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Atmospheric Chemistry and Physics Discussions

Interactive comment on "A pathway analysis of global aerosol processes" *by* N. A. J. Schutgens and P. Stier

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Review of "A pathway analysis of global aerosol processes" by Schutgens and Stier, for publication in Atmospheric Chemistry and Physics

The paper presents an analysis of results from the ECHAM5.5-HAM2 modeling system, nudged to ERA-Interim meteorological reanalyses. The focus is on aerosol processes with in the 7 mode aerosol scheme run inside the model. A detailed budget analysis is presented, in which pathways of mass and number transfer among the modes and into and out of the model are explored. The expectation is that this sort of analysis can provide some insight into how aerosols are processed in the atmosphere, as well as suggesting improvements to the modeling system (i.e., reducing complexity

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by removing cost associated with unnecessary pathway treatment). There is a suggestion at the very end that this analysis can suggest particular measurements to be made with which to test the model, which is appreciated as the paper is mainly devoid of comparison to constraining data. We cannot answer here either how realistic this particular model is, nor how other models might differ from it.

The authors are to be commended for their general thoroughness, but the paper is challenging to read. The attentive reader will need their scorecard handy (Tables 1 & 2), but even so this is a paper that will need to be viewed on a large computer monitor to make the figures at all usable. I think the color schemes for the pie chart figures are difficult to read, and so difficult to interpret without the aid of the text. I would suggest perhaps a color scheme like those suggested at http://colorbrewer2.org for "qualitative" data as useful to people whoâĂŤlike myselfâĂŤhave a hard time distinguishing shading of various blues (e.g., Figure 5b).

I think though the paper will serve as a benchmark for others to look at in evaluating aerosol schemes, helping to understand differences among models, and perhaps providing some testable hypotheses, so I recommend it for publication with the minor comments below (and the request for a better color scheme noted above).

1) Please clarify in the model setup description what year was run? Were there any important events in that year (volcanoes, wildfires)? 2) For the reduced spatial resolution run I am a little surprised at the consistency of the results. Although I understand the tuning of dust and sea salt emissions mentioned, my experience has been that clouds may be quite different across changes in horizontal resolution, with possibly large effects on in-cloud sulfate production, for example. Your baseline is already relatively coarse ($\sim$2x2 degree) so maybe your cloud fields aren't so different at the coarser resolution (my experience was in moving from 2x2.5 degree grids to 0.5x0.625, for example). Could you explain a few sentences more about the nudging? Are you imposing cloud fields, or are those solved from the imposed dynamics? 3) Regarding the discussion of pre-industrial emissions (p. 15062, line 10), would preindustrial meteorology

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14, C6246–C6248, 2014

matter to the results? 4) Section 4.4.1, page 15064 line 2 (and throughout section): reference to Figure 6 should be to Figure 5, and reference to Fig. ?? should be to Fig. 6 (also in Section 4.4, line 14). 5) page 15065, line 7: I think reference to figures 8d & e should be to Figure 8 c & d. 6) I'm a little confused about the presentation of the aging processes for the hydrophobic Aitken mode (Section 4.4.2, esp. lines17 - 20 and Figure 9). The text talks about coagulation with nucleation particles (which is process 15 on my scorecard)âĂŤwhich wouldn't be a loss of particles in the Aitken mode, I realize (what is plotted in Figure 9)âĂŤand condensation is called out in the lower troposphere. These things all make sense, but I can't tell what they have to do with Figure 9, where the processes illustrated there aren't seemingly discussed. Please clarify the intent here. 7) There doesn't seem to be any reference or discussion of Figure 17.

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 15045, 2014.