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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Updated aerosol module and its application to simulate secondary organic aerosols during IMPACT campaign May 2008" *by* Y. P. Li et al.

Anonymous Referee #1

Received and published: 22 March 2013

This manuscript describes changes made to the SORGAM aerosol model, and demonstrates improvements in the ability of this modified module to simulate observe organic aerosol concentrations as measured during the IMPACT campaign in the Netherlands. The suggestions about which parameters are key targets for improvement are likely to be of interest to the readership of ACP, and as such this manuscript is appropriate for publication in this journal, but changes are suggested to improve its readability and usefulness to the atmospheric modeling community.

General comments:

-This paper needs editing for language. There are numerous grammatical/wording

errors throughout. Please find a native English-speaking editor to help you improve the readability of the manuscript. I don't include any copy-editing comments here.

-In the abstract, model improvements are all described solely in terms of increasing SOA yields to better match field measurements from IMPACT. However, in the text it becomes clear that you are also describing improvements to the description of chamber data, where the previous models OVERESTIMATED rather than underestimated SOA concentration. First, I suggest including this in the abstract/intro, so that the reader is prepared when it comes up on p. 5974 line 8 in the description of a figure. Also suggest including more discussion in the introduction of this - why would field data be underestimated and chamber data overestimated by the same model? Furthermore, it's unclear to me how your new model would reduce SOA under any circumstances – in Figure 7, it looks like every change you made added SOA. Which change is it that reduced SOA in the chamber simulations?

-It's not clear to me why the newly temperature-dependent model should include temperature dependence in BOTH K's and alphas. What is the physical explanation for why alpha's would change with temperature? Are these additional parameters justified or could you just be overfitting the available data?

-Particularly in the case of the 3rd-order polynomial fit of the small temperature range of available data for aromatics, I wonder if you are overfitting a small dataset. The shape of the function in Fig. 3 doesn't seem physical, and the high correlation coefficient reported in Table 4 (0.933) seems suspect in this light. Is there a physical reason to believe a 3rd order fit is appropriate, or could you be fitting noise in the data?

-Does the RH parameterization have any substantial effect? This is introduced but then not discussed in detail later – did it not change much?

-In the discussion of improved model performance (e.g. last 2 paragraphs of section 3.2), I suggest using parallel sentence structure and reporting the same variables for each case. Currently, you sometimes give the NME both before and after changes,

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sometimes only after. Then, in section 3.3.3. when you describe the use of SORGAM-TIN for the Cabauw data, you describe model improvement in different terms. I suggest being consistent throughout – report all effects of changes in the model in terms of that same NME metric.

-In general, the figures look great and illustrate the authors' major points well.

-Fig. 8: Why does isoprene, like NO3, also add more SOA at night than during the day, even though emissions should be 0 at night?

Specific comments:

-You sometimes refer to the field data as "IMPACT" and elsewhere as "Cabauw" – better to chose one and be consistent.

-The last sentence of the abstract should be removed - this is appropriate for the discussion at the end of the manuscript but not the abstract.

-Section 2.2 : at end of 2nd sentence, add "with the following exceptions:" to clarify what you did/ didn't change with Hvaps.

-p. 5971 line 27: please justify / discuss using the largest experimental value for isoprene, rather than e.g. a mean value

-p. 5972 line 22: missing space

-p. 5973 lines 9-11: "We limited the form . . . not higher than 3" : Why 3? Seems overfit with such a small dataset over small T range

-p. 5973 lines 14-15: ". . .extended to all oxidation pathways. . ." this assumption deserves some further commentary – how realistic is it?

-p. 5981 line 11: SORGAM

-Table 1: suggest adding lines in between VOC rows – the alignment is confusing now. Also, in the footnotes you say updated parameters are bold, but they don't look bold,

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and it would be helpful to the reader if they were.

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