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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Aerosol forcing based on CAM5 and AM3 meteorological fields" *by* C. Zhou et al.

Anonymous Referee #2

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Review of "Aerosol forcing based on CAM5 and AM3 meteorological fields" by Zhou *et al.*, submitted to *Atmos. Chem. Phys.*

The authors study the impact of the meteorological fields driving an offline aerosol model on the aerosol distributions simulated by that model, and on the aerosol forcing exerted. The paper is detailed and complete, and aerosol differences are well attributed to differences in the meteorological fields. The discussion tends to overemphasize some differences, and authors should not hesitate to discuss agreement where appropriate, as mentioned below. I would recommend publication after minor revisions to address the following comments.

1 Main comments

- The authors discuss differences throughout the paper, but seem to be unaware that the more striking results are actually about the lack of differences. For example, multiplying the condensed water content by three leads to virtually no differences in global-averaged direct and indirect forcing for a given set of meteorology. This is very likely due to compensating impacts on different aspects of the aerosol distributions, but suggests an impressive robustness in forcing estimates with respect to wet removal – interannual variability would in fact influence aerosol forcing more than that. The impact of the very large changes in vertical transport and relative humidity is larger, with global-averaged forcing from IMPACT-AM3 and IMPACT-CAM5 differing by 30%. However, uncertainties in aerosol emissions (present-day and pre-industrial), absorption, and indirect effects are likely to dwarf that number.

- In their sensitivity study, the authors choose to multiply the condensed water content (L+W) by three from 0.5 to 1.5 cm^{-3} m^{-3}. Why chose those numbers? Are they the limits of some range constrained by observations?

2 Minor comments

Page 10682, line 10: Is that the dry or wet particle radius?

Page 10686, line 8: "significantly larger". Is that statistical significance?

Page 10687, line 20: In the baseline models CAM5 and AM3, do aerosols interact with radiation and cloud microphysics, and affect meteorology? Section 2.2 is silent on that subject. If aerosols interact with meteorology in those models, then there is an internal consistency between aerosol and meteorology, and the impact of meteorology

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on aerosol forcing is conceptually different than for offline aerosol models.

Section 4.1: Is is really necessary to give percentages with two decimal digit precision?

Page 10694, line 15: Where does the "50% of OM is HULIS" come from? It sounds large.

Page 10695, line 2: Please detail how the cloud-free relative humidity is computed.

Page 10696, lines 16–17, and page 10697, lines 10–11: You are discussing small differences there – it would be more relevant to discuss why there is agreement.

Page 10697, lines 25–26, and Table 9: How can the first indirect forcing be weaker at the surface than at the TOA?

3 Technical comments

Page 10683, line 9: Typo "humudity".

Page 10683, line 14: Typo "precipiation".

Page 10684, line 21, and page 10685, first paragraph of section 3, and elsewhere in the paper: Please spell out "yr".

Page 10695, line 10: "factor" should read "fact".

Page 10701, line 12: "emphasize" should read "emphasis".

Table 4: Typo "Aitkin"

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 10679, 2012.