

We thank the reviewer for the thorough review and constructive comments. Several interesting and significant changes/additions were made to the manuscript in accordance with the reviewers' suggestions. Consequently, this revision makes this paper differ from the past work in that:

- (i) MODIS AOD retrieved from both Land and Ocean algorithm are assessed separately over the same set of AEROENT stations along the coast, and it is shown that AOD retrievals over the coastal region from Land or Ocean algorithm both have larger uncertainties than their counterparts in other (e.g., over open ocean or over non-coastal land) regions;
- (ii) the assessment includes characterization of the PDF (mean and standard deviation) of biases and its statistical fitness with PDF from AERONET;
- (iii) the impact of sediments (pigments and suspended particulate matter) on the AOD bias are analyzed, and is shown to be important;
- (iv) further evaluation of correction for wind speed and cloud impact is conducted, and the implication of such correction for the trend analysis is studied with analysis over different AERONET stations.

Since the manuscript has gone major revision, it is recommended that please first read the revised manuscript as a whole (attached through separate entry in the interactive discussion) and then read our replies.

Response to reviewer #2:

- **Comment:** “1. P5205 Abstract:
Line 2: “..., but the underlying surface characteristics are not favorable for the Moderate Resolution Imaging Spectroradiometer (MODIS) algorithms designed for retrieval of 5 aerosols over dark land or open-ocean surfaces.” This is partly true and partly not true. One of the concerns is the satellite’s footprint size. Currently MODIS L2 version 5 has 10 km in the nadir, if the coastal AERONET station is within this spatial range, then the retrieval has to look at the ratio of land-sea to determine which algorithm (Land or Ocean) to be applied. However, this issue may be reduced when MODIS L2 version 6 becomes available. But the authors did not mention any of this throughout the paper.
Line 14-18 “Furthermore, the MODIS...in retrieval algorithms.” The content is not clear to me.”

Response: This section has been re-worded during revisions to improve clarity. In terms of the footprint size, the comment is not entirely accurate. The MODIS L2 version 5.1 product does have a 10 km resolution at nadir, but, the retrieval is based on the presence of land pixels not a ratio. If any land pixels exist in the 10 km retrieval box the Land algorithm is used, else, the Ocean algorithm is used.

- **Comment:** “2. P5207 Line22-26 I do not understand the context of “trend analysis” here in relation to the paper.”

Response: We have revised this paragraph. Please see our response to the first reviewer on this one.

- **Comment:** “3. P5209 Line 22-25 “Secondly, a simple merge of ...” This is not the case. MODIS L2 (MOD04 MYD04) has 2 merged products, one is the QA’ed (variable name is Optical_Depth_Land_And_Ocean, has QA for land and ocean followed Science Team recommendation) and another one is not QA (variable name is Image_Optical_Depth_Land_And_Ocean). Apparently, the authors are not familiar with MODIS products.”

Response: Two different Land_And_Ocean data sets are available in collection 5.1, “Image_Optical_Depth_Land_And_Ocean” which has no QAC threshold, and “Optical_Depth_Land_And_Ocean” which requires quality flags > 0 over land, and ≥ 0 over ocean (MODIS level 2 atbd). This information has been added to the manuscript to avoid future confusion. The Optical_Depth_Land_And_Ocean product is not QA’ed with the MODIS teams recommendations it simply removes the 0 confidence retrievals. Collection 6 will filter the product with the MODIS science team recommended quality flags. The analysis completed here may serve as a quantitative characterization of those changes.

- **Comment:** “6. P5213 line 7-14 the whole 2.2 session needs to re-write. Need to indicate the version of MERRA data, and where did you get the data from. From the context in the paper, it seems we can get the data from GMAO. This is very misleading and I thought the MERRA data can only be accessed through NASA GES DISC. Also, need to specify which MERRA variables are using for the study in this session. I finally found out the variable that is used from other following sessions and from figure captions.”

Response: Data access has been updated to credit NASA GES DISC. The version of the GEOS-5 DAS used is 5.2.0 and has been updated in the manuscript. To the knowledge of the authors there aren’t any version numbers for MERRA directly, only the GEOS-5 version used. A data access date was provided to help avoid any confusion on specific data used.

- **Comment:** “7. P5214 Line 19-24 Is this the criteria for picking out “coastal stations” as long as it has a value in the “Land_And_Ocean” variable? If so, you may want to report each station status (e.g., how far away from this station to the shore). This may affect your claim in the differences of the method you use (mean or central method). Also you should list all the stations here graphically, what are global stations, coastal stations, open-oceans, land only. You should move around your analysis/graphs from other sessions.”

Response: This section was updated to improve clarity. The criteria for picking “coastal stations” require 15 high quality MODIS retrievals from both the Land and Ocean algorithms, not the Land_And_Ocean algorithm. By setting this limit the “coastal sites” must be in close proximity to the coastline. Distances from AERONET to the coastline ranges have been added to the manuscript.

- **Comment:** “8.p5216 & 5217 You describe different statistical tests for determining “statistical significance”, and yet I only see t-test results in Fig 1. Since Fig.2 already indicates the aerosol loading is log-normal distributed, why you still want to use t-test for most of the results?”

Response: In Fig 2 the t-test is used to determine the fit of a log-normal approximation to the actual AOD distributions. The other statistical techniques that are mentioned are used to evaluate the fit between AERONET and the different MODIS retrievals. For example, in Section 3.2, likelihood test, and K-S test both show that at a statistically significant level MODIS AOD retrievals do not fit the same distribution as AERONET AOD measurements.

- **Comment:** “9. P5218 You may want to point out the fact that the linear regression line in the scatter plot may mislead information, because you already mentioned they are not normal distribution.”

Response: A brief statement of the problems associated with using OLS has been added.

- **Comment:** “10. P5221 Section 4 Wrong information about the combined product. Please see comment #7.”

Response: See the response for #7. Along with the updated product information, it has been more clearly stated that the quality flags are not carried through to the Land_And_Ocean product and, therefore, need to be read from the individual Land and Ocean products.

- **Comment:** “11. P5223 Section 5 Wind and cloud impact on the MODIS ocean algorithm It is not clear whether you use the “mean value” of cloud fraction in your ensemble or not.”

Response: The average cloud fraction for each 55 km averaging region is used. This information has been added to the manuscript.

- **Comment:** “13. P5226 Line 21-25 I do not understand why you discussed the cloud fraction with surface wind. And they should not have any relationship. Cloud fraction is determined from higher altitude and maybe you should look at different level of the wind field?”

Response: Because both are meteorological parameters, it is important to verify that they do not co-vary. If any covariance did exist between them a correction that accounts for both simultaneously would be required. Since they do not co-vary, the method accounting for them individually is appropriate.

- **Comment:** “14. P5227 Line 10 “Furthermore, ...retrieval algorithms” I do not understand this portion of the context.”

Response: This statement has been revised to improve clarity.

- **Comment:** “Figure 1. The caption is not well described. And the information about μ and σ actually is coming from Fig. 2.”

Response: The caption has been re-written to better describe the figure. μ and σ are included in this figure to give a quantitative value to the different distributions.

- **Comment:** “Figure 2. Since it is already indicating as log-normal distribution, why you still use t-test for the significance test?”

Response: It is not enough to simply say the distributions appear log-normal, that is why a t-test is used to quantitatively assess the fit of a log-normal distribution.

- **Comment:** “Figure 4 A should appear early in the paper.”

Response: It is helpful to have the location plot alongside the bias plots because it may be hard to determine the location of AERONET sites where MODIS shows a large bias, or where bias dots overlap. The entire manuscript has been re-structured.

- **Comment:** “Figure 7 Regardless of some missing stations over islands/coastal areas, it will be very helpful to give more detail discussion for certain stations, such as west coastal station of US, South-East Asia stations, etc.”

Response: See earlier comment about absent AERONET stations. A more regional discussion is provided in the text in the updated manuscript toward the end of Section 5.