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

Anonymous Referee #3

Received and published: 1 June 2012

This paper describes the development, application, and evaluation of two different surface models in the Bremen AErosol Retrieval (BAER). The authors correctly point out the significance of the problem of constraining the surface reflectance when attempting an aerosol optical thickness (AOT) retrieval from satellite observations, such as those from MERIS on Envisat. They propose and test two methodologies based on different underlying assumptions about the true land cover type: a land cover type dependent model and a two-source linear mixing model.

Unfortunately, the paper suffers from poor grammar, unclear writing, bad organization, and confusing data analysis, all of which make it extremely difficult to follow. I am afraid that I must agree with my fellow referees and suggest that this be rejected from AMT.

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I believe that the other referees have provided the authors some very helpful comments with regard to a few of the issues in the paper, and future submissions from these authors would greatly benefit from more careful proofreading, perhaps with the assistance of a native English speaker. In terms of the data analysis itself, I can offer the following advice, related to the figures in the paper:

Fig. 2: I'm not sure why the authors are satisfied to obtain a somewhat linear relationship. The point of this type of comparison is to demonstrate a more or less one-to-one relationship, rather than just a linear relationship. At least the authors have selected the ranges of the axes to be identical, so that the diagonal represents the one-to-one line. This shows that the BAER retrievals consistently underestimate the AOT, rather than overestimate, which seems to be the main concern of the authors. Also, I didn't understand how 12 potential observations (3 dates x 4 sites) ended up being represented by only 10 points (in black) and 9 points (in gray). Also, what wavelengths do the colors correspond to? What MERIS wavelengths were used?

Fig. 5: Similar comments as above for Fig. 2. What good is a linear relationship? The point of the analysis is to simulate the MODIS reflectances on the x-axis and once again the one-to-one line is the diagonal. Also, it appears that many of the points cluster at (very small) MODIS reflectances (< 0.02) at both wavelengths. It's not clear how many points are represented on these plots, but showing point density rather than the points themselves may make sense and draw less attention to the few large outliers.

Figs. 8 and 9: Referee #1 already pointed out the strikingly non-linear nature of the relationships in this graph. This bears some consideration. Rather than simply fitting a line to the data, as the authors have done, it would be interesting to try to understand why the curves have the shape they do. I would guess a second-order polynomial would provide an adequate fit to data and might provide information that could feed back into the surface parameterization.

Fig. 10: See comments above for Fig. 5.

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Fig. 12: At first glance, I thought this showed an improved comparison of the BAER AOT retrieval compared with AERONET. Looking more closely, I realized this was simply a comparison of the BAER retrieval to itself. In this case, a nearly one-to-one relationship is evident, but I suspect this is simply an outcome of the change to the surface having little effect on the AOT retrieval. Note that the range of values in the figure (mainly from 0.2 to 0.45) does not cover the range of AERONET AOT values shown in Fig. 2, so the overall underestimation of AOT in the BAER retrieval has not been addressed.

Interactive comment on Atmos. Meas. Tech. Discuss., 5, 2645, 2012.