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Interactive comment on "The Collection 6 MODIS aerosol products over land and ocean" *by* R. C. Levy et al.

Anonymous Referee #2

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The manuscript provides a detailed description of the transition from MODIS C5 to C6 aerosol products. It is well written and systemically structured with sections describing general considerations, over land and over water improvements and the merging of dark target (DT) and deep blue (DB) data to provide better coverage. Also the provision of a higher resolution product (3x3 km) is described. The MS documents problems that have emerged with previous versions of MODIS aerosol products and how these were handled in C6, either by providing a better solution or giving justification to continue with the same solution as in C5. This is an excellent overview of the various steps that have been made and how MODIS aerosol products have evolved. This is very useful for both MODIS aerosol data users and scientific algorithm developers. In particular an overview is given of current and previous products and motivation for the deletion of previous products from C6 is provided. Usually such changes and descriptions are

provided as a report, i.e. an ATBD. However, the risk is that such ATBD's are published on a website and not easy to trace, or eventually may get lost. Furthermore, the wide use of the MODIS aerosol data requires an easily accessible and traceable reference and AMT offers an excellent forum for this. The MS reads indeed a bit like a report but this makes it also easy to follow the different steps. The paper has become very long. However, splitting it in two or more different papers would lead to duplication in the various papers and since the authors have done a good job in outlining the various topics it fits very well together, so I recommend keeping it all together. For all these reasons the manuscript deserves publication in a peer-reviewed journal like AMT with an open discussion which can be followed by the scientific and user's communities. I noted that I was asked to provide a review at a later stage when 2 reviews had already been provided. Apparently a third opinion was needed. However, I chose to provide an independent evaluation rather than commenting on the earlier two reviews and leave it to the editor to balance these with mine. They are very good reviews and raise a number of interesting points which should be addressed. Certainly the paper will improve from these reviews.

I have only few comments. The authors have done validation for January and July in a few years. I think this is sufficient in the present context of outlining changes to the algorithm. However, certainly they will have tested each change individually and they are indeed reporting on the results. In this respect it would be good to see some more detail on testing the effects of using different aerosol models for dust or biomass (or absorbing smoke) aerosol which have been identified as problem areas (e.g. p. 186, lines 15-16). For instance an evaluation versus a limited number of AERONET data for selected sites. p. 187-188: I am very happy to see that the effect of wind speed is addressed and that there is a significant effect on the over-ocean AOD. However, with only three additional LUTs with simulations for 3 different wind speeds, I wonder how these are interpolated and how effects of wind speeds exceeding 14 m/s are dealt with. Whitecap fraction increases with the cube of the wind speed (U10ˆ3.4, Monahan, E. C., and I. G. Ó Muircheartaigh (1980), Optimal powerâĂŘlaw description of oceanic

whitecap coverage dependence on wind speed, J. Phys. Oceanogr., 10, 2094–2099, doi:10.1175/1520-0485(1980)010<2094:OPLDOO>2.0.CO;2). There are several publications addressing the effect of wind speed on AOD. p. 192, line 9: I can hardly imagine that any case could exist with "no aerosol" or AOD=0. At the end of the page is indicated that in C6 cases with no retrieval are given QAC=1. However, if there is no retrieval possible, and AOD is set to 0, this data should not be used and QAC=1 would be misleading. QAC should be either 0, or maybe even a -1 should be introduced for cases where no retrieval has been made. Such values should certainly be discarded from any further processing. I emphasize that I am not advocating to discard all AOD values < or = 0, when they indeed results from a retrieval. Only those cases where retrieval is not possible, for whatever reason, should be flagged and discarded from further analysis. p. 194 raises an interesting question as to the cause of the large decrease of the order of 0.04 or more in AOD in the Roaring Forties. Increasing the wind speed form the previous default value of 6 m/s to the actual values (which I presume are generally much higher than that) would increase AOD (more production of sea spray aerosol) while at the same time increasing whitecap fraction. But in current sea spray source function models the production is linear with whitecap fraction, and hence it must be mixing which reduces sea spray aerosol concentrations to a less than cubic function of wind speed (as often observed). Does the new cloud screening also affect the retrieval in these areas? Have tests been made to this effect to see the effect of each of these changes (i.e. cloud screening vs wind speed)? I have a general question on the merging of different aerosol products provided from different algorithms but the same sensor. Apparently the QAC is used to determine which product is best. Have tests been made to determine the continuity of the aerosol products between adjacent pixels from different algorithms, and how this affects the various quality assessments? Figure 1: the lower left shows the difference new-old; however, new goes to larger sza, and hence further south, to -60. However, the difference plot should then also extend to -60 and show the actual AOD from blue as plotted in top right. Why is that not the case here? Figure 11 shows a histogram over ocean that goes up to AOD= 5.

However, over land (Figure 5) the maximum AOD is 3. How can AOD over ocean be higher than over land where the aeroosl sources giving rise to high-AOD sources are situated? And why are there no negative AODs over ocean?

I noted a few typos, but there may be more; and some minor questions: (page, line no) 171, 1; had been made 179, 1: should be SSA > 0.95 for low absorption 180, 23 what do you mean with 'heavy' aerosol: high concentrations or AOD? Or large large particles? 183, 19: Figure 190, 22: I guess that continuation should be contamination? 192, 3: C5 over ocean MODIS ... 200, 2: I think the reference is Levy et al., 2009a 207, 16-17: the sentence reads a bit strange, could it be written as "the VIIRS algorithm should provide at least as good an aerosol product as the MODIS algorithm" 207, 21: should it really be ensure, or something weaker like "the VIIRS aerosol record may be somewhat different from that has been ..." 208, 1: something missing, should it something like: "... VIIRS shows up in the global climate data record"? 210, eq A1: does atmospheric pressure, i.e. gas pressure, play a role here?

Interactive comment on Atmos. Meas. Tech. Discuss., 6, 159, 2013.