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Interactive comment on "Validation and empirical correction of MODIS AOT and AE over ocean" *by* N. A. J. Schutgens et al.

Anonymous Referee #1

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Comments on "Validation and empirical correction of MODIS AOT and AE over ocean" by. N. Schutgens et al submitted for possible publication in Atm. MEas Tech.

This paper performs an analysis of coincident measurements of the atmospheric aerosol load from space (MODIS retrievals) and from the surface (Aeronet). It shows that the satellite product has significant biases (compared to the sunphotometer measurements that may be used as a "truth") as a function of various geophysical parameters. The paper proposes an empirical correction of the satellite data that removes the biases. It has significant impacts on the global distribution of the retrieved aerosol parameters. This paper is well suited to AMT. It does show original results that may be of interest to the community. What is done is well described so that the objectives and results are clear. The drawbacks of the paper are (i) The submitted paper is not in final

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form with several "?" indicating that the author planned to fill the missing information but did not do so before submission (ii) too many figures so that the most important points of the paper get diluted within less interesting ones (iii) lack of proper interepretation of some results.

Because the paper shows interesting values and is properly presented, it could be published with limited corrections (as outlined in the detailed comments below). However, I strongly suggest significant revision to increase its value and make the life of the potential reader easier.

P3767-L7 known => suited P3767-L9. Contrarily to what is written, Terra is NOT part of the A-Train P3767-L21 "significant agreement". Too vague statement P3767-L26: "Systematically". Not true. It may tend to overestimate, but it is certainly not systematic P3768-L17: It should be mentioned that the big drawback of AE, is that it has no meaning as the optical depth tends to zero. It is very obvious that its noise gets large for small aod, which is not the case for the fine mode aod or the aod at another wavelength (or the aod difference between two wavelengths) P3770 L3 : Provide the spatial resolution of the product P3770 Eq1 : I believe this equation was not finished writing. P3771 section 3.1 : Several "?" indicate that the paper was not finished editing when submitted. This looks bad. P 3771-L26 : I do not understand the threshold at 1 times the typical value. Why remove cases that have typical values for the gradients. This may remove a large fraction of the data. P3772 Section 3.2. I fully disagree with this section and the example that is given to explain the process seems poorly chosen. In this paper, two fairly independent measurement of the same parameter (the AOD) are analysed. On the other hand, the example that is used uses non independent data of different parameters (ie the AOD at different times). If the biases are estimated for bins of the aeronet AOD, one should not expect a bias in the MODIS AOD. This is an important point in the paper that I would like the author to address carefully P3773-L16: Why 142 km ??? If the two MODIS pixels are less than 50 km from the aeronet site, it seems obvious that their distance is less than 100 km P3773L23-26: Not clear. Please

reword P3774, first paragraph. There are some very surprising (almost impossible) results described in this section, and the authors make no effort to interpret them. It seems impossible that a random sampling leads to a statistically different bias than that obtained with the full dataset. Besides, the authors make a discussion that involve the different biases between clear and partly cloudy scenes but fail to mention that the bias of both types of scenes are larger than for the "all cases". Both of these results seem impossible and impose some fact checking and explanations. P3775-L8-9. Co-variation of to and AE may be purely physical. The largest AOD over the oceans are mostly desert dust events, and are therefore associated with small AE. This is one of the case where more interpretation of the results would be expected. P3776-L7: . . . for the scattering angle. What is the parameters that co-varies with the scattering angle? P3776-L17: why jump to Figure number 21 ? P3777-L2: [. . .] outside the scope of this paper. Not clear why P3778-L18-20 : Low correlations for a few sites. All sites listed here are located in very clean regions and the AOD remain extremely small (<0.1) all year long. As a direct consequence, the random noise of ≈0.05 on the MODIS AOD leads to poor correlations, even when the RMS error remains small. This is a clear indication that the correlation is a poor indicator of the AOD retrieval performance. There is no good reason to discard these sites. I am rather surprised that the author have not identified this cause and they cannot claim that there is a "big discrepancy between those sites and aeronet". P3779-L4: "As robust multiple (linear) regression is a field very much in development". I am highly surprised by this statement. Multiple linear regression is mastered for many, many years, and I wonder why the authors have not chosen to use such method (using the proper parameters) rather than the somewhat complex method they chose. P3779-L10-16: This section is not clear and must be re-worded P3782-L5: "due to surface reflection". This paper analyses observations over the oceans. For such cases, 860 nm is more favourable than 470 nm as for the surface reflection (realy black in the near IR, but not so in the blue part of the spectrum) P3784-L2-5: The strong reduction in spatial variations of the AOD is certainly an interesting result that deserves discussions. What are the areas where significant changes

in the AOD are observed, and what are the parameters that lead to this change. Is it mostly the cloud cover, or something else ? The change in the climatological distribution of AOD is certainly a key outcome in this paper and should be discussed in detail. P3786-L23-25: Statement that there is no validation of fine mode AOT is plain wrong. Several papers, including some cited by the authors, have assessed the MODIS fine mode AOD.

P3787-L8: Can one state that the band of elevated aerosols in the southern ocean is due to cloud contamination ?

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