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Atmospheric Measurement Techniques Discussions
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Interactive comment on "Improved MODIS Dark Target Aerosol Optical Depth algorithm over land: Angular effect Correction" *by* Yerong Wu et al.

Anonymous Referee #1

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This paper seeks to improve the MODIS Dark Target (DT) aerosol optical depth (AOD) land retrieval by replacing the empirical surface reflectance estimation method with another empirical surface reflectance estimation method. Based on histogram and analysis and comparison against AERONET, the AOD retrieval seems to be improved (more often within the uncertainty envelope, fewer unphysical negative AOD retrievals).

This builds on a previous version of an algorithm developed by the authors, Wu et al (2016), which is listed in the bibliography as "submitted to IEEE, 2016". Without seeing that paper it is impossible to judge some aspects of what is done and how this study builds on that, or what the extent of overlap between the two studies is. It seems strange to me to submit this paper as a follow up to one in a different journal which appears to still be in peer review. Why are they not one paper if they are both refinements to the same algorithm on the same theme (surface reflectance model),

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simultaneously under peer review? Since this analysis appears to work better than the Wu et al (2016, submitted) results indicated, why should that paper be published? In fact this paper (line 29 of page 4) explicitly notes that it is a “reconsidered and updated” version of a paper still in peer review!

My recommendation at this time is to wait until the outcome of the paper Wu et al (submitted to IEEE, 2016) is known. Maybe these two papers need to be combined into one. Without the context provided by that, I do not feel it is possible to give a full assessment of this paper at this time.

I have a few other general comments at this point:

1. The paper involves a modification to the NASA MODIS DT aerosol product. Was the retrieval code (aside from the surface model improvement) also drawn directly from the MODIS operational code? I may have missed it but did not see this mentioned. From my understanding, this would be important to guarantee that the only difference in the results is from the surface treatment. The DT team do not appear to be listed as co-authors to this paper. However some of the plots look similar to those published by e.g. Levy et al so I assume some code was provided for parts of the analysis/plotting.

2. Related to this, is there any plan to implement this in the next version of the MODIS DT code? If so, this should be stated; if not, why was this analysis done? It does not represent a theoretical advance and the results will not be transferable to other data sets, so I am not sure what the benefit of publication would be unless this will feed directly into a data set.

3. More information should be given about ASRVN, specifically items like uncertainties in its atmospheric correction. Errors in the ASRVN data will propagate into the empirical fit and in turn the AOD retrievals. The same is true about MCD43A1: although it is stated that Rdd is retrieved, the algorithm appears to be making assumptions about the other reflectance terms coming from this product, which has its own (independent) atmospheric correction.

4. In Figure 3, the blue points are partially hidden by the red points. It looks like there are two branches of blue data. This, and the curvature in the blue points, suggests that there is more going on here and these linear parameterizations may not be the best approach. This is also reflected in the large variability seen in the binned data in Figure 4. It is unclear how much more can be squeezed out of these empirical relationships to improve these retrievals. I suspect we are at the point of diminishing returns and a new approach developed based on theoretical considerations is necessary to achieve anything more than modest refinement. For example perhaps it would be more physically meaningful to parameterize the relation between BRDF kernels vs. NDVI, rather than the BRF vs. NDVI, since the color and kernels are close to the real-world intermediate step between surface cover and BRF.

5. Four months of global data were processed. It would be good to see before/after maps of these four months, to judge how much difference these changes make to the global picture.

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