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Atmospheric Measurement Techniques Discussions

Interactive comment on "Critical evaluation of the MODIS Deep Blue aerosol optical depth product for data assimilation over North Africa" *by* Y. Shi et al.

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Review of "Critical evaluation of the MODIS Deep Blue aerosol optical depth product for data assimilation over North Africa" by Shi et al. for Atmospheric Measurement Tecnhiques

The paper is an evaluation and correction of the MODIS Deep Blue (DB) aerosol optical depth (AOD) product. The objective is to develop empirical corrections to the DB product in order to facilitate its use in operational data assimilation models. They address numerous sources of bias in the distributed DB product and provide a prognostic

error model that can serve as the basis of corrections.

Mostly the paper is thorough and well written. This group has previously provided similar analyses of the MODIS over ocean AOD product and the MODIS over land Dark Target AOD product, so they are on familiar ground. This is a logical extension of that previous work, although in places the text seems too presumptive of deep familiarity with that work, and I try to point out in the detailed comments where I think some clarity could be introduced that wouldn't have me scrambling for additional reference material. Most of my comments are also for clarification. I think the paper is otherwise suitable for publication.

1. The introduction seems quite well written. 2. In Section 2 I think there should be a little more information provided about the DB product. The product is available at 10 km nadir resolution. How many pixels of what resolution does that comprise? What are the cloud screening criteria? Can you get a 10 km DB retrieval from a single pixel? Later there is some discussion of the number of 1 km pixels used, but some explanation here would be helpful. 3. In Section 2, page 7819, line 12 you state the Aqua DB extends 2002 - 2010, but in section 5 you evaluate 2010 and 2011. So change 2010 to 2011. Also, why does Terra stop in 2007? I think it has to do with radiance calibrations, but please clarify. 4. Section 3, Table 1: I didn't find this table very useful as laid out. Instead, I found the multiple columns in Step 2 and 4 confusing. In any case, the table is never referred to again. As a tool to help interpret the flow of the paper it fails. Maybe a graphical flow chart would be better. Also, under step 5 you say the data is aggregated to 1 degree grid, while in the text you talk about 0.25 degree grid. Please clarify. 5. Caption to Figure 1 indicates shading is percentage data density. Judging by the numbers I guess it is fractional data density (fraction of 0.06 as opposed to 0.06%). Clarify. 6. Page 7821, line 12 you indicate r^2 values shown in Figure 1. They are not shown in Figure 1. 7. Page 7821, line 20, you could make a mention of this information appearing in Table 2. 8. Page 7821, line 28, other regions have insufficient numbers of collocated MODIS and AERONET points. What is the criteria for sufficiency? 9. Page

7822, line 7, you say “regions other than North Africa,” but I think you mean regions other than the four (North Africa, Europe, East Asia and West Asia). 10. Figure 4, could you please explain the binning? Why aren’t the different colored dots vertically aligned? I mean: shouldn’t the green, blue, and black dots appear at the same point on the x axis? Also, the legends in Figure 4a and 4b really should be the same, with all four colored dots. Breaking up like this is confusing. 11. This is a general comment about the figures. Beginning about with Figure 4 the captions for the multiple sub-panels get to be torturous. This is maybe the worst in Figure 19, which also contains an error in the last bit (“(a), (b), and (e) but for Aqua” should read “(a), (c), and (e) but for Aqua”). Clarity could be improved by titling the individual panels. Alternatively, where they are clearly some tabular form (columns = Aqua and Terra, for example) you could label the columns and rows. Just a thought. 12. Page 7823, line 5, it is not obvious to me why the large scattering angles somehow fail the “very good” retrieval QA. Could you explain? 13. Page 7824, text describing figure 7a seems not correct. I see an increasing trend in delta with increasing view angle, and values do not appear to be around -0.09 for 0 degree view angle. 14. Page 7824, line 23: this is pedantic, but doesn’t fine mode fraction *have* to be smaller than 1 (or, at least, never exceed 1)? 15. Last paragraph of Section 3.2.2, I found this confusing on the first read. Then I realized you did the fine mode fraction analysis based on your own construction of that, not from DB product. So, to clarify, fine mode fraction is from AERONET data and you assign to the collocated DB retrieval. Is that right? So your final sentence here could be emphasized that you want to tie the microphysical aspects to something reported in DB product, not to something externally constructed. 16. First paragraph Section 3.2.3 seems unnecessary. 17. Figure 11 seems to suggest biases in the DB product are essentially gone for retrievals that make use of more than 20 pixels. This point is introduced and discussed only briefly, but it leaves me scratching my head. It doesn’t apply to Terra, but at least for Aqua does it explain most of the other biases you’re seeing? Did you explore your other possible sources sorting on the number of pixels? 18. Plots are presented in Figure 12 for sensitivity of STE_sfc with respect to surface

reflectance, AOD, and aerosol type. Figure 13 shows plots of STD_aod, but not in any way comparable to Figure 12. Figure 13 gets a parenthetical mention (page 7829, line 12) but no discussion as to what it is actually showing. I think I’m confused here as to how these are being used in the subsequent analysis. Some thresholds are given in Table 2 and in the text, but I can’t figure out how those are arrived at. I feel like there’s a missing figure like Figure 12 but for the STD_aod and associated discussion, as Figure 13 seems to imply only cloud contamination issues (or so the text says, it doesn’t make any sense to me what I’m looking at). So I think some further explanation is warranted here for what is going on. 19. Page 7829, line 16: please explain what the “buddy check” is and how it is used here. 20. Page 7830: At this point I’m confused about the prognostic model. Is the prognostic model the same as the DA-quality DB? The choice of the slope correction limit to 1.3 (line 25) is stated to be arbitrary and pragmatic. So why 1.3? What is the sensitivity to 1.2 or 1.4? 21. Page 7831, line 11: The slope for Terra (Figure 17d) appears to be 0.95 and not 1.03. 22. Page 7831 and 7832: the concept of the “noise floor” is not defined, nor is it explained how the stated numbers are arrived at. Please expand. 23. Figure 20a: there is a typo in the title. 24. Page 7834, line 9: I think I see what you’re trying to say, but please clarify what you mean “data developing procedures.” 25. I’m trying to come up with a summative question. Much of what’s been done here is ad hoc, and maybe that’s the nature of the beast, although it is suggested that this can filter back to the algorithm developers. Another group may approach the same problem with a different tool set (e.g., neural networks) and arrive at a different prognostic model. Is one approach more “right” than another? What are the limitations of your approach? Would more or less data lead to different conclusions? Can you speculate on this somehow?

Interactive comment on Atmos. Meas. Tech. Discuss., 5, 7815, 2012.