

# ***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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Authors' response to interactive comments 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.

Reviewer 1: Armin Sorooshian (Referee), armin@email.arizona.edu Received and published: 30 June 2020

We greatly appreciated Dr. Sorooshian's review of our paper. His praise for certain

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parts of the manuscript means a lot, given his PI role for an ongoing Earth-Venture-Suborbital project. Below, we have taken the liberty to number Dr. Sorooshian's comments and attempted to respond to the best of our abilities; we hope that our responses meet with his approval.

Detailed comments:

1. 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.

Response: Agreed. We changed the word "questions" to "themes".

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

Response: We added "at fixed liquid water content" before the Twomey reference.

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

Response: We changed the noun to "aerosols".

4. Figure 1: Line 120 suggests there is a site called "Príncipe" 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.

Response: This confusion derived from the fact that the country is indeed called "São Tomé and Príncipe", but we were operating from the island of São Tomé. We decided to remove the word "Príncipe" from line 120 so as to eliminate confusion and not clutter Figure 1 with longer labels.

5. 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

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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.

Response: We deliberated this carefully amongst lead authors - we would prefer to keep the yellow bars as they speak directly to the physical separation of BB and cloud layers referred to later in the manuscript. We eliminated the words “See text” per the recommendation.

6. 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.

Response: The overarching questions here were meant to encompass the more specific science questions Table 1. We have tried to clarify by changing the text to read “The overarching ORACLES science goals, which encompass the specific science themes and questions in the abstract and Table 1 below, are:...”

7. 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.

Response: We agree and added the word “spectrometer” to read: “...CCN spectrometer for cloud condensation nuclei...”

8. Line 596 and 863: change “further” to “farther”.

Response: Done. Thanks.

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

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Response: Thank you.

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

Response: We have changed the light blue tracks to red.

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

Response: Thank you.

12. 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.

Response: We have increased the font and changed the location for the text in this figure.

13. 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.

Response: We added text that specifies that this statement referred to figure 15. We have addressed the comment on specificity by adding “approximately”.

14. 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 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,

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especially those reported by Diamond et al. (2018).

Response: We agree with the interesting similarity between the absolute values in f44 between our study and the Mardi et al. paper. However, the latter does not make a quantitative connection between f44 and physical smoke age, and we would hence prefer to not reference the Mardi paper here.

15. 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).

Response: Change made.

16. 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.

Response: We removed the panel titles from this figure and did our best to improve legibility.

17. 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>

Response: We added text to specify what the term unprecedented referred to: “...unprecedented for suborbital efforts at geographical scales of up to 2,000km (Shinozuka et al., 2020);”.

18. Line 1159: Authors should be more specific about what is actually less than “0.2”.

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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.

Response: We removed the bullet point with the conclusion about the kappa parameter (which was referred to with the numerical value of 0.2) and eliminated all references to papers that have not yet been submitted. Fortunately, except for the bullet point with the kappa parameters, all other conclusions are supported by figures in this paper and added references to sections 4.2, 4.3, 5.2.2 and 5.2.3 and Figure 18, where necessary.

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

Response: We removed this reference.

20. Figure 3: can the caption more clearly state the meaning behind "440" and "441" on the y-axis labels?

Response: The "440" and "441" referred to the wavelengths of the AERONET retrievals. We have changed the y-axis labels to read "AOT (440/441nm)" and "SSA (440/441nm)", respectively, and added the wavelengths in the caption.

21. 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

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of the PRF13Y16 entry.

Response: This point is well taken - we were trying to strike a balance between highlighting the main components of the flights and keeping our statements brief. This resulted in some entries that were difficult to comprehend. We have made numerous changes in all four table (A1a, A1b, A2, and A3): for all flight entries, we added a statement describing the primary science objective or at least the general plan for the flight; we added verbs to make some sentences more comprehensible, and, where short-hand notation was not conducive to the reader's understanding, we expanded the short-hand notation to full sentences; we replaced most jargon and acronyms; and we fixed a number of punctuation issues beyond the one mentioned in this review comment.

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

Response: As the table caption indicated, the bold entries refer to measurements that were archived in the official ORACLES archive. We have changed the Table caption to clarify this: “P3 instrumentation in ORACLES (bold entries indicate quantities submitted to the ORACLES archive, see ORACLES Science Team (2020), in the list of references).”

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

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