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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Comparison of MODIS 3 km and 10 km resolution aerosol optical depth retrievals over land with airborne sunphotometer measurements during ARCTAS summer 2008" *by* J. M. Livingston et al.

Anonymous Referee #1

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This paper is one in a long series by this author and collaborators about the validation of satellite aerosol retrieval algorithms with data from sunphotometers. The novel aspect here is the comparison of two different resolutions, the standard 10km product, and the new 3km product with the "ground truth" from the sunphotometer, especially under partially cloudy conditions. A very thorough description is given of aerosol algorithms and their development. The data and analysis are presented with a lot of detail. By comparison, the conclusions are rather short and broad: "The 3km retrievals can depict finer horizontal structure, albeit at the price of 'noisier' results. . ." It is somewhat

disappointing that almost no interpretation is given for the systematic biases that are seen/not seen. Do they differ for the different cases? And why? Which pixels stand out? For which pixels is the agreement good and why? Why is the center of the plume excluded from the retrievals? Why does the offset in AOD between sunphotometers and MODIS under cloudy conditions go in the opposite direction to what would be expected (e.g., considering the Varnai/Marshak papers about near-cloud bluing)? Where does the "curvature" in Fig. 3e come from - just uncertainty or systematic effects? As a reader, one misses these kinds of questions. Although this is still a valuable contribution as a MODIS validation study, it seems that it would have had the potential for a deeper understanding of scale-related retrieval effects/artifacts, retrievals under cloudy conditions etc.

There is one major problem in the statistics: It is unclear what the regression coefficient's function is in this paper. Proving a correlation between two data sets requires more than just Rˆ2, as I am sure the authors know very well. This is not just a statistical subtlety. Rˆ2 needs to be translated into the probability that two data sets are correlated/uncorrelated/anti-correlated through the technique described in statistics textbooks (e.g., Taylor). Statements such as "X and Y are 'somewhat' positively correlated (Rˆ2=0.52)" (p15026, l13) are unacceptable; a value of Rˆ2=0.52 may not be a statistically significant correlation, depending on the number of data points in the scatter plot. Please provide the required statistical measures.

Section 3.6 addresses what Levy et al. (2010) have already stated on theoretical grounds. I therefore don't see the purpose of Fig. 14 and section 3.6 for that matter because it seems to re-state the obvious. Besides, the fact that the MODIS and AATS AE are not correlated in this particular case does not prove much; there could be spurious correlations in other cases. If the authors decide to keep the section, the more interesting question might be why MODIS has two "modes" of AE in both 10km and 3km product, one high, one low, whereas AATS ranges from 1-2.

Minor comments:

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Can the mechanism of deselection, which, in the abstract, is presented as the reason for the failure of the aerosol algorithm to retrieve thick smoke in cloud-contaminated as well as clear-sky zones be [more clearly] explained somewhere in the main text?

There are multiple occurrences of "Figure XX (over)plots/overlays. . .". This is wrong syntax; a figure cannot do anything, please modify to passive voice or correct otherwise.

p15027,l26: What is "overburden"?

Some of the figures are extremely densely spaced. Consider revising.

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 15007, 2013.