

Your following responses to the referee's comments are not clear. They do not reflect any changes.

“satisfactory results (bias lower than 20\%)” replaced by “satisfactory results (bias lower than 20%)”

“Oligomerization was found to have a strong effect on SOA composition” changed to “Oligomerization was found to have a strong effect on SOA composition”

Editor

General comments:

1) As pointed out by both reviewers before, the paper lacks a clear statement why the current parameterization is better than previous ones. At many places, the fits and estimates seem arbitrary and empirical. The comparison to previous model results using other parameterizations is often very descriptive without interpretations. In order to clarify the message of the manuscript, I suggest clarifying throughout the paper the novelty and improvement based on scientific explanations, i.e. going beyond ‘our model results are closer to observations’ – which might be a coincidence.

2) I agree with Reviewer #2 that the manuscript is often hard to follow. I think some of this is due to an often sloppy reference to your various parameterizations. For example, ‘the extended parameterization’ is nowhere clearly defined, and instead of writing the ‘HSO4-’ approach, it should be referred to the corresponding equation etc. I suggest going carefully through the manuscript and to be as clear as possible in such cross references between sections.

Specific comments

p. 1, l. 20: then → than

p. 4, l. 21: “all the range of values” – better: “The full range of values”

p. 4, l. 24: reach → reached

p. 4, l. 28: ‘humidities’ misspelled

p. 5, l. 7: either ‘leads’ or ‘led’

p. 6, l. 0: “A new mechanism was developed for SOA formation from toluene (TOL), o-xylene (XYL) and trimethylbenzene (TMB)”

Isn't that statement a bit pretentious? Did you reformulate all oxidation steps etc in the oxidation of these precursors semi-/non-volatile compounds? Or did you just update the yields and stoichiometric coefficients using a previous approach, e.g. Odum or the VBS framework?

p. 7, l. 16: these results

p. 7, l. 23: "Oligomers are represented by simple species to know if "monomer blocks" are present mainly as oligomers or as monomers."

I don't understand this sentence.

p. 7, l. 28: "the same compound AS.."

p. 9, l. 6: "To do that": What does it refer to? 'To measure that' or 'to estimate that'? – It might help to clarify in l. 5 "in their study" (not to be confused with "in this present study")

p. 9, l. 10: Here is the first place where you introduce the term 'extended parameterization'. Some explanation would help why it is extended and called like that.

p. 9, l. 28: ..did not find...

p. 9, l. 29: "...with a dimer formation that cannot react further..." – better: ...formation of dimers that cannot react further .." (a 'formation' cannot react further)

p. 9, l. 34: "that for those 4 dimers are not formed from particle-phase reaction" – remove 'for'

p. 10, l. 3-4: "In this study, the second order parameterization was used for simulations. In case of the oligomerization inside an aqueous acidic phase, a kinetic rate of $8.76 a[H^+]$ should be used to take into account the effect of acidity on oligomerization."

- a) What is the second order parameterization? Can you refer to a previous equation or paragraph?
- b) The connection of the two sentences is not clear.

p. 10, l. 24: Liggio and Li (2006b) did not evaluate

p. 11, l. 5: Why is it called J_{trans} here?

p. 11, l. 9: What assumption can be/are made for the back reaction of the reversible process?

p. 11, l. 21-27, and Table 7: It is not clear which of the references in the text were used for the data in Table 7. At the very least add references to the values in Table 7.

p. 12, l. 31: "...the wall deposition rate [...] are different..." – either 'rate is different' or 'rates are different'

p. 13, l. 2: "...to ensure that effect of changes on deposition remain low."

Clarify this statement. How low is 'low' and why would it make sense to assume different deposition losses with and without oligomerization in general? Wouldn't it be more useful to use the same (averaged?) deposition loss rate for both scenarios?

p. 13, l. 3-5: "For the biogenic experiments, the model gives good results (bias lower than 20%) with or without oligomerization for all experiments with slightly better results without oligomerization for experiment B5 and slightly better results with oligomerization for experiment B1."

Can we learn something from this finding? What is reasoning behind it?

p. 14, l. 15: "Assuming aging leads to a slight decrease of SOA mass due to fragmentation for toluene SOA or an increase of concentrations due to functionalization for TMB and α -pinene SOA."

This sentence seems incomplete.

p. 14, l. 18-27: Can you give any recommendation on which of the parameterization should be used in future modeling studies? And why?

p. 14, l. 31: the partitioning of monomers IS sensitive

p. 15, l. 2: "The pH and HSO₄ parameterizations and the parameterization of Pun and Seigneur (2007) assuming equilibrium"

At this point, the reader might not remember what those are. Please refer to the equations.

p. 15, l. 9: same results AS assuming no uptake

p. 15, l. 13: "acidic acid of pinonaldehyde" -- ?

p. 17, l. 18: Redefine here briefly the term 'chemical regime ratio'

p. 18, l. 1: 'decrease' of what?

p. 18, l.3: ans → and

p.18, l. 4: "This decrease could however be compensated by decreasing the volatility of SVOC by 20%."

It is not clear what you want to say here.