

## ***Interactive comment on “Intercomparison of satellite retrieved aerosol optical depth over ocean during the period September 1997 to December 2000” by G. Myhre et al.***

**Anonymous Referee #2**

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Review of the paper:

Inter-comparison of satellite retrieved aerosol optical depth over ocean during the September 1997 to December 2000 by G. Myhre et al.

Positives -importance to introduce a range of available aerosol products from remote sensing -use of AERONET statistics in the search for (good) references for aot retrievals -different aspects in terms of spatial averaging and statistic when comparing data

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Concerns -too much focus on data presentation rather than interpretation and analysis (comparisons are useful only, if known limitations/biases are considered (few limitations are mentioned, certainly not all)) -lack on recommendations on what data to use or to avoid (on a regional and seasonal basis) -conclusions are not necessarily representative due to spatial limitations, assumptions of regionality for local statistics (AERONET), non-matching samples and unclear sample counts in monthly data -the restriction limitation to aot retrievals over oceans disappoints ('aerosol' satellites can do more)

#### General comments

The paper compares available aerosol optical depths monthly averages of retrievals from various satellite sensors in the late 90'. The (dis-)agreement is illustrated in many nice graphs. However, many of these comparisons leave the wrong impression due to particular biases of individual data-sets.

Some (but by no means all) satellite specific limitations are introduced (e.g. threshold cutoffs for SeaWifs, large pixel size for TOMS or GOME, or poor statistics of MISR). These limitations should be an additional item in Table1 and also should appear in figure captions comparing uncorrected aot retrievals. Clearly preferred is a harmonization (e.g. like to a common wavelength), that takes account of these deficiencies (surely Seawifs aot has to be low in many regions, if the aot maximum is set to 0.3). Even the minimum requirement for global ocean coverage is not always fulfilled (GOME/ATSR) and differences between MISR and MODIS and especially between MODIS and AERONET are belittled.

The entire comparison, as it includes some strongly biased retrievals, leaves the wrong impression that there is large uncertainty among satellite retrievals for aerosol optical depths over oceans, while in fact these differences are largely driven by deficiencies of retrievals method and a-priori assumptions. I strongly recommend to clearly identify deficiencies and even better to correct for comparability (if possible) any biased data-

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set.

Along those lines I like to see a recommendation, what data-set to use (pre-2000 and past-2000) and what uncertainty to expect by region and season. There should not be a fear that some co-authors take offense, as long as with (even with their help, such as for MISR) weaknesses and strengths are explained and demonstrated.

Finally, I regret that the authors only tackled the easiest retrieved aerosol property (aot over oceans) and left out comparisons of the spectral dependence (Angstrom parameter, thus size) and especially any efforts to compare retrievals of aerosol optical depths over land.

#### Minor comments

- The last sentence of the introduction promises to explore differences of aot for certain satellites—but somewhat such a summary is missing. A table summarizing findings in a more general sense (remote, dust-, biomass-, urban- outflow) satellite by satellite would be great, maybe in reference to MODIS or to AERONET.

-Table1 needs an additional item on limitation and how this limitation is likely to impact the aot retrieval - also based on comparisons of this paper.

- info on page 8206 is very important, but can be condensed with an appropriate addition to Table1. The TOMS wavelength conversion is not quite clear. Remember it is not only the size that changes but also the absorption-especially for dust (O.Torres has a 550nm product based on his assumed aerosol model, which may be a better choice to use). Also isn't there also an Angstrom limit for Seawifs?

- Comparing strong local statistics to poor statistics for large regions (mainly here with the center >100km off in one direction) will at best allow very general conclusion - not to speak of the case when the local site is characterized by local pollution.

- on page 8209: wouldn't we expect background contamination with the large pixels of TOMS, that is, if we want any data at all? On line 25 the 20-30deg low aot feature looks

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like a humidity effect. How does the dust outflow off Africa fit into this picture?

- on page 8210: explain the statement in the last sentence, as the assumptions on absorption (and often on size) in retrievals are usually pre-defined. Different sampling IS a problem, so some info on regional or monthly sample number statistics would help put results into their place.

- AERONET aot data (direct measurements) are certainly more accurate than retrievals (this can be stated!)

- What do you want to say in the last sentence of chapter 2? How does it relate to aot retrievals?.

- on page 8213 line 17: the sentence is difficult to understand.

- Figure 1b illustrates why the GOME/ATSR2 retrieval really is not global in the sense of other retrievals with very poor spatial coverage (Did you ever consider to plot global difference plots (sat minus sat) with respect to MODIS -which I consider the best choice. This will nicely illustrate problem areas.)

- in the captions of Figures 2,3,4 I would mention the expected biases for comparisons to AERONET, which are shown later (expected to convey that aot differences are much smaller than these figures indicate)

- Figure 6 correlations refer to monthly averages with different time-sample. As sampling is generally low (large pixel [you may want to indicate, how many pixels contribute for each region], few overpasses) and overpass times usually disagree, these data can be best taken in a relative sense, indicating that TOMS, MISR and AVHRR2 are outliers (if the MODIS data are the 'trusted' reference over oceans). Thus, as the general information is contained in Figure 5, I would leave out Figure 6.

- Figure 8 can and should be utilized to somewhat quantify regional and seasonal retrieval biases, which eventually can be the basis for a recommendation on data-sets to be used. The statistical summary in Figure 9 somewhat contributes, but I would

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leave out satellite data with poor statistics and taking the global average diffuse some of the biases seen in Figure 8.

- Appendix A: Based on the scatter plot A1b there appears to be a high aot MODIS bias, especially if optical depths are low - while the text talks about general agreement. In Figure A1c it also may be of value to show the y-axis intercept, if correlations are high to demonstrate biases.

- To compare local AERONET statistics not only to 3\*3deg data but also to 1\*1deg data is a big stretch. Problems are expected for polluted sites (e.g. Arica) and the fact that ocean retrievals are linked generally only in one direction to the 'near-coastal' land data.

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Interactive comment on Atmos. Chem. Phys. Discuss., 4, 8201, 2004.

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