

Interactive comment on “New approach to the retrieval of AOD and its uncertainty from MISR observations over dark water” by Marcin L. Witek et al.

Anonymous Referee #2

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Review of “New approach to the retrieval of AOD and its uncertainty from MISR observations over dark water” by M. Witek et al. for AMT

Synopsis: This paper describes a new method for retrieving AOD over water, using MISR observations. Specifically, instead of picking a retrieval solution based on the minimum cost (“best”) fitting of lookup table versus observations, the new algorithm retrieves based on weighting the cost of each ensemble member. Instead of thresholds, the new retrieval is more dynamic, and appears to provide more accurate and more consistent results. Additionally, a new confidence index (known as ARCI) is proposed, which can help to screen the results. In this way, the uncertainty of the retrieval is

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quantified.

Assessment: This is a good paper, and should be published after minor/medium revision. The most obvious issue is that there is neither “validation” (comparison with ground-truth, e.g. AERONET) nor detailed comparisons with other datasets (e.g. MODIS on the same Terra platform). Based on my own experiences, I agree that the new results seem better (lower average AOD; fewer blunders, etc). However, a more skeptical reviewer needs some more proof including validation. I also wonder why the previous ($\leq V22$) retrievals had such a complicated chi-squared decision tree, when in fact it seems to be much simpler? The paper appears to be primarily about the advantages of the new ARCI/chi-sq metrics, which is fine. The issue becomes confused when discussing new aerosol model/mixtures, and much more confused when discussing 17.6 vs 4.4 km resolution. I recommend ONLY concentrating on the new fitting metrics here, because that is useful enough.

Also, with the subject being the new ARCI/chi-sq metrics, I would be completely curious to see what these look like on the globe? (function of season, perhaps?)

Writing: While the English writing is easy to read, there are issues of paragraph formatting (hanging vs indents). References are hard to read etc.

Specifics:

*P1L15: Why only allow AOD < 3.0? sometimes even higher?

*P2L22: Suggest using the term “confidence” rather than “quality”, as the MODIS retrieval can’t measure quality until performing validation. Confidence refers to how well the algorithm marched through its logic steps (enough pixels? Good enough fitting? Etc).

*P2L29: Suggest adding where these uncertainties would be useful, especially in applications of data assimilation/forecasting etc.

*P2L35: Note that the MODIS retrieval (and I think others) do not validate in terms of

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$\pm \text{MAX}(a, b \times \text{AOD})$, but rather as $\pm(a+b \times \text{AOD})$.

*P3L8: Ensemble approach. YES! We have more computer power, I agree! Note that the MODIS over-ocean retrieval does a poor-man's ensemble.

*P4L12: Are you reviewing the old algorithm (v22) or the new one (V23)? Or is everything common to both?

*P4L15-17: This sentence is a run-on and confusing

*P4L17: Not sure what the sentence about 1-D RT means.

*P4L36: So this more comprehensive model set is not used for V23, correct?

*P6L3: What happens to fitting error if AOD is near zero? Very low signal.

*P6L28: This sentence is a run-on.

*P6L31: What is a "blunder"? Is this a retrieval by mistake? No retrieval when should be? One with a big error? Do you really want to screen all "outliers"?

*P7L3: Does Fig. 1 represent a particular date/time/case? I know it is discussed further in a future section, but it's confusing here. At least mention that it will be discussed more. I however, like the visualization. What happens in case of bigger (or smaller) AOD? Will the spreads be smaller or larger?

*P8 last paragraph: I am getting confused because paper is discussing TWO upgrades. A. The ARCI/chi-sq stuff, and also the B. Spatial resolution (17.6 to 4.4 km). I think you need to concentrate on only A.

*P9L16: Why is low ARCI related to cloud contamination? It is definitely one reason. Could there be confusion between small ice particles and dust particles, and somehow derive a large ARCI?

*P9L20 (and Fig 3). Hard to see, because panels (b) and (d) have different y-axis scales and they are not in terms of %. To me, it looks as if there are much fewer

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retrievals in panel (d) versus (b). Also, why the wiggles in (b)?

*P9L32: Is there a chance you are throwing out “good” aerosol data? Maybe you can show some AOD imagery (on a map) over-plotted on the suspected clouds?

*P9L35: Are data in Fig 4 the same data as plotted in Figs 2 and 3?

*P10L10: These are HUGE differences? Can you compare with anything (e.g. MODIS, AERONET, a model?) to prove this is reasonable? Fig 5 is nice. The “blunders” in the high latitudes (primarily around Antarctica are still glaring.

*P10L37: Fig 6. See comment from P2L35: Definitely looks like an $a+b \times \text{AOD}$ rather than $\text{MAX}(a, b \times \text{AOD})$.

*P11L12: I am not sure that V23 uncertainties look like V22 uncertainties is useful and or a desired result.

Figures:

Fig. 3: Needs consistent y-axes between pairs of plots

Fig. 7: I am not sure this is a useful figure.

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