

Interactive comment on “Global and regional trends in aerosol optical depth based on remote sensing products and pollutant emission estimates between 2000 and 2009” by A. de Meij et al.

Anonymous Referee #3

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Review of paper: “Global and regional trends in aerosol optical depth based on remote sensing products and pollutant emission estimates between 2000 and 2009” by A. de Meij et al.

This study investigates trends in Aerosol Optical Depth (AOD) from MODIS, MISR and AERONET and associated aerosol emissions over the period 2000 – 2009. The knowledge of trends in AOD on global and regional scales is critical for the discussion of decadal climate change, and may have greatly improved with the availability of recent products from MODIS, MISR and AERONET. The present study therefore

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touches upon an important issue. I think it is a worthwhile (and necessary) endeavor to evaluate and intercompare these different products with respect to their degree of consistency in terms of global and regional trends, as done in this study, and should be encouraged. There are, however, a number of issues which have to be addressed before the manuscript can be considered for publication in ACP.

General comments:

1. I have some concerns regarding the structure of the analysis, particularly Section 3.2. I do not see the point of comparing MISR and MODIS at 152 AERONET stations if they are not compared also to the AERONET values. A comparison at specific points only makes sense to me when there is also the observational reference added (as done in section 3.3), otherwise it is an unnecessary restriction to isolate these points in gridded datasets. As it is now, a discussion of MISR and MODIS only, at 152 points, without the AERONET references, and then in section 3.3 a discussion now at 60 points with the AERONET data in addition, leads to duplication and makes the paper unnecessary lengthy. I understand that it is because only 60 out of the 152 Aeronet sites have enough data for a proper comparison. But then I would replace the pointwise comparisons in Section 3.2 with a more representative comparison of continental scale trends in MODIS and MISR. On the other hand I would find it useful to have a discussion and a first order comparison of AOD trends on a global mean as well as ocean and land mean basis before going into the regional details. I would structure the analysis therefore as follows, first a global mean (+land/ocean mean) trend discussion, second a regional (continental scale) discussion without restriction to points where there are no observations anyway, and third a pointwise discussion at those sites where there are useful observations (as done in Section 3.3).

2. A main merit of this paper is from my point of view the evaluation of the satellite products with surface reference sites from Aeronet. So a couple of clear statements and recommendations on the usefulness and limitations of the two satellite products, which could serve as guidelines for readers who may apply these data, would be helpful

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and enhance the practical usefulness of the paper. As it reads now, it is not too clear to what extent we can trust these datasets and whether there are any distinct differences in the quality and usefulness of AOD trends in MISR and MODIS.

3. For the reader not familiar with satellite products, the extensive use of the terms level 2 and 3 is confusing and should therefore be clearly explained, before they are used for the first time (e.g. in the introduction, or maybe even briefly in the abstract, to understand this one properly).

4. It is interesting to note that the AOD trends identified in this study qualitatively agree well with trends in surface radiation observations in time series after 2000. The surface radiation observations indicate increasing solar radiation over Europe and the US, and declines over south and East Asia. See Wild et al. 2009. Global dimming and brightening: An update beyond 2000, *J. Geophys. Res.*, 114, D00D13, doi:10.1029/2008JD011382. This agreement could be mentioned in the paper.

Specifics:

Abstract L 21, "other criteria pollutants" sounds unfamiliar to me.

P30736, L 24 why do you use the 550nm and 870 nm band and not other ones for the calculation?

P 30739, L 16. What is the meaning of 3-PD

Section 3.1. As noted above, it would be interesting to show and discuss here in a figure also global mean as well as land /ocean mean trends and the consistency therein between MODIS and MISR AODs.

P 30744 L 6. How about seasonal differences in the trends? Is there something noteworthy to say?

P 30744 L 13, is there an explanation why MODIS AOD is in general higher than MISR AOD?

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P 30745 L 22. What could be the reasons that the SSA trend in the US is so different from Europe?

P 30752 L 3 "are generally positive", this doesn't seem to apply to MODIS with a trend of -1%.

P 30752 L 22ff, as pointed out above these AOD trends are in surprising agreement with the trends in surface radiation records after 2000.

I do not see an added value of Figures 2 c) and d) compared to Figures 2 a) and b). They provide the same information, if I understand the figure correctly. More useful could e.g. be difference plots between MISR and MODIS slopes to see more clearly where the 2 estimate agree and disagree the most.

Interactive comment on *Atmos. Chem. Phys. Discuss.*, 10, 30731, 2010.

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