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Atmospheric Measurement Techniques Discussions

Interactive comment on "Determination of particulate matter vertical columns using satellite observations" *by* A. A. Kokhanovsky et al.

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I think this paper represents a start at a good application. But as best I can tell, the paper does not really present a new technique for obtaining PM concentration or column mass concentration.

Rather, column mass concentration is obtained using satellite-derived column AOD along with satellite-constrained angstrom exponent and surface spectral reflectance, based on assumed particle optical properties, particle density, and vertical distribution. A similar approach has been applied to MODIS data before, albeit with some different assumptions about particle properties. More importantly, the uncertainty of the results is not assessed in light of the many assumptions, so it is difficult to tell how heavily the results depend upon them.

1. Intro, line 6. Might read "Most of these systems do not include satellite

observations. . ." An exception is the IDEA system, which you actually reference in the next paragraph (Al-Saadi et al., 2005).

2. Intro, line 9. Why only geostationary? I realize the time- resolution advantage of geostationary, but, especially for pollution monitoring, there can be good reasons to integrate the additional detail about particle properties derived from polar-orbiting satellite snapshots.

3. Methodology, p3, after equation 1. ". . . particle size distribution, shape, . . ." The assumption of spherical particles might introduce significant uncertainties in properties retrieved from radiance measurements if non-spherical dust is in the column (e.g., Mishchenko et al., GRL 1995).

4. Methodology, p4, after equation 6. "This explains the differences. . ." In part. M depends on the vertical distribution as well.

5. Methodology, p5, top. "These conditions hold for the desert dust outbreaks." What is the impact of non-spherical dust particle shape?

6. Methodology, p5, after equation 7. ""... enables the determination of the mass concentration M. . ." Doesn't vertical distribution matter, especially for transported dust? I can see how the column mass loading (m) might be derived.

7. Methodology, p5, middle. How large are the uncertainties produced by these assumed particle properties? How much do the satellite measurements actually constrain the result?

8. Methodology, p5, last paragraph. The majority of airborne dust particles have effective radii in the range 0.5 to 10 micron. Also, the scaling parameter b is not defined, nor explained.

9. Methodology, p6, second bullet. How well must the angstrom exponent be constrained by the satellite data to be useful here? Is the satellite constraint good enough? I'm wondering also about the wavelength range over which the angstrom exponent is

evaluated, relative to the size of the particles, especially for dust. An uncertainty analysis would be helpful.

10. Methodology, p7, second paragraph. "Clearly, the technique is superior. . ." Most likely the parameter b scaling improves the representation of larger particles, but is the improvement overwhelmed by the particle shape, particle density, angstrom exponent and surface retrieval assumptions made here?

11. Retrievals, p9, first paragraph. ". . .single scattering albedo equal to 0.9. . ." How justified is this assumption, and how much of an effect is it likely to have on retrieved AOD? Urban pollution and dust often have very different single scattering albedo values.

12. Retrievals, p9, top. How good a constraint on angstrom exponent do you get for dust-sized particles from a measured wavelength range of 0.41 to 0.67 micron?

13. Retrievals, p9, "Generally, the agreement is good." Can you quantify the agreement, e.g., with a regression coefficient?

14. Results, p10, Figure 5. Does it appear from this figure that the satellite-derived angstrom exponent is more-or-less constant, i.e., possibly not correlated with the ground-derived angstrom exponent?

15. Results, p11, after equation 10. How much of the difference between the AOT and the PMVC pattern do you believe represents actual differences in aerosol mass or column mass concentration?

16. Results, p11, bottom. To compare with ground observations, you might minimize the spatial sampling differences by selecting fairly uniform sites, away from major sources.

17. Results, p12, middle. "Poor correlation is also seen in our Figure 11. . ." With the wavelength range used for the angstrom exponent, would you expect much sensitivity to the larger particles included in PM10?

18. Results, p12, last line, to p13 top. "They just bring an additional type of . . .. We also found. . ." This seems weak. I'm not sure I see a demonstration of cancellation of errors.

Interactive comment on Atmos. Meas. Tech. Discuss., 2, 1027, 2009.