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Atmospheric Measurement Techniques Discussions

Interactive comment on "Aerosol optical depth and fine-mode fraction retrieval over East Asia using multi-angular total and polarized remote sensing" *by* T. Cheng et al.

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The authors present a retrieval algorithm that provides an alternative to the POLDER global algorithm that appears to be relatively simple, uses aerosol microphysical models that are specific to East Asia and allow not just fine mode optical depth, but also total optical depth to be estimated. The comparisons to AERONET are encouraging and suggest that the algorithm performs quite well.

The main issues I have with this paper are 1) a lack clarity and comprehensiveness in the discussion of the algorithm and 2) an absence of error estimates associated with the forward model and the measurements that would allow the residual terms to be

appropriately weighted.

With regard the first item the authors state that "The retrieval algorithm employs the least mean squares fitting method in the form of a series of numerical iteration procedures to search for the computed total and polarization reflectance that best match the measured total and polarized reflectance," However Figure 1 does not indicate that there is any iteration and I am guessing that what they mean is that the algorithm outlined in Figure 1 is applied to each of the 36 possible mixtures. If so they should say so. It is also totally unclear how the Initial Total AOD is weighted in the determination of Total AOD and FMF from the polarized reflectances which are presumably dominated by the FMF*AOD. Without a complete description of the functioning of the algorithm it is not possible to reproduce these results and they cannot therefore be regarded as scientifically sound.

In terms of my second concern, there are potentially substantial errors associated with the use of the von Hoyningen et al. (2003) and Nadal and Bréon (1999) models that are parameterized on NDVI that will depend on the aerosol loading and the surface type (cf. the cited references to Waquet et al. 2009 and Litvinov 2010 for example). There are also errors in mixing approximations that are smaller for polarized reflectances than for total reflectances, but which should be quantified (see Wang and Gordon papers references by Referee #1 and Abdou, W. A., Martonchik, J. V., Kahn, R. A., West, R. A., and Diner, D. J., 'A modified linear-mixing method for calculating atmospheric path radiances of aerosol mixtures,' J. Geophys. Res., 102 (D14), 16,883-16,888 (1997). If estimates of these errors were derived it would be possible to also provide estimates for the retrieval errors on the Total AOT and FMF and also to appropriately weight the total and polarized measurements that are being used. Without error bars retrievals of this kind have little value, since it is impossible to evaluate them against other sources of information.

Interactive comment on Atmos. Meas. Tech. Discuss., 4, 5689, 2011.