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Atmospheric Chemistry and Physics Discussions



# *Interactive comment on* "Improvement of aerosol optical depth retrieval from MODIS spectral reflectance over the global ocean using new aerosol models archived from AERONET inversion data and tri-axial ellipsoidal dust database data" *by* J. Lee et al.

**J. Lee et al.**

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The reviewer's comments were precise and helpful in improving the quality of our manuscript. We basically reflected all the comments of the reviewer and attached the revised manuscript. The following is the response to the specific comments. Thank you.

———- The paper contains a new input database for MODIS aerosol retrieval algorithm

over the ocean. Although observed aerosol properties such as size distribution, single scattering albedo, and phase function are primary parameters in satellite remote sensing of aerosol, they are assumed to be simplified values in satellite data retrieval. This study tried to overcome or minimize the error caused by such assumption. However, revisions as stated below are needed.

1) The error analysis proved that authors' new approach has less error than NASA's operational method. Such result can be expected since NASA's aerosol model does not consider highly absorbing aerosols over ocean except for dust-like model. Authors should prove whether the improvement is mainly caused by use of tri-axial dust model or not. I strongly suggest that sensitivity study or error analysis is included for the estimation of AOD retrieval accuracy (especially for aerosol absorption).

–> Differences in TOA reflectances between new aerosol models and MODIS operational models (Figure 4), test for retrieval accuracy (Figure 5), and error analysis for aerosol absorption (Figure 10) are included.

2) This specific consideration is a valuable part of the new retrieval algorithm study and need to be addressed in the manuscript. The organization of the paper needs to be also improved. For example, it would be better to include more detail explanations of the suggested algorithm and aerosol models. Most importantly detailed description of the retrieval procedures outlined in Figure 1 should be added since it is critical for the readers to better understand the algorithm.

–> The two differences between the test-bed algorithm and MODIS operational algorithm are aerosol models and inversion procedure. More detail description for these differences is added in Section 2 in a more explicit way, and key optical properties of aerosol models are summarized in Table 2.

3) AERONET inversion products provide only for 4 wavelengths, how such limited spectral information was transported to MODIS 7 bands? –> Detail description for combining AERONET inversion data and tri-axial ellipsoidal dust database data is added in



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Section 3.2.

4) More information on the characteristics of 23 aerosol models is needed. Readers can only find the number of models with FMF and SSA ranges.

–> Key optical properties of new aerosol models are included in Table 2.

5) What kind of RTM used to calculate LUT? What are pros and cons of using that RTM?

–> Description is added in Section 3.2. We used a DISORT code introduced by Mayer and Kylling (2005).

More minor comments and suggestions are proved below.

1) Page 33327, line 5: What is the range of 'high AOD cases'?

–> Criterion added. High AOD represents AOD > 0.3.

2) Page 33327, line 10: How can FMF be wavelength dependent?

–> Definition added. FMF is defined by a ratio of fine-mode AOD to total AOD. Since AOD is wavelength dependent, FMF is also wavelength dependent.

3) Page 33327, lines 22_24: In Fig 6, absolute error for AE<0.8 and theta>130 seems to be similar values?

–> The 'spectral angle dependence' of retrieval error is improved, while absolute error is similar between the two products.

4) Page 33332, line 3: Provide 4 wavelength values. More explanation on Meng et al.(2010)'s model is needed. Does it contain only dust model?

–> More detail description is added. The database provides single scattering properties for various refractive indices, size parameters, and aspect ratios, so that application for non-dust aerosols is also possible.



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5) I'm not sure Fig.3 is required to explain aerosol model from AERONET. Instead, aerosol models with AOP would be more appropriate.

–> A table for key optical properties of new aerosol models is added.

6) Page 33334, lines 8 _ 9: How to merge these information into RTM for LUT calculation?

–> More detail description is added in Section 3.2.

7) Page 33336, line 5-10: These are confusing.

–> Sentence revised.

8) Reference: Remer et al (2006) is cited but not listed.

–>Reference added.

Please also note the supplement to this comment:
http://www.atmos-chem-phys-discuss.net/11/C16581/2012/acpd-11-C16581-2012-supplement.pdf

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