

RC Reviewer Comment 2 on egosphere-2023-2354

Peng Xian et al.:

Intercomparison of Aerosol Optical Depths from four reanalyses and their multi-reanalysis-consensus

This paper is comparing and analyzing the difference of aerosol reanalyses (RA) from NAAPS-RA, JRAero, NASA MERRA-2, CAMSRA and a consensus of these for RAs named multi-analysis consensus (MRC). The parameter used for the comparisons are the AOD (Aerosol Optical Depth), and the FM (fine mode) part of the AOD, and the CM (Coarse mode) part of the AOD. The four RAs are compared to each other and the MRC is confronted to all four methods also. As evaluation, AODs from these RAs are compared with AEROSol Robotic NETwork (AERONET) and with the combined MODIS Dark Target/Deep Blue retrievals.

The paper is well written, in perfect English, all the parts are very clear.

The paper is brilliant in showing the differences between the four RAs and the MRC, also in showing, commenting and analyzing the trends and seasonal and geographical variabilities of AOD, FM-AOD and CM-AOD.

The paper suffers of a lack of an explanation concerning the methods. Especially in introduction and part 2. We would expect a longer explanation about what is meant with the "consensus" (MRC). The MRC should be better explained in details: Is it an average of all four other methods? How it differs to a simple average, are there situations/regions/seasons/periods for which one method will have a larger or a weaker weight in the consensus compared to others? If yes why? -> A real effort should be done for explaining better the methods and specificities of this MRC "consensus". Also, you should explain what are the needs of this consensus. Are the four RAs methods not enough?

Other lack of explanation in the methods is for the method of comparison AERONET vs. RAs and MRC. The comparison method should here be much better explained (Part 3.3). Especially for the regional comparison: Which stations are taken account for a given region? Is the AERONET value used in the comparison for the region an average of all stations present in the region and accepted for the comparison regarding the criteria explained in Part 2.5? If yes, is it a relevant method = are all n AERONET sites of the region representative with the same weight $1/n$ for this region? How do you deal then with sub-regions with higher concentrations of AERONET stations? Are there then not over-weighted in the computation of the "regional AERONET-AOD"? Do you have considerations concerning urban and rural AERONET sites?

These for the general scientific comments.

A general presentation comment is that they are a lot of acronyms used. Positive is that the authors very often detailed in the text several times the meaning of the acronym. Nevertheless, I suggest you to add an acronym table in order to help the reader to understand quickly the acronyms.

I have some specific comments/questions for two pictures:

- Maps of Figure 1: First line of maps (MODIS): I understand that on the Antarctic region during JJA there are no measurements, but why is it the same during the other seasons (example austral summer in DJF)?

- Figure 10: 10b) On the Antarctic Graphic: It is so obvious that JRAero is much more overestimating the AOD that it is worth that you give an explanation in a comment in the text of the article

And a comment about References:

- The most important cited reference (Sessions et al. 2015), cited L104, L235, L292, L351 is missing in the "References" part.

- Sessions et al. 2016 (cited in L66-67) is missing in the References list