

Interactive comment on “Evaluation of BAER surface model for aerosol optical thickness retrieval over land surface” by Y. S. Chiang et al.

Anonymous Referee #2

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Review of “Evaluation of BAER surface model for aerosol optical thickness retrieval over land surface” by Chiang et al., for AMTD

Summary: This paper describes two methods to model surface reflectance, where the goal is a global use within the BAER aerosol retrieval from MERIS data. Values from the surface model are compared to data produced operationally by the MODIS surface reflectance retrieval. The first model, the land cover type method, did not compare well with MODIS data. On the other hand, the two-source linear type method compared somewhat better and was therefore may be appropriate for further consideration with BAER retrieval.

Assessment: Every researcher, attempting to do aerosol retrieval from passive satellite
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measurements of solar reflection, knows that the largest uncertainty over land is from in-sufficient knowledge of the land surface properties. Since it does not have long wavelength (e.g. SWIR band) information, MERIS is a very difficult instrument to do aerosol retrieval with. Therefore, I was very interested to read this paper and see what might be possible.

Unfortunately, I found the paper very unsatisfying. Over the years I have read numerous papers from the BAER team and am honestly amazed how much work has gone into the algorithm, without any new results to show. There is little application for this study outside of the BAER environment, and yet it is unclear whether use of these surface models will help BAER-MERIS anyway. For these reasons alone, I feel this paper should be rejected for publication.

The work presented here is really a sensitivity study with little global application. The study is performed with data taken over Taiwan, but the prescribed aerosol information is from Germany. The different surface models are taken from MODIS data, but MODIS is at different spatial resolution and wavelength. Plus, I am sure that Taiwan surface mixture is A) more than just vegetation and soil, and B) has different land cover types within one MERIS pixel. If the authors wants to test different prescribed surface models, then there has to be much more detail about how pixels are chosen, how they are mixed, etcetera, especially when applying data different spectral and spatial resolutions.

I want to highlight one section (section 4.2) on “Evaluation of VCF as vegetation fraction”. The entire evaluation is only one paragraph.

“VCF is defined as the proportional estimates for vegetative covers. It may depict areas of heterogeneous land cover better than discrete classification scheme. Compared to NDVI, VCF provides an absolute physical measure of the surface property. Therefore, this study modified linear mixing model and simulated surface reflectance with VCF as parameterization for Cveg. In Fig. 8, the comparison between simulated re-

flectance and MODIS counterpart has suggested that the slope of the regression line has increased (compared to Fig. 5). However, the modification will also introduce more uncertainty from VCF retrieval to the estimated reflectance. The use of NDVI can still better preserve a linear relation and the correlation (Table 3)."

And yet, I do not understand what this paragraph means, and what it is evaluating. I don't see much correlation ($R=0.64$) in Fig 8 when they should be measuring the same thing. Why all the weird curvature along the lower envelope and the absolute maximums (0.05 and 0.10) for Fig 8? Are they at different geometries? Is there something else? Why do MODIS and MERIS not agree? What about TOA observations (with no atmospheric correction); do MODIS and MERIS measure the same thing?

I have suggestion for approaching the paper in a different way.

- 1) BAER retrieval may not work because surface reflection is too uncertain.
- 2) Since MODIS has more spectral information, maybe we can derive a simple land surface model that sufficiently calculates surface reflectance properties in MERIS-like wavelength bands.
- 3) The first test is whether our simple land surface model sufficiently calculates surface reflectance properties in MODIS wavelengths,
- 4) Then we can discuss how to go to MERIS wavelengths, and what kind of errors we expect
- 5) ... and how these errors might impact the BAER aerosol retrieval
- 6) ... and how these errors compare with other errors (aerosol models, gas corrections, collocation errors, clouds, etc. . .)

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