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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 #3

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Aerosol vertical structure (AVS) determines much of the climate impact of aerosol in the atmosphere, but it is difficult to measure with the spatial and temporal coverage needed for many applications. This study uses the spectral radiance matching (SRM) method, which infers AVS from column measurements by matching them to similar measurements with collocated vertical profiles, to construct global AVS from MODIS and CALIOP data. The paper is well organized, and the methods section is especially clearly written.

Although collocated AERONET data is widely used to validate MODIS aerosol, its use in a case study for this manuscript does not seem sufficient to evaluate the AVS retrieval. This is undoubtedly difficult, because the scarcity of AVS data that makes this study so valuable also leaves little basis for comparison. However, airborne field cam-

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Discussion paper

paigns and ground-based lidar networks do measure vertical profiles of clouds and aerosol on a smaller scale, and given the global MODIS/CALIOP record to choose from, it should be possible to use some of these measurements to validate the satellite AVS.

Specific comments:

Page 2, lines 1-23. I'm surprised not to see any mention here of ground-based lidar networks, which are sometimes used in combination with CALIOP data; or of the shorter-lived NASA CATS lidar that was aboard the ISS.

Page 6, lines 18-21. These cloud cover rates seem very low. For passive sensors, 70% is a reasonable ballpark estimate for the fraction of the globe covered by clouds at any given time. Most such clouds would occupy only a small part of the vertical column (and as the paper states, almost never at high altitudes) but the numbers still seem difficult to reconcile. Have you calculated the global cloud cover from the column perspective, for comparison?

Page 6, Figure 2. This is fascinating. It would be interesting to see a more detailed discussion of the contrast between 0-2 km and 2-4 km, which appear to distinguish local aerosol from aerosol undergoing long-range transport.

Page 8, Figure 3. This plot is somewhat difficult to read. A different color scheme may make the drop in the matching rate at the ITCZ easier to spot, but I'm having trouble seeing any other patterns.

Technical comments:

Page 6, line 14. "Losing".

Page 8, line 19. "CALIOP profiles".

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