

Interactive comment on “Accuracy Assessment of MODIS Land Aerosol Optical Thickness Algorithms using AERONET Measurements” by Hiren Jethva et al.

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Dear Reviewer,

Thanks for offering your valuable comments on our manuscript # amt-2019-77. We have tried our best to incorporate all your suggestions, which have greatly improved the scientific merit of the paper. In the revision, two important and major changes have been applied according to the suggestions made by Reviewer # 3. These changes include,

1) use of the latest AERONET version 3 dataset (instead of version 2 used in the

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original paper) 2) replacement of MAIAC BRF dataset with the MODIS standard BRF product (MOD09) in performing error characterization vs. BRF shown in Figure 6.

With these two changes, the entire analysis presented in the paper was reperformed to derive results tabulated in Table 3, 4, and Figure 1 through 6. While using AERONET version 3 dataset provided increased matchups and marginal change in the resultant statistics of the comparison (R, RMSE, bias, slope, intercept), the overall interpretation and conclusion of the MODIS-AERONET comparison for all three algorithms, i.e., DT, DB, and MAIAC, presented in the original paper haven't altered.

Following is the one-to-one response to each comment/suggestion made on the submitted manuscript.

RC: Referee's comment AR: Author's response

General comments:

RC: I suggest to add “over North America” to the title to clearly identify the scope of the study already in the title. AR: Following the suggestion, the title of the manuscript has been revised as,

“Accuracy Assessment of MODIS Land Aerosol Optical Thickness Algorithms using AERONET Measurements over North America”

RC: Please make sure to use consistent terminology: Through most of the paper you use “aerosol optical thickness”, but in few places (conclusion, fig. 2) you use “aerosol optical depth” AR: we adopt aerosol optical thickness (AOT) terminology throughout the revised manuscript, i.e., in text as well in figures/legends.

RC: In the abstract and the introduction TEMPO / ABI as future perspective get too much weight and then in the paper it only appears again in the conclusion which may mislead a user on the scope of the paper. I therefore suggest to shorten this part (p. 1 / l. 11-16) in the abstract and put it at the end of the abstract (near p. 2 / l. 7/8) under future perspective. From the introduction I recommend to shift the part p. 3 / l. 3-24 to

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the conclusion, where it may get more attention.

AR: The research work presented in the submitted paper was conducted as a part of the Geo-CAPE Aerosol Working Group at NASA Goddard in the context of evaluating existing aerosol algorithms for its possible application to the TEMPO/ABI synergy. The context has been adequately referred to in the abstract in order to highlight the objective of the paper, as well as in the Introduction (first two paragraphs) to begin with the motivation, and finally in the conclusion to close the loop.

Detailed comments:

RC: p. 1 / l. 17: delete “of” AR: Corrected as, “In this work, we evaluate three distinct aerosol algorithms of MODIS deriving aerosol optical thickness (AOT) over land surfaces using visible and near-IR observations.”

RC: p. 1 / l. 28: add “allows FOR a” AR: Corrected as, “The higher spatial resolution of MAIAC product (1 km) allows a substantially larger number of matchups. . .”

RC: p. 2 / l. 3: write “show” instead of “showed” to remain consistent in tense with the first part of the sentence AR: Corrected.

RC: p.3 / l. 14: explain “PM” AR: PM is defined as “particulate matter”

RC: p.3 / l. 5: “we investigate the applicability to ABI observations” – I find this misleading since the paper neither analysis ABI datasets nor discusses relevant differences and similarities of MODIS and ABI in much detail. This is why I recommend to shift the discussion on the strategic potential into the conclusions. AR: The sentence is now revised as, “In this paper, we evaluate the accuracy of the available multi-year long records of AOT products derived by the three MODIS algorithms by a direct comparison to ground-based observations from the Aerosol Robotic Network (AERONET) at multiple sites in North America-an area or regard for both ABI and TEMPO field-of-views.”

RC: p. 5 / l. 1+2: delete “appropriate” (as vague wording); delete “are” AR: The sen-

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tence is revised as, “Each valid retrieval is assigned with a quality assurance confidence flag (QAC) with best retrievals tagged as QAC=3.”

RC: p. 5 / l. 3+4: is should be “over land” and “over ocean”, without “the” AR: Corrected.

RC: p.5 / l.11: replace “greater” by “larger” AR: The sentence is re-written as, “The expected error associated with the 3-km aerosol retrievals over land globally is found to be 0.01 to 0.02 higher than that of 10-km product (Remer et al., 2013).”

RC: p.5 / l.22: replace “greater” by “larger” AR: Changes accepted.

RC: p.5 / l. 24: delete “The” at the beginning of the sentence AR: Corrected.

RC: p. 6 / l.17: use singular: “Each valid : : : retrieval : : :” AR: Corrected.

RC: p. 7 / l. 2-5: this sentence is too long; you can delete “to evaluate – aerosol algorithms” at its end and split the remaining sentence into two parts. AR: Changes accepted.

RC: p. 7 / l. 12: “: : : retrieves and reports. . .” AR: Corrected.

RC: p. 7 / l. 12: delete “spatial grid” at the end AR: Changes accepted.

RC: p.7 / l. 22: delete “the” (ground truth) AR: Corrected. RC: p. 8 / l. 4 it should read “out of A total” AR: Corrected.

RC: p. 8 / l. 13: I would write “we choose 470 as reference wavelength common to all three. . .” AR: The sentence is re-written as, “.we choose 470 nm as a reference wavelength due to the fact that all three algorithms actually retrieve AOT at this common wavelength.”

RC: p. 8 / l. 19: is there no q/a flag for MAIAC? If so this should be stated. AR: MAIAC aerosol product does provide quality flags for each 1-km pixel retrieval, which is mentioned in section 2.3. We use best quality retrieval pixels which are free of cloud contamination.

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RC: p. 8 /l. 29: use singular “matchup” AR: Corrected.

RC: p. 9 /l. 4: I would write “under-estimated” – otherwise it may be miss-understood that MAIAC AOTs are under-estimated by AERONET AR: Corrected.

RC: p. 9 /l. 1-3: I cannot find those numbers (0.04 – 0.12) in fig. 2 and also in tab. 3 the ranges of all stations are wider (MODIS DT bias -0.07 . . .0.10). AR: Since the statistical comparison results printed in Figure 2 are site dependent, the sentence has been simplified without mentioning the numbers as follows,

“While the AOT retrievals from all three algorithms are generally well-correlated ($R>0.90$) with those of AERONET, MAIAC AOTs are found to be slightly under-estimated, albeit with the lowest RMSE and the largest number of matchups among the three algorithms.”

RC: p. 9 /l. 18: use singular “AOT matchups” AR: Corrected.

RC: p. 9 /l. 22: replace “greater” by “larger”; delete “the” after the comma fig. 2 and fig. 3: the spatial matching criteria are indicated as $\approx 0.4 \times 0.4$ (misleading to degrees), while the text reads them as $40 \times 40 \text{ km}^2\text{km}^2$ consistently throughout the manuscript including figures.

RC: p. 10 /l. 11: replace “greater” by “larger”; also two times “the” is missing in this sentence (“of the DT algorithm”, “the satellite-ground” AR: Corrected.

RC: p. 10 /l. 21: replace “with MAIAC” by “for MAIAC” AR: Corrected.

RC: p. 11 /l. 2: use present time “provides” AR: Corrected.

RC: p. 11 /l. 10+11: delete “the” before “retrieval” and “satellites” AR: Corrected.

RC: p. 12 /l. 3: delete “the” before “leaf area” AR: Corrected.

RC: p. 12 /l. 4: add “the” before “MAIAC surface” AR: Corrected.

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RC: p. 12 /l. 10: delete “the” before “box and” AR: Corrected.

RC: p. 12 /l. 17: correct to “remaining” AR: Corrected.

RC: p. 13 /l. 15-17: I suggest to swap 1 and 2 (same order as in the paper body) and to add “for each algorithm” to the “independent comparison against AERONET” AR: Suggestion accepted and included in the revision.

RC: p. 13 /l. 21: correct “an RMSE” instead of “and RMSE” AR: Corrected.

RC: p. 13 /l. 23: use “remain” instead of “remained” AR: Corrected.

RC: p. 13 /l. 23: “similar” is sufficient (i.e. delete “almost”) AR: Corrected.

RC: p. 13 /l. 24: use “is” instead of “was” AR: Corrected.

RC: p. 13 /l. 26: replace “greater” by “larger” AR: Corrected.

RC: p. 13 /l. 26: add “the” before “DT algorithm” AR: Corrected.

RC: p. 14 /l. 1: use “show” instead of “showed” AR: Corrected.

RC: p. 14 /l. 3: use “provides” instead of “provided” AR: Corrected.

RC: p. 14 /l. 4: use “than” instead of “that” AR: Corrected.

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