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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Particulate absorption of solar radiation: anthropogenic aerosols vs. dust" *by* C. Wang et al.

Anonymous Referee #2

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The study quantifies, within a numerical model, the relative contribution of anthropogenic and mineral dust aerosols to the absorption aerosol optical depth. This is an interesting contribution to an uncertain issue, and I recommend publication after revisions are made to account for the following comments.

1 Main comments.

- The quality of the aerosol modelling is assessed by comparing against AERONET, MODIS, and GOCART. CAM3 seems to do ok, although the logarithmic scale used in Figure 1 is forgiving. However, we are not given enough information to know where the modelled aerosol distributions stand compared to

other models. Publishing the global-averaged aerosol optical depths and burdens for each aerosol species included, and comparing those values against AeroCom estimates (Schulz *et al.*, ACP, 2006) would place the authors' model in context. Of course, being outside the AeroCom range on a given variable is not a bad thing, but it helps considering whether results would be reproduced in other models.

This is particularly important for the mineral dust aerosol, which seems to have quite a large contribution in this study. This is also important for the black carbon. The total black carbon emissions of 14.7 Tg per year used in the baseline estimate are on the high side.

More generally, AeroCom publications are of interest here. Kinne *et al.* (ACP, 2006) discussed the distributions of aerosol absorption in participating models. Results are now slightly dated, as aerosol modelling has since evolved, but remain relevant.

- Sea-salt should not be left out of the calculation of the anthropogenic fraction of total aerosol optical depth. Neglecting such an important natural aerosol yields large anthropogenic fractions that are difficult to compare against other estimates (it will not impact the anthropogenic fraction of the absorption aerosol optical depth). In addition, considering sulphate aerosols produced by DMS oxidation as "anthropogenic" is not a good move. This is a natural process.

- Showing that mineral dust absorption can be as large as black carbon absorption over India is an interesting result (provided that mineral dust fields are not overestimated). However, from a climate change perspective, anthropogenic absorption remains more important, as it can be controlled to some extent.

2 Minor comments.

Lines 11-12, page 6575: "*except for events influenced by episodic pollutants*". What does that mean? Hopefully those episodic pollutants are not aerosols...

Lines 16-18, page 6576: It would be worth indicating that the scaling of the refractive index results in a less absorbing mineral dust aerosol. Giving the resulting single-scattering albedo at selected wavelengths would be helpful.

Pages 6575-6576: Different aerosol species seem to come from different sources. To make it clearer: Were the mineral dust and sea-salt models run independently of the rest of the model? If so, are climate and atmospheric circulation consistent across all models?

3 Typos.

Line 2, page 6573: "*back carbon*" should read "black carbon".

Line 5, page 6573: "*absorbing strength*". The usual term is specific absorption coefficient.

Line 6, page 6573: "*lowered*" should read "lower".

Line 21, page 6574: "*the models*" should read "numerical models".

Line 29, page 6580: "*base*" should read "case".

Line 13, page 6582: "*been*" should read "be".

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 6571, 2009.