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Atmospheric Chemistry and Physics Discussions

Interactive comment on "The SOA/VOC/NOx system: an explicit model of secondary organic aerosol formation" *by* M. Camredon et al.

M. Camredon et al.

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We thank the referees for the comments and corrections.

Reply to comments by referee 1:

Specific comments:

»Section 5.1.3: This section describes the relationship observed between Ymax and the relative contribution of OH to the removal of 1-octene. This relationship could perhaps be better highlighted if Figures 6 and 8a were overlaid or at least presented in the same figure, so that comparison between the results could be made more easily by the reader. As the text focuses on the relative contribution of OH to oxidation, Figure

8b, showing the relative contribution of O_3 on the same isopleths, might be redundant. As suggested, figures 6 and 8.a have been combined in a unique figure in the revised version to highlight the relationship between SOA yield and OH removal. In addition, figure 8.b has been removed.

»Section 5.2: This section briefly describes the time-dependent growth curve that has been modelled (depicted in Figure 9), and refers to Ng et al (2006). Ng et al noted that, from experiment, SOA formation appeared to be limited by the first oxidation step for species with single double bonds whereas second generation products contribute substantially to formation of SOA for species with several double bonds, and that a vertical section of the growth curve characterises this behaviour. 1-octene (the species simulated in this study), has only a single double bond, though was not one of the species studied by Ng et al. This study suggests that 1-octene may also contribute to SOA formation via multiple oxidation steps. It could therefore be interesting to comment specifically on the observation of a vertical section in the modelled time-dependent growth curve for this species, whilst discussing Figure 9.
Species studied by Ng et al. (2006) were terpene and sesquiterpene species. Smog chamber results show that for these C_{10} and C_{15} hydrocarbons, the first generation products lead to significant SOA production. Furthermore, for species with more than one double bond, reactions on these second reactive sites lead to the formation of additional compounds that partition into the condensed phase. These secondary reactions are (1) fast enough to occur within the timescale of a smog chamber experiment and (2) sufficiently slow to mostly occur after the removal of the parent compound. This likely explains the vertical section of the growth curve for C_{10} and C_{15} compounds bearing more than a single double bond. Here, we simulated SOA production from 1-octene at fairly low initial concentrations (i.e. between 1 and 100 ppb). First generation products are too volatile to lead to any significant SOA formation. As discussed in the paper, SOA contributors are formed after multiple oxidation steps, mostly after the removal of 1-octene. This explains the distinct shapes

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of the time-dependant growth curve simulated for the 1-octene and the time-dependant growth curve observed by Ng et al. (2006) for larger monoalkene.

General Corrections (graphs):
» where there is a logarithmic scale on the axis, the numbering system on the figures alternates between (0.1, 1, 10, 100...) and (10^{-1}, 10^{0}, 10^{1}, 10^{2} ...). Keeping to one system here might improve clarity.
The numbering system of the logarithmic scales on the figures has been homogenized.

Reply to comments by referee 2:

Specific Comments:
»Page 11234, Line 10. Should this be Ymax.
The sentence has been corrected: "The dependence of SOA formation on Mo is generally discussed by observing the evolution of the aerosol yield, Y, versus Mo"

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 11223, 2007.