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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Cloud processing, cloud evaporation and Angström exponent" *by* G.-J. Roelofs and V. Kamphuis

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1 General Comments

This paper addresses the impact of aerosol cloud processing on the Angstrom exponent. It is a timely paper, as there is much research associated with the microphysics of aerosols in and around clouds, and our ability to detect aerosol-cloud interactions via remote sensing. Although there are many papers relating aerosol microphysics to cloud processing using cloud parcel models, I have not seen any that also relate the aerosol-cloud dynamic to the Angstrom exponent. This is important, as the Angstrom exponent is something that we can retrieve with satellite measurements...

2 Specific Comments

- The authors need to specify which wavelengths they are using to compute the Angstrom exponent. This is very important, as short-wavelength Angstrom exponents are often quite different than long-wavelength Angstrom exponents for a given aerosol size distribution because of spectral “curvature" that is not captured in the Angstrom equation. This will help put the authors’ Angstrom exponent in perspective with the Angstrom exponent articles that they cite.

- The authors are using a single refractive index for all particles (1.33), but the extinction coefficient is sensitive to the particle refractive index (especially at shorter wavelengths). This is particularly important if the authors are computing Angstrom exponents with wavelengths shorter than $\sim$500 nm. Ideally, the authors should account for a variable refractive index in their extinction computations, or at least comment on the uncertainty in the optical thickness and Angstrom exponent associated with this simplification. The Tang et al. papers provide empirical relations for the refractive index of many aerosol-water mixtures that might be useful (*Tang et al.*, 1978; *Tang and Munkelwitz*, 1991, 1994; *Tang*, 1996; *Tang et al.*, 1997; *Tang*, 1997).

- How did they choose their “marine" aerosol size distribution? A citation of the aerosol climatology would be helpful.

- The size distribution needs to be shown as a volume size distribution at some point for us aerosol folks. The volume distribution is more closely related to mass than the number distribution, and it is the form of the size distribution that is usually related to the Angstrom exponent (hence, showing the volume distribution would make the paper much stronger). Perhaps repeat (or better yet, replace) Fig 2 with volume size distributions.

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8, S5995–S5997, 2008

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- The authors state that “The modification appears to be stronger for aerosol representative of relatively clean (marine) conditions than for more polluted conditions. . . " in their conclusion, but they don’t show the polluted conditions in the paper. I think that it would be beneficial to repeat figure 1d with an initially polluted aerosol size distribution that backs up this statement. This might add another piece to the puzzle of the seemingly contradictory results of satellite studies over the ocean (i.e., Loeb and Schuster, 2008) vs. surface measurements over land (Koren et al., 2007), which would be a nice addition to the discussion.

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