Atmospheric
Measurement
Techniques

Discussions

Interactive comment on "Two decades observing smoke above clouds in the south-eastern Atlantic Ocean: Deep Blue algorithm updates and validation with ORACLES field campaign data" *by* Andrew M. Sayer et al.

Anonymous Referee #3

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This paper provides an update on a previously published algorithm for retrieving the optical thickness of aerosols (AOT) above clouds from any one of the three satellite instruments, MODIS, VIIRS and SeaWiFS. The updated algorithm is then compared with co-located measurements of AOT above clouds from the ORACLES field campaign. Furthermore, the comparison of the long-term time-series of retrievals from both MODIS instruments currently in orbit and the VIIRS and SeaWiFS instruments. The paper provides a significant update to the previously published algorithm, as well as a valuable validation study. The paper is long and comprehensive. It certainly de-

serves publication in AMT, however, I think that some of the key results of the study are obscured by the lengthy discussion and I encourage the authors to take steps to elevate some of the key results, in particular the quantitative results of the comparison with the aircraft data, which are buried in the middle of the long paper.

The results of the comparison with the ORACLES data in the abstract and conclusion are presented as "performance generally in line with theoretical expectations". However, the quantitative meaning of "theoretical expectations" is obscured by the lengthy discussion. Likewise, the many sources of uncertainty and assumptions made in the algorithm are documented in great detail, but their quantitative impact on the retrieval does not clearly come through. Nevertheless, one presumes that these determine what the theoretical expectations are for the retrieval error.

Figure 7 indicates that the error statistics for the different satellite instruments are substantially different, but the understanding for what accounts for those differences does not come through in the discussion. For example, differences in resolution among the instruments are mentioned and the confounding problem of broken cloud scenes is discussed, which would presumably impact instruments with different resolutions in a different manner, however these matters are not discussed in the context of the actual errors and biases presented in the paper.

The paper would be significantly improved if the abstract and conclusions provided a more quantitative summary of the main results of the paper: the comparison with the field campaign data, rather than simply referring to the expected error. Section 2 of the paper should then make clear in a quantitative manner how the details of the retrieval scheme contribute to the error of the result. In some places in section 2 there are numbers cited for contributions to error, however in other places there are only qualitative, e.g. "results are only weakly sensitive to the value of this threshold". It would be much easier to understand what the expected error means if section 2 included a summary section and summary table that assembles the quantitative details that are currently obscured and spread across several pages. If adding such a section,

the authors should seek to reduce discussion that is not directly pertinent to evaluating the performance of the retrieval as the manuscript in current form is very lengthy.

The conclusion section includes lengthy discussion of other retrieval approaches and sensors that were not elements of the work presented earlier in the paper. The key paragraph summarizing the take-away message of the paper seems to be the second-to-last paragraph beginning line 11 on page 41 where it is noted that sensor calibration and assumed aerosol/cloud optical properties and structures are key areas to focus on for improving the retrieval. This should be the emphasis of the discussion rather than the unrelated matters of other sensors and techniques. This conclusion implies that there has been some effort to evaluate the sensitivity of the retrieval to the assumptions regarding the cloud and aerosols properties in the forward radiative transfer calculations. Again, this is not made clear in section 2. If the top-line result in the conclusion is the importance of aerosol/cloud properties and sensor calibration, then section 2 of the paper should include the quantitative support for this conclusion and this should be elevated in the abstract in conclusion sections rather than obscured by lengthy discussion of matters unrelated to the retrieval technique presented in the paper.