

Interactive comment on “Comparison of AOD between CALIPSO and MODIS: significant differences over major dust and biomass burning regions” by X. Ma et al.

Anonymous Referee #2

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General comments

This manuscript compares the retrieved AODs from CALIPSO and MODIS with the aid of GEOS-Chem-APM model. I found the main content of the manuscript interesting in general, but would like to see more scientific explanation of the difference between the two satellite products beyond its correlation with aerosol type and thus the source. The sampling issue between the two different satellite measurements needs to be discussed in the manuscript, and the number of data needs to be added where possible. For the figures from Fig. 6 to Fig. 9 in particular, the number of data points can be

C3609

added as dashed line in the figures. For the dust, when the nonsphericity of dust particle is not considered in the MODIS retrieval, AOD can be underestimated, as the phase function of spherical assumption is higher than that of nonspherical for the backward scattering, i.e. the geometry for the satellite retrieval (Lee et al., ACP, 2012). Thus, with the same reflectance measured from the satellite, the current MODIS retrieval underestimates the AOD. Furthermore, near the source region of biomass burning, it has been observed that the strong biomass burning also lifts dust together. Thus, it is likely that the current MODIS retrieval algorithms may not select the proper aerosol model in such case. The difference in the correlation between the Δ AOD and aerosol type in between South Africa and South America could be due to the different burning type. In South America, the burning is more for the smoldering type, while in South Africa it is more for the flaming type. This can cause different aerosol type from the biomass burning. Lastly, this study relies on the assumption that the GEOS-Chem-APM model provides accurate information on aerosol type at least. Then, it is necessary to include such statement on the performance of the model with appropriate references.

Minor comments

p.7:22-24 It is not clear to me how the frequency distribution of MODIS can differ between daytime and nighttime as shown in the box in Fig. 3 and 4 respectively, as the MODIS measurements are for daytime only anyway. Is this just a sampling issue?

Table 1 How significant is the difference in the global average AOD in this table, considering the uncertainty of the retrieved AOD products? Please add the uncertainty of the AOD products for both over land and ocean with references. The standard deviation should be included together in this table.

Reference

Lee, J., J. Kim, P. Yang and C. Hsu (2012), 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

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data, submitted to Atmospheric Chemistry and Physics, Atmos. Chem. Phys., 12, 7087–7102, doi:10.5194/acp-12-7087-2012.

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