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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Inconsistency in spatial distributions and temporal trends derived from nine operational global aerosol optical depth products" *by* J. Wei et al.

Anonymous Referee #3

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The authors provide a comparison of nine satellite-derived global AOD data sets, with ground-based AERONET (land) and MAN (ocean) AOD data as reference. They apply different statistical metrics and look at the data sets on different spatial scales: global, regional and per reference site. They also look at trends. Differences and agreements between data sets are described. The manuscript provides an interesting overview of AOD data sets available in the public domain, although some recent data sets like those from VIIRS are missing. Also I wonder why for AVHRR only the over-ocean AOD is included and the recent over-land data sets described by Sayer and Hsu in JGR, 2017, were not included. It would be interesting to see how these data sets, retrieved from a sensor not designed for aerosol retrieval, compares to those from dedicated sensors

like MISR and MODIS. Likewise, a comparison with PARASOL (POLDER) would have been interesting. As regards the title, I would recommend to change "inconsistency" to "Intercomparison", because not all and not always are the data sets inconsistent, they are often also consistent.

Specific comments (line numbers refer to the pdf published online) 46: suggest "composition and short life time of atmospheric aerosol particles" 57: remove "observable" 79: remove "seemingly" 80: This sentence suggests that some studies have indeed focused on exploring ... ; hence references to these studies are needed here 85: suggest "evaluation and comparison" 91: validation 103: ADV was first published by Veefkind et al., 1998a, for retrieval over land; Over Ocean ASV was first developed by Veefkind et al., 1998b 112: A more recent reference for the Swansea algorithm is Bevan et al., 2012 117: Holzer-Popp 122: "AVHRR aerosol product is only available": this is NOT true, see my general comment and references to Sayer and Hsu Sect. 2.2: not only AERONET is used, AOD over ocean is provided by the Marine Aerosol Network (Smirnov et al., 2009) 196: could you reword the text to make more clear how the lsq fit is applied 199: trend symbols: same direction of the trend Para starting at 230: An important indicator is also the EE, and the above and under EE which clearly indicate overestimation (e.g. for MODIS) and underestimation (e.g. for MISR). Here and in the next paragraphs, I do not understand how MISR can have a similar number of collocations as MODIS in spite of it's much smaller swath; MISR should have an N similar to AATSR 235: I am not sure that your judgement of ADV is completely fair, since indeed MAE and RMSE are worse, but not EE; looking at the statistics in Table 2, it seems that none of the sensors has the best statistics for all numbers, so it is hard to make such statements 236: smaller number of retrieval collected: I think this should be a smaller number of collocation pairs since less references data are available; again, how can MISR provide a similar number of data collections as MODIS? 244: SeaWiFS is not improved, but it's performance is better 251: what is the statistical parameter indicating estimation uncertainty and accuracy? 257 and 263 and 275-277: a high R does not imply that the performance is better: MODIS has high R, but figure 2 shows that

MODIS overestimates, so actually it's performance in estimating AOD is not so good. This should be re-worded in the text 266: RSA, typo and you mean ESA? Sect. 5.2: there are very large differences in the mean AOD values; yet they all compare well with AERONET (Fig. 2 and 3): why are these differences not visible in the scatterplots? 304: suggest to plot the eight-year mean value in the figures Sect. 5.3 title not clear: suggest to change the Section title to " Comparison of satellite- and AERONET- derived annual mean AOD at each site 340: this sentence is not accurate: you compare annual mean AOD for each satellite over an AERONET sites with the AERONET annual mean value 375-376: I do not understand the sentence "Four . . . areas." Why are the first 4 similar and the other 2 consistent? What do you mean with that? MYD08 and SeaWiFs show quite some differences. Could you re-word so it is more clear? 379: what do you mean with "treatment in neighbouring pixels": did you describe that in the text? Sect. 6.4: Linear trends were fitted, so it may be that upward and downward trends are compensated over this long period of 18 years and thus the trends in Fig 14 are not representative. Could you please add a comment in the text? Figure Captions: 2 and 3: Density scatterplot of the monthly averages of satellite-derived AOD (operational products) versus AERONET AOD 8: replace aerosols with AOD 10: ".. with annual mean AERONET AOD data for all sites . . ." 11: trends of AOD at 550 nm 12: replace "aerosol trends" with "trends of AOD at 550 nm" 13: I think you show trends of AOD at 550 nm, not annual mean aerosols? 15: remove "variations"

References: Bevan, S. L., North, P. R. J., Los, S. O., & Grey, W. M. F. (2012). A global dataset of atmospheric aerosol optical depth and surface reflectance from AATSR. Remote Sensing of Environment, 116, 119–210. Hsu, N. C., Lee, J., Sayer, A. M., Carletta, N., Chen, S. H., Tucker, C. J., . . . Tsay, S. C. : Retrieving near-global aerosol loading over land and ocean from AVHRR. Journal of Geophysical Research: Atmospheres, 122. doi:10.1002/2017JD026932, 2017 Sayer, A. M., N. C. Hsu, J. Lee, N. Carletta, S.âĂŘH. Chen, and A. Smirnov: Evaluation of NASA Deep Blue/SOAR aerosol retrieval algorithms applied to AVHRR measurements, J. Geophys. Res. Atmos., 122, doi:10.1002/2017JD026934, 2017. Smirnov, A., et al. (2009), Maritime

Aerosol Network as a component of Aerosol Robotic Network, J. Geophys. Res., 114, D06204, doi:10.1029/2008JD011257. Veefkind, J.P., G. de Leeuw and P.A. Durkee (1998a). Retrieval of aerosol optical depth over land using two-angle view satellite radiometry during TARFOX. Geophys. Res. Letters. 25(16), 3135-3138. Veefkind, J.P. and de Leeuw, G., 1998b, A new algorithm to determine the spectral aerosol optical depth from satellite radiometer measurements. Journal of Aerosol Sciences, 29, 1237-1248.

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