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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Global error maps of aerosol optical properties: an error propagation analysis" *by* K. Tsigaridis et al.

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1 Summary

This paper pursues an interesting and useful idea. Conventional wisdom states that aerosol properties are uncertain. How much could these uncertainties affect predictions of optical depth, and where do those uncertainties occur? The authors take aerosol mass predictions from a chemical-transport model and apply a range of assumptions to determine the optical depth. Many calculations with a wide range of input parameters are presented. Refractive index, aerosol size and water content are varied. This model experiment could be quite informative.

However, to achieve the authors' goal of representing uncertainty, additional work and significant analysis are needed. I have outlined some suggestions below.

2 Major criticisms

1. Probability: The authors, apparently, treat all input values as equally probable. This is far from the case. A Monte-Carlo type approach would be better to develop probability distributions for the parameters required for the radiative transfer model (g, SSA, etc). Then, these probability distributions could be applied to the aerosol maps. This may sound like an arduous task, but authors have already done most of the computationally-intensive work (Mie calculations). Lookup tables could be used based on the outputs presented in the figures.

2. Ranges chosen: For size distribution, authors state that radius varied by only 20

3. Detail level: The optical calculations are described with far too much detail, and not enough attention is given to the resulting optical property maps, which are the new part of this paper. Figures like 1, 2, 38212;even if not these exactly8212;have appeared in other papers and are not really new. This discussion should be condensed greatly. Then, more attention should be given to the figures 5-10. There is some discussion of where uncertainties are largest, but this should be expanded. This leads into my next comment.

4. Figures: I think that Figs 5-10 could be more informative. The figures look nice, but it is hard to extract useful information from them. Means and medians are not so different that they require two plots. Differences could be plotted spatially or in scatterplots. I realize that authors have generously made their data publicly available, for which I commend them. However, the authors should be doing the analysis8212;not other researchers who can access the data.

5. The goal of this uncertainty analysis, I think, is estimates of uncertainty in satellite retrievals (interpretation of radiance) and perhaps aerosol radiative forcing. These will depend on AOD, g, SSA as provided here. But those variables are not independent, so authors should explain how they will account for the interdependences when moving

ACPD

8, S8314–S8316, 2008

Interactive Comment

the work forward.

6. Interpretation of uncertainty. Authors state that uncertainty in g and SSA not as large as AOD. This seems like a trivial conclusion. Of course g (which varies from -1 to 1) is more tightly constrained. The real question is how much that uncertainty alters predicted quantities of interest (radiance or radiative forcing). Also, I disagree with the statement that SSA has low uncertainty. The important quantity is co-albedo (1 minus SSA), and this will become obvious if authors examine the sensitivity of radiative forcing to the optical parameters calculated here.

3 Other comments

The paper needs some additional detail for clarification. The aerosol model in the LMDz-INCA model should be described briefly. I realize that the readers could look up the citation, but the aerosol treatment in that model is critical to the paper, and so should be presented here. Does LMDz-INCA predict sizes or is it just a mass-based model? What emissions were used and what removal parameterizations?

The English is generally good. However, there are a few awkward statements or misuses. - Kahnert et al 2007 is not in the reference list. - p 16036 "water is not mixing", change to "water does not mix" - p 16036 lines 10-22 are very confusing. Text needs to be rewritten. I could not reproduce this calculation if I needed to. That should be the test of clarity. - p 16037 "participated" should be "participating", 8220;spread on aerosol size8221; should be "spread of8230;"

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 16027, 2008.