

Interactive comment on “Global modeling of secondary organic aerosol formation from aromatic hydrocarbons: high- vs low-yield pathways” by D. K. Henze et al.

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Reviewer comments are italicized. References to specific text of the revised manuscript are given as sYpZ for section Y, paragraph Z.

1. Add an appendix explaining with one of two equations how the branching between high and low VOC/NO_x ratios is taken into account in the model (mentioned in page 14577, line 3).

We feel that the description of the mechanism suffices, as tracking the branching ratio is no more complicated than tracking chemical production or loss via specific pathways, a common feature of CTMs for species such as ozone, and would not be enough to

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warrant an Appendix. The code for this will eventually become part of the standard GEOS-Chem code, which is publicly available for those interested in the specifics of such calculations. Also, the second sentence of s3.2p1 has been revised for clarification to read, “The loss of RO₂ via each reaction is tracked in order to explicitly calculate the branching ratio between these two pathways.”

2. page 14577, lines 20-24. Need to better justify the use of an OM/OC ratio of 2.1 in the present study, ratio that is recommended for non-urban aerosol, although most of the primary carbonaceous aerosols are in urban areas where this ratio is closer to 1.4.

We have amended our description to include the following (s3.2p2): “Given the ubiquity of highly oxygenated carbonaceous aerosol in urban and remote areas (Zhang et al., 2007) and that M represents both primary and secondary organic aerosol mass, the higher ratio is thought to better represent the bulk properties of global organic aerosol.”

3. page 14578, line 4: Offenberg et al., 2006 suggest a lower enthalpy of vaporization for SOA from aromatics, what the result would be if that almost 3 times smaller number was used here instead of the 42 kJ/mol ?

The result would likely be less than a third as much SOA formation. However, given that the temperature dependence of SOA in the model is treated in a bulk fashion (i.e. SOA from α -pinene is not distinguished from SOA from toluene), the larger values for species such as α -pinene may be more appropriate. However, the uncertainty in the NO_x dependence of such properties, especially for species like isoprene, cause this to remain an open question. The associated range of uncertainty is now more clearly stated in s5p2. The following specific example of the effect of ΔH_v on SOA is now given, “in Henze and Seinfeld (2006), a 19% increase in ΔH_v was found to result in a 28% and 50% increase in the SOA production and burden, respectively.”

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4. page 14579, lines 21-23: *This information should be given in the emissions sub section. It is also not clear if extra tropical (for instance, boreal forest) emissions are taken into account in this study.*

We now first give this information in the emissions section. Boreal forest emissions are considered for aromatics (to the extent that they are considered for CO), but they are not a large source compared to the urban sources in the NH.

5. page 14580, line 7: *than 1%*

Corrected.

6. page 14581, line 17. *after 8217;larger8217;; add 8217;than those from biogenics8217;;*

Done.

7. page 14583, lines 9-11: *this is a very strong statement, what about sesquiterpenes?*

Sesquiterpenes would also likely be emitted in low-NO_x environments, and their high reactivity minimizes the importance of accounting for their oxidation far from their sources. Though some sesquiterpenes may thus have a lower yield than in high-NO_x environments (see Ng et al., 2007b), it may not be necessary to calculate both possible branches in global models with relatively coarse resolution. They were not listed here as estimates of global sesquiterpene emissions are small compared to the other BVOC considered, though there is a large amount of uncertainty in our understanding of emissions factors from sesquiterpene sources (Duhl et al., 2007). The sentence has been changed to read “In contrast, implementing a similar model description for

monoterpenes, sesquiterpenes, or isoprene, largely emitted in low-NO_x environments, may not be as crucial for estimating their contributions to SOA in global models.”

Ng, N. L., Chhabra, P. S., Chan, A. W. H., Surratt, J. D., Kroll, J. H., Kwan, A. J., McCabe, D., Wennberg, P. O., Sorooshian, A., Murphy, S. M., Dalleska, N. F., Flagan, R. C., and Seinfeld, J. H.: Effect of NO_x level on secondary organic aerosol (SOA) formation from the photooxidation of terpenes, ACP, 7, 5159-5174, 2007b.

Duhl, T. R., Helmlg, D., and Guenther, A.: Sesquiterpene emissions from vegetation: a review, Biogeosci. Discuss., 4, 39878211;4023, 2007.

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 14569, 2007.

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