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Atmospheric Measurement Techniques Discussions

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

Anonymous Referee #2

Received and published: 23 April 2019

This paper consists of a unique analysis comparing three different algorithms (dark target, deep blue and MAIAC) applied to MODIS measurements over North America. This is the first inter-comparison of datasets produced with those three algorithms (except one earlier study over South Asia). The target area North America is of course relevant for many aspects impacting the environment and population of this continental area. The paper provides a detailed analysis using AERONET ground-based sun photometer measurements as reference and thus gives insight into the performance of the three algorithms, separately for Eastern and Western part of North America with known different environmental conditions and behavior of aerosol algorithms. I therefore recommend acceptance with minor revisions along my comments below.

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1. Does the paper address relevant scientific questions within the scope of AMT? Users are always seeking guidance on choosing an appropriate dataset among several options offered by the retrieval community – the detailed analysis in this paper helps users understand the performance of three algorithms in direct comparison and choose along the criteria most relevant for their application. 2. Does the paper present novel concepts, ideas, tools, or data? This is clearly the case with for the first time comparing three mainly used MODIS algorithms over North America. 3. Are substantial conclusions reached? Yes, the paper gives clear conclusions for which criteria the algorithms perform similarly and where one of them shows better quality than the others. 4. Are the scientific methods and assumptions valid and clearly outlined? The validation exercises follow common practice and are described clearly. I appreciate that the analysis is conducted for all matchups and for common matchups which does best justice to all algorithms including their differences in coverage. In section 3.3 where a by-product from one of the three algorithms (surface BRF) is used to stratify the results of all three algorithms, this is explicitly explained. 5. Are the results sufficient to support the interpretations and conclusions? The conclusions are all supported by the statistical results in the tables and images. 6. Is the description of experiments and calculations sufficiently complete and precise to allow their reproduction by fellow scientists (traceability of results)? As validation follows common best practice, a reader in the field of aerosol retrievals should be able to reproduce the analysis with the descriptions provided. 7. Do the authors give proper credit to related work and clearly indicate their own new/original contribution? The new aspect of this paper is the target area (North America) in comparing three (not only the older two) MODIS algorithms. Underlying work of the developers of the three algorithms and the only other inter-comparison study (over South Asia) are cited. 8. Does the title clearly reflect the contents of the paper? Yes, but I would add the geographic area covered by this study. 9. Does the abstract provide a concise and complete summary? Yes, but I would rearrange it to put the future outlook at its end. 10. Is the overall presentation well structured and clear? The overall structure is appropriate and give good guidance to a reader. 11. Is

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the language fluent and precise? As non-native English speaking, I am quite satisfied with the wording and have only few suggestions in my detailed comments. In some cases sentences tend to become very long – I would recommend to break those into two to ease reading. Also the tense used swaps sometimes from present to past. 12. Are mathematical formulae, symbols, abbreviations, and units correctly defined and used? There are mainly statistical results provided which are all using correct nomenclature. 13. Should any parts of the paper (text, formulae, figures, tables) be clarified, reduced, combined, or eliminated? The authors could think of moving tables 3 and 4 into an annex to shorten the main paper 14. Are the number and quality of references appropriate? Yes, all relevant material is provided. 15. Is the amount and quality of supplementary material appropriate? 16. N/A

General comments: I suggest to add “over North America” to the title to clearly identify the scope of the study already in the title. 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” 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 the conclusion, where it may get more attention.

Detailed comments: p. 1 / l. 17: delete “of” p. 1 / l. 28: add “allows FOR a” p. 2 / l. 3: write “show” instead of “showed” to remain consistent in tense with the first part of the sentence p.3 / l. 14: explain “PM” 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. p. 5 /l. 1+2: delete “appropriate” (as vague wording); delete “are” p. 5 /l. 3+4: is should

be “over land” and “over ocean”, without “the” p.5 / l.11: replace “greater” by “larger” p.5 / l.22: replace “greater” by “larger” p.5 / l. 24: delete “The” at the beginning of the sentence p. 6 / l.17: use singular: “Each valid . . . retrieval . . .” 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. p. 7 /l. 12: “. . . retrieves and reportS . . .” p. 7 / l. 12: delete “spatial grid” at the end p.7 / l. 22: delete “the” (ground truth) p. 8 /l. 4 it should read “out of A total” p. 8 / l. 13f: I would write “we choose 470 as reference wavelength common to all three . . .” p. 8 /l. 19ff: is there no q/a flag for MAIAC? If so this should be stated. p. 8 /l. 29: use singular “matchup” p. 9 / l. 4: I would write “under-estimated” – otherwise it may be miss-understood that MAIAC AOTs are under-estimated by AERONET. 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) p. 9 /l. 18: use singular “AOT matchups” 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 =0.4x0.4 (misleading to degrees), while the text reads them as 40x40km2) – this inconsistency should be corrected p. 10 /l. 11: replace “greater” by “larger”; also two times “the” is missing in this sentence (“of the DT algorithm”, “the satellite-ground” p. 10 / l. 21: replace “with MAIAC” by “for MAIAC” p. 11 / l. 2: use present time “provides” p. 11 / l. 10+11: delete “the” before “retrieval” and “satellites” p. 12 / l. 3: delete “the” before “leaf area” p. 12 / l. 4: add “the” before “MAIAC surface” p. 12 / l. 10: delete “the” before “box and” p. 12 / l. 17: correct to “remaining” 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” p. 13 / l. 21: correct “an RMSE” instead of “and RMSE” p. 13 / l. 23: use “remain” instead of “remained” p. 13 / l. 23: “similar” is sufficient (i.e. delete “almost”) p. 13 / l. 24: use “is” instead of “was” p. 13 / l. 26: replace “greater” by “larger” p. 13 / l. 26: add “the” before “DT algorithm” p. 14 / l. 1: use “show” instead of “showed” p. 14 / l. 3: use “provides” instead of “provided” p. 14 / l. 4: use “than” instead of “that”

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