

# ***Interactive comment on “Above-Cloud Aerosol Radiative Effects based on ORACLES 2016 and ORACLES 2017 Aircraft Experiments” by Sabrina P. Cochrane et al.***

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We would like to thank both reviewers for their valuable and constructive comments. The manuscript has been edited in response to these comments to the extent we believe improves the scientific understanding. Please find the reviewer's comments and our responses below. A revised manuscript is attached, showing all changes. Unless specifically stated, the line numbers cited in our responses refer to the revised manuscript.

Anonymous Referee #2

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General comments This paper introduces an approach to derive aerosol properties from aircraft measurements in the presence of underlying clouds, which normally bias the retrieval. Although I'm not an expert on aircraft measurements, the manuscript is easy to read. The sections can be better structured though, separating methods and results better. The manuscript is well suited for publication in AMT, and I recommend publication after a few minor modifications, which focus mainly on the clarification of the text, to make it more accessible for the general audience. It is up to the authors to follow these recommendations.

Thank you for the recommendations. We have made slight modifications to the paper, such as including additional subheadings and increasing contextual information, to increase clarity. However, we choose to keep the separation of methods and results as is.

#### Recommendations:

Section 1.2. There are two references in the publication list that are not mentioned in the text: Peers, 2015 and De Graaf, 2012. These two publications describe DARE retrievals from specific instruments which are unique and useful in their own ways for DARE retrievals from satellite platforms (polarization measurements from POLDER, and hyperspectral measurements from SCIAMACHY). It makes sense to briefly mention these studies in this section. Thank you for this suggestion. We have included a brief description of these studies, as well as a new paper [de Graaf et al., 2019] that just came out in ACP on p. 5, l. 3-14

It would be useful to have an idea of the situation on the two selected days during which the measurements were obtained. Section 2.5 and figure 2 give the technical details and the exact locations, but it would be nice to have a general idea of the situation: Are we looking at smoke above clouds, which I know was the general goal for the ORACLES campaigns? Where was the smoke coming from, was it aged, how far are we

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from the coast? How closed was the cloud field, which is rather relevant in this study? A figure showing e.g. satellite overview and flight track may help, and a general description of the meteorological situation would be nice. Thank you for this suggestion. While we agree that it would be beneficial to include the suggested information, many of the elements are currently being studied in other analyses from the oracles campaign and outside the scope of this paper (i.e. aerosol age, meteorological conditions, aerosol back-trajectories). We have included more situational information on both the clouds and aerosols in section 2.5 on p 12. We have chosen not to include a satellite overview figure, since the conditions change so rapidly we have concerns that it would give the reader an inaccurate description of the conditions. Figures 2b and 2d include cloud imagery from eMAS (b) and SEVIRI (c) with the spiral flight track overlaid, which give the reader a sense of the cloud field during the spiral.

I belief p13, l.22 – p14, l.16 should be part of section 3 and described before section 3.1.

We understand that this refers to “To ensure that the aerosol signal is isolated...” and the following text from 3.1. We considered moving this section to before section 3.1 (for example, to section 2), but then found that it makes the most sense to talk about the filtering and separation of cloud/aerosol signal after introducing the walls and spiral sampling strategy. We added a sub-heading to make this more clear (3.1.1: Data filtering; 3.1.2: Horizontal Flux Divergence, as before).

I found section 3.1.1. hard to understand. The relevance of  $H\lambda$  is clear, but the determination of  $H_\infty$  is not clear to me. I don't understand the legend and the symbols used in Figure 4a. How and why are the dates and the wavelengths mixed? We have updated Figure 4 along with the caption for more clarity. 20160920 is presented in blue; 20170813 in red; a wall example from 20160920 is presented in green. Each case uses all of the 4STAR wavelengths to derive  $H_\infty$ . The specific wavelengths of 452 and 865 nm are highlighted to illustrate that the full spectrum is used.

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Section 3.2: p18, l23: Figure 6b shows the example at 380nm according to the title of the figure. Thank you for pointing this out. The text has been updated on p19 l. 27

Section 4.1: The authors describe figure 7 here, but switch to Figure 8 on p22, l.2. This should probably be Figure 7 as well. The figure number has been updated in the text on p. 23, l. 11

App. A.2 The SSA is described here, depicted in Figure 7, not 8. Do the authors mean Figure 7a and 7b on p. 48? Yes, it should be Figure 7, thank you for pointing out the inconsistency. App. A.2 has been updated significantly for clarity and correctness on p. 48-51.

Please also note the supplement to this comment:

<https://www.atmos-meas-tech-discuss.net/amt-2019-125/amt-2019-125-AC2-supplement.pdf>

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Interactive comment on *Atmos. Meas. Tech. Discuss.*, doi:10.5194/amt-2019-125, 2019.

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