

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.

Anonymous Referee #2

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This paper is a valuable and very comprehensive summary of the ORACLES field campaign. I particularly appreciate the effort to document key elements of the field campaign planning and implementation, including elements that may be innovative. This knowledge is rarely documented in the literature, and therefore only conveyed to the lucky few that get to participate in or observe the management of a complicated field campaign. Some minor revisions, particularly in the presentation of some of the preliminary science results, may be warranted. However, the paper is certainly suitable for publication in ACP. Some detailed comments follow.

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The first four sections of the paper are lengthy, but very informative. I wish that the background and context for more of these large field campaigns were so thoroughly documented in the literature. However, the conclusions drawn from figure 9, which are very important to the broader context of the experiment, could be more concretely supported. The notions that the “fire counts in the three deployment years are very similar to the climatologies” and that the analysis “supports the conclusion of an earlier and possibly prolonged presence of the biomass burning plume . . . in recent years” are only supported with small color/contour maps, when the quantitative data presented in those charts could actually be interpreted with proper statistics to determine the magnitudes of any differences between them and how the relative differences or similarities compare to the magnitude of interannual variability. Rather than asking the reader to eye-ball the differences and interpret subtle differences in shading or contour shapes, why not actually reduce the data to statistics that support the conclusion?

At the very end of section 4.3 is a brief summary of the broad conclusions for how the aerosol and cloud properties during the months of the field campaign relate to climatologies and interannual variability, but no conclusion is drawn for what this means for the outcome of the field campaign. Do the authors feel they captured representative conditions from their sampling? Do the differences from climatologies noted for August 2017 and October 2018 have any implications for the resulting dataset in terms of whether the results drawn from the data can be thought of as broadly representative of aerosol/cloud relationships in the region?

The discussion in the paragraph starting in line 820 raises the question of whether any future planned satellite lidar instruments will have the signal-to-noise ratio to provide a better view of the frequency of clear air between aerosol and cloud layers? Can the results of ORACLES help constrain a future mission so that past inferences about the relationships between aerosol and cloud layers can be improved upon with large statistics from satellites in the future?

The discussion between lines 861 and 865 is confusing and seems to be missing some

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key elements to the interpretation of the observed SSA and BC:OA ratio. From figure 14, Aug. and Sept. appear similar with Oct. being the outlier, but the discussion draws a distinction, in terms of 4 km winds, between Aug. and the other months. Furthermore, I was not clear on exactly what the higher winds in Sept./Oct. are responsible for. Finally, if I am understanding the argument correctly, the aerosol lower in the column is older and also exhibits lower SSA and higher BC:OA ratio. However, the discussion does not link these aerosol properties to age? Am I to conclude that aging depletes the organic fraction of the aerosol, and that is why the SSA decreases with altitude?

The results presented in figure 18 are intriguing and certainly demand further study. I understand that there is a paper in progress to do just that (Gupta et al. 2020). However, it is rather disappointing to read that there are hypotheses that might explain the results, but not be able to read what they are. Is it not possible to share the hypotheses and then note that they are to be evaluated in the other paper?

Conversely, there are a number of declarative statements in the bulleted list in section 7 of the paper that are not supported in the paper and the supporting citations are to papers that are not yet published. While I understand that the notion here is to summarize some of the findings from the campaign as they presently stand, this does raise a question of whether it would be proper to have this paper on the record citing some declarative results that may either not end up in the peer-reviewed literature, or be altered somewhat after peer-review.

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