

Interactive comment on “Where do we need additional in situ aerosol and sun photometer data?: a critical examination of spatial biases between MODIS and MISR aerosol products” by Y. Shi et al.

Anonymous Referee #2

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Aeronet sunphotometer measurements have been used extensively for validation of aerosol optical depth (AOD) retrievals from MODIS and MISR. Both MODIS and MISR teams have often been able to improve retrieval performance in regions where extensive sets of Aeronet measurements are available. Many regions of the globe have few (or no) Aeronet stations or other means of aerosol validation, though. This paper intercompares MODIS and MISR AOD retrievals with the purpose of identifying regions with large, spatially-correlated discrepancies. It is suggested that the location of addi-

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tional Aeronet sites in these regions of large discrepancies would be highly beneficial to further improving the MODIS and MISR retrievals. The motivation and objective of the paper are laid out very clearly. The paper presents a useful summary of the primary reasons for error in passive aerosol retrievals and where they tend to occur. It is important to conduct studies such as this one. However, the paper suffers from a lack of detail and a lack of rigor in a few areas and the value of the paper would benefit from revisions in a few areas.

Since the topic of where additional sunphotometer observations are required is of considerable interest to the small community doing satellite AOD validation, and to the Aeronet team, a more detailed report with more specific recommendations in each region and more detailed justifications would probably be useful.

1) The title asks “Where do we need additional in situ aerosol and sun photometer data?” There is extensive discussion related to sun photometer data, but no real discussion of in situ measurements, unless by ‘in situ’ the authors are referring to measurements of surface reflectance. Either ‘in situ’ should be removed from the title, or some additional discussion of in situ measurements should be added. For example: What in situ measurements are required? Where have in situ measurements been acquired in the past, or are now being acquired, and have they been useful? Are long-term in situ data records required, as is discussed for sunphotometers?

2) The authors draw significant inferences from the linear regressions shown in Figures 1 and 4. Inspection of Figure 1, however, shows that in many cases the assumptions underlying standard linear regression are violated (Wilks, 2011: Statistical methods in the atmospheric sciences, Chapter 7). In many of the cases shown (MISR over Banizoumbou for example) the error characteristics of the data clearly change with increasing optical depth. In these cases, linear regression may give misleading results, particularly in the location of the intercept. The small number of MISR samples at large AOD are probably not statistically significant yet have a large influence on the regression, which is not resistant to outliers. The authors attempt to account for a

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reported low bias in MISR AOD by restricting the regression analysis to AOD less than 0.5. A separate regression should be applied to AOD greater than 0.5 as well. Applying the regression to clusters of points selected for uniform error characteristics would yield more reliable results.

3) Given the evident problems in Figure 1, where the regression lines often do not appear to represent the relation of the data points very well, it is difficult to know how much confidence should be placed in the results shown in Figure 4. Examples of regressions to the MODIS and MISR data should be presented in the format of Figure 1 to establish whether the regression results fairly represent the underlying data.

4) p. 4201, line 10-11. In section 3, eight Aeronet sites are chosen to be “representative” of a region. In fact, the regions described are much too large and heterogeneous for any one site to be representative of the entire region. The intention here is to select Aeronet sites with long data records in diverse locations. The authors should be more specific about what exactly each of these sites is representative of, in terms of aerosol and surface types.

5) p. 4303, line 9-15. The language used here implies the aerosol type or composition is being retrieved. For example, saying something like “high aerosol loading is seen in regions characteristic of smoke ...” would be better than “heavy smoke aerosol plumes are found ...”

6) page 4305, line 21-22. It is not clear to me what is meant by “uncertainties in the microphysical models used in these retrievals are amplified ...” What is the mechanism in mind here? What is meant, quantitatively, by the “multiple scattering regimes”?

7) page 4310, line 22. Identification of Greenland as one of the key regions needing additional Aeronet sites seems an odd choice, given the lack of satellite retrievals over Greenland. There seem to currently be three Aeronet sites on the coast. Is the recommendation for sites on the plateau?

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8) For the benefit of those not so familiar with the Aeronet network, it would be useful to add the location (lat/lon) of each of the sites in Table 1.

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