

We thank reviewer for his/her comments and suggestions.

*The manuscript provides an extensive cross-comparison between MODIS (collection 5 and Deep Blue) and collocated MISR AOD products with the goal of identifying regions where additional in-situ and ground-based remote sensing studies are needed to improve retrieval techniques. The paper brings up an important topic of satellite disagreements in regions where variable surface and/or complex aerosol microphysical conditions complicate operational satellite AOD retrievals. The problematic regions certainly need to be clearly identified, and climate modelers should be aware of regional biases in satellite data. The paper is well written, the motivations are clear, and it is relevant for AMT.*

*The presented results are interesting and important, however the paper does not clearly explain why and how additional AERONET or in-situ measurements can help improve satellite retrievals. Making additional AOD data available for satellite- AERONET regressions will not necessarily help unless the underlying reasons for satellite disagreements are well understood. The authors attempt to address this issue with a gradient map of AOD differences, however the suggested scenarios are not convincing. For example, why separate high AOD from suspected aerosol optical property assumptions when both can contribute? In-situ measurements of regional aerosol microphysics and surface reflectance are useful for region-specific retrievals that could be developed and applied to MISR or MODIS L1 products, although in many cases global operational satellite retrievals are limited by the size of look-up tables and therefore cannot fully incorporate complex regional aerosol microphysics. Satellite retrievals that use different spectral and angular information, as in case of MISR and MODIS, do not necessarily have to have similar patterns in their regional biases.*

*I suggest refocusing the discussion to motivate the need for addition surface data in the context of modeling studies in regions problematic for satellite retrievals. The paper should be published after minor technical revisions that were pointed out by other reviewers.*

We agree that adding more AERONET sites may not resolve the discrepancies among satellite products. On the other hand, AERONET data are being used as a golden standard for validating most, if not all, satellite aerosol products. However, the performance of the satellite products could be dramatically different from their performance over the AERONET sites (sampling bias of the AERONET network), as demonstrated by this study. A study like this is necessary not only to remind users and modelers of the limitations of validating products with only point measurements, but also to identify regions where large discrepancies are found among satellite products and where there are not enough AERONET sites for the satellite aerosol community. By identifying problematic regions; we hope that a solid validation plan can be developed by the community so that the sampling bias from the current AERONET network can be reduced.

We have added the following paragraph:

“Adding more AERONET sites in and of themselves will not resolve the discrepancies among satellite products. However, if AERONET data is used properly, it will help developers and data

users alike understand the true nature of uncertainty in important regions of the globe. Already, AERONET data are being used as a golden standard to validate most, if not all, satellite aerosol products, especially AOD. We show that the performance of the satellite products could be dramatically different from their performance over the AERONET sites (sampling bias of the AERONET network). This study identifies regions where large discrepancies are found among satellite products and where no coverage exists from existing AERONET sites. What we now have is an estimate of diversity among commonly used products, but little information about true uncertainty in any of the products. We hope this study will aid in future decisions of constructing ground based and in situ aerosol observing network stations.”