

## ***Interactive comment on “An overview of the ORACLES (ObseRvations of Aerosols above CLouds and their intEractiOnS) project: aerosol-cloud-radiation interactions in the Southeast Atlantic basin” by Jens Redemann et al.***

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Received and published: 30 June 2020

This work represents a review of the (ObseRvations of Aerosols above CLouds and their intEractiOnS) ORACLES project. This expedition took place over Southern Africa, where nearly a third of the planet's biomass burning aerosol particles are produced, with the potential to interact with a large stratocumulus deck over the Southeast Atlantic Ocean. Through a series of three Intensive Observation Periods, numerous findings were obtained focusing on three major topics: a) direct aerosol radiative effects; (b) effects of aerosol absorption on atmospheric circulation and clouds; (c) aerosol-cloud

C1

microphysical interactions. The nature of a paper like this is to not get too deep into any one finding but to familiarize the community with the project and its dataset, in addition to pointing interested readers to more specific studies pertaining to an individual topic if they desire more depth. The paper is a challenging one to design and write as there is so much content for an experiment of this large scale to try to capture in one place; the authors did a good job of summarizing pertinent details and pointing interested readers in the right direction if they want more details about any one specific topic area. I do recommend publication of this work and provide some suggestions for improvement below. Finally, I congratulate this science team for an excellent job done when considering the high degree of difficulty. I look forward to the future science results that still require time to be developed and published.

Comments: Abstract, Lines 75-76: The list of three topics does not qualify in my view as being “science questions” as they are not written as questions. I suggest re-wording.

Line 92-93: when describing the Twomey effect, I suggest to clarify this is at “fixed liquid water” conditions.

Line 103: is “aerosol” considered to be singular since the word “contains” is used? I would assume it would be plural.

Figure 1: Line 120 suggests there is a site called “Principe” that I am not sure I see labeled in Figure 1. Figure 1 generally looks busy and not the easiest to see all the features; I understand a lot of work went in to make this figure though so likely no need to change this unless the authors also feel it is too complicated.

Figure 2: The “See text.” addition at the end of the caption seems unnecessary to me. Also, while the blue and red bars are easy to make sense of, the yellow ones seem like a bit too much especially since they are presumably hidden at times behind blue bars. I leave it up to authors to decide whether to break out the yellow bars on a separate axis or figure; perhaps it is desirable to not have more figures and thus they can ignore my suggestion.

C2

Lines 193-198: It would have been nice if the number of science goals listed here (2) mapped on directly to the number of science questions in the abstract (3). Again, up to authors to decide if this is worth addressing or not. It is good to see that the 3 science questions/topics in the abstract map on to Table 1 well.

Line 314: Sounds off to just say "CCN for cloud condensation nuclei". Is the "CCN" supposed to be the instrument name (presumably the CCN counter)? I do not think that "CCN" is the full name of the instrument. Please check.

Line 596 and 863: change "further" to "farther"

-I especially enjoyed reading Section 3.5 and applaud the team for excellent outreach efforts.

Figure 11: I wonder if having a color other than light blue would help with contrast since there is another shade of blue.

Table 3: Nice strategy to provide this. Great idea.

Figure 14: quite challenging to see the text, especially in the bottom 3 panels. Please improve aesthetic quality and the ability of readers to see the information clearly.

Line 883-884: What is the reference for this claim about the "f44" metric? I ask since the reference to "up to ten days" is quite specific and I am curious what study showed that result.

Line 885-886: Interestingly, a 2-part paper series in JGR was inspired by ORACLES to see how similar aerosol-cloud interactions and smoke plume properties would be based on aircraft work off the US West Coast (<https://doi.org/10.1029/2019JD031159> and <https://doi.org/10.1029/2018JD029134>); I leave it up to the authors to decide if it is worth mentioning that one of the many values of the ORACLES dataset is contrasting it with smoke impacting some of the other major SCu decks, such as what was explained in great detail by those two papers above in JGR. In this capacity, I found it interesting that the f44 values reported for smoke in the Mardi et al. (2019) study were very similar

C3

to those in Figure 15, which may be worth mentioning to go along with the Siberian plume comparison. This 2-part paper series interestingly has a lot in common with ORACLES results in other areas, especially those reported by Diamond et al. (2018).

Line 920-921: Note that the paper here is cited for the year 2010 (presumably the JGR paper about precip susceptibility) but the one in the reference list is 2009. Since I am familiar with both papers, I admit either one would work well, but to save yourself time, stick with the one in the reference list (2009 GRL).

Figure 20: I suggest removing the panel titles above each panel figure since they are already in the caption. This is a tough figure to see in terms of clarity and font size. If anything can be done to improve it for the final draft, that would be great since it is a really nice figure idea.

Line 1200-1201: I suggest another word other than "unprecedented". I can think of multiple other campaigns that have applied routine sampling strategies highlighted below (albeit others likely exist). Perhaps I did not interpret the sentence correctly and the authors meant to say something more specific about how their routine strategy was unprecedented and different than other studies like the ones described below? <https://doi.org/10.1029/2019JD032346> <https://doi.org/10.1175/BAMS-D-18-0100.1>

Line 1159: Authors should be more specific about what is actually less than "0.2". What specific hygroscopicity parameter? In fact, I don't remember reading about this in the main body of the paper. I suggest sticking to the policy of not adding new information to the Conclusion section that wasn't reported on in the main body of the paper. In this regard, I was particularly hoping to hear more about the aerosol composition and hygroscopicity in the paper, and especially what was learned from the CVI measurements; I assume the authors prefer readers to look at specific papers about these results, which makes sense.

-The Wong et al reference is missing from the reference list.

C4

Figure 3: can the caption more clearly state the meaning behind “440” and “441” on the y-axes labels?

Table A1a: Some of the entries are a bit difficult to understand; for instance, in PRF03Y16 it say “...and capture CF=100% case”. Presumably this means their was interest in sampling in an area of 100% cloud fraction, but I am not sure this was described as clearly as I know it could be. I suggest re-reading some of these entries to make them a bit more clear to those who are relatively newer to the field of airborne science like a beginning graduate student who would want to make sense of these entries. Editing the entries would clean up little issues like a double period at the end of the PRF13Y16 entry.

Table A4: Why are some entries bolded and others are not? Also, there are some acronyms that should be defined such as “droplet sd”.

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Interactive comment on Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2020-449>, 2020.