyms are defined, but others (OSIRIS, PLASMA2, POLDER) are not. Need to make it consistent.
- Line 27: a show -> show a
- Line 44: "telluric": English speakers tend to prefer "terrestrial"
- Line 80: change on -> change in
- Figure 1: the coastline could easily be mistaken for a flight track! Perhaps set a Google Earth background, or blue over ocean, or something like that?
- Line 133: airborne the -> airborne
- Line 190: overcoast -> overcast

- Line 209: form -> form
- Line 256: north cape -> northbound heading
- Caption of Figure 7: need to state that panel b is from OSIRIS measurements.
- Line 315: spatial -> spatially

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