Response to reviewer 3

I'd like to thank the reviewer for their time and many useful comments. I think the paper has improved in clarity as a result of their feedback.

The reviewer suggests condensing the paper. Other reviewers have suggested this as well, pointing out the use of supplementary pages. I have decided to move part of the AOT representation discussion (e.g. variations by regions) and the entire AAOT representation discussion to a supplement. That should significantly shorten the main paper, without detracting from the main conclusions. The original AAOT analysis will be available for those with an interest in it.

Sometimes figures are referred by using "Fig." and sometimes "Fig".

All changed to "Fig.".

It would be interesting to see or at least have a comment on the absolute representation errors. This would show if high representation errors mainly correspond to small AOT values only or are there relatively large errors present also in cases with large AOT.

A good point. I started using relative errors in S16b as it allows more easily a comparison across different types of measurement. Also in the current paper, it allows comparison of AOT and AAOT representation errors. But I will include a paragraph on absolute values of these errors.

p.2 l.14 "return times" Would "overpass times" or "revisit times" be more commonly used term to be used here?

Yes, I'll use revisit times.

p.5 l.1 "The maximum cloud-fraction was slightly tuned..." Please clarify what you mean by "slight tuning".

Yes, I can see how this is confusing. I can choose values between 0 and 1 and ended up using 0.01 because the results agree *slightly* better with the observations. As the original text stated, the impact is small. Also, I only explored five different values (0.01, 0.1, 0.5, 0.9, 0.99) so in that sense the tuning was coarse. I have removed 'slight'.

p.6 l.7 "...we will limit our analysis to latitudes below 60°." In Figure 4, there are stations at above 60 degrees.

True, AERONET sites exist at higher latitudes and my data included those as well. For the evaluation of G5NR, I used all sites. For the representation study, I included only sites below 60 latitude (except in Fig 4 & 5). Text now reflects this.

p.7 l.9 For reproduction of the results, please list the sites that were removed from the analysis.

They were only removed from the analysis for one result (Table 5, line Europe*). Throughout the paper they have been used in the analysis of representation errors. I have amended the text to clarify this.

p.7 l.20 Is AOT threshold of 0.25 correct? To my understanding the threshold at 440 nm is 0.4 and it depends on the spectral dependence of AOT (Angstrom Exponent) what it will be at 550 nm. So for me this seems a bit low value for the threshold. Please make sure the reader understand that you have used a "non-standard" value of 0.25 or correct to match the true AERONET threshold (throughout the manuscript, same limit mentioned for example on p.9 l.13).

The reviewer is correct. The text will be modified accordingly. Note that this has almost no impact on the paper as I mostly study Inversion L1.5 data. Only in Fig 9, where a comparison is made between L1.5 and L2.0 will this affect the L2.0 analysis (i.e. representation errors will be underestimated). Note that this issue (AOD@550nm >0.25 instead of AOD@440nm >0.4) will mostly affect dusty stations (for which AOD@550 ~ AOD@440). Since most of my statistics are based on year-averages from stations and dusty stations form a minority, I do not expect very big changes.

p.9 l.22 Altitude of -410 meters, is this correct?

This is correct. These are geopotential altitudes, see also Table 1 & 2.

p.9 l.29 Here notation "r" is used for representation ranking by Kinne et al. (2013). In some parts of the manuscript "r" is used to denote correlation coefficient so there is a conflict here. Please correct throughout the manuscript to remove the possible misunderstandings.

Yes, that is a bit unfortunate. “r” is a common symbol for correlation, which is why I use it. Kinne et al use “r” for their rankings. I will address this specifically when discussing Kinne rankings.

p.13 l.12 "G5NR and the OSSE are evaluated and found to show significant skill." This result was found for AOT, not for AAOT. Please clarify that this statement applies only to AOT to avoid misunderstandings.

I suggest to change this to: “G5NR and the OSSE are evaluated and found to show significant skill in AOT and reasonable skill in AAOT.”

p.18 Figure 1 Bottom row, what are the differences between solid and dashed lines?

Caption has been clarified.

p.21 Figure 9 Please define DS. Also on the upper right corner the text is overlapping with the figure and may be difficult to read.

Caption has been clarified.

p.25 Figure 16 What are the dashed lines?
p.27 Figure 20 "r" is not defined.
p.28 Figure 21 If possible, please add the another colour bar from Fig. 7.

And thanks for the typos etc.