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Atmospheric Measurement Techniques Discussions

Interactive comment on "Analysis of Global Three-Dimensional Aerosol Structure with Spectral Radiance Matching" *by* Dong Liu et al.

Anonymous Referee #2

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The authors use the cloud construction algorithm developed by Barker et al. to construct vertical profile of aerosols. The algorithm seems to be exactly the same as the algorithm of Barker et al. with a different spatial resolution (a 5 km resolution for the lidar instrument). The study is focused on aerosol vertical profiles. They construct a 201 km wide of global aerosol profiles over two time periods. They test the algorithm by the same method discussed by Barker et al. They also evaluate the aerosol optical depth computed over nadir and off-nadir view regions and compare with the aerosol optical depth derived from AERONET.

I have serious concerns on this version. First, the algorithm developed by Barker et al. uses near infrared and infrared channels. I expect that the algorithm does not work for aerosols for two reasons. Aerosol signals in near IR and IR channels are very weak

and I am surprised that the algorithm works for aerosols. In addition, aerosol signal in the upward radiance is very small over land. The variability of visible radiance over land is dominated by the variability of surface reflectance. Again, I expect that the Barker algorithm does not work for aerosols especially over land. These lead me to wonder why the algorithm works. There is no physical explanation provided in the manuscript. The authors need to explain reasons why the authors expect that the Barker algorithm works for aerosols. The current manuscript is written in a way that the authors took the algorithm and found it works for aerosols.

Second, the authors compare the aerosol optical depth for validation of, essentially, the Barker's algorithm. Figure 7 clearly shows that MODIS AODs agree with AERONET AOD better than "nadir" and "expanded". MODIS instruments have a full coverage of Earth. Therefore, comparison of AOD presented in the paper does not show any advantage of the aerosol-constructing algorithm compared to MODIS. The authors need to show the validation of constructed aerosol vertical profiles, perhaps compared with ground-based observations to demonstrate the advantage of constructing aerosol profiles. The authors also need to show how the error in the vertical aerosol profiles reduces, compared with nadir view only, when constructed aerosol profiles are used.

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