

***Interactive comment on “Investigating the use of
secondary organic aerosol as seed particles in
simulation chamber experiments” by
J. F. Hamilton et al.***

Anonymous Referee #1

Received and published: 8 December 2010

Review of [Investigating the use of secondary organic aerosol as seed particles in simulation chamber experiments]

This paper reports results of SOA chamber experiments conducted at the Manchester environmental chamber. Seed particles of β -carophyllene SOA were created by reaction in the smog chamber, diluted, and used as seeds for partitioning limonene SOA. The amount and composition of gas and particle phase species were characterised with a number of new techniques, including some advanced offline techniques.

This paper is interesting and deserves to be published. I question, however, whether

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ACP is the most appropriate journal for this paper. When I finished the paper I asked myself: what have I learned about the atmosphere or atmospheric chemistry from this paper, that I did not know already? Unfortunately I came up empty. This paper is really about chamber measurement techniques, in particular the trick of using SOA as a seed, instead of the more common sulphate seed or seedless experiments performed by most groups. It seems to also be a first literature description of the Manchester environmental chamber and its instrument suite. For that reason relatively detailed descriptions are provided, for example the chamber setup and functioning. Some newer techniques are used, but they are used mostly superficially (for example the 2D GC data in Figure 5). My recommendation is that the paper is published in Atmospheric Measurement Techniques (also an EGU journal) instead of ACP, after a revision to address the issues listed below. I understand that this transfer is possible and relatively straightforward because they are both EGU journals with close connections between their editorial boards.

Detailed comments are included below with page and line number at the start of each comment

25120-9, I suggest writing [one possible explanation]

25120-14, [it can be considered more reasonable] is awkward

25120-16, the advantages & disadvantages of using inorganic vs organic seed particles are not well summarised in the paper. Surely the SOA seed has some advantages, but it also introduces additional uncertainties. For example the seed may evaporate over long times even if it does not in the short dilution period. Also the seed makeup is quite different than the limonene SOA as exemplified by the O:C data presented later. Activity coefficients for limonene SOA will be higher than one and distort its composition, favouring partitioning of less polar species and decreasing partitioning of the more polar ones. Also partitioning of limonene SOA will increase activity coefficients of less polar seed species, causing some of them to evaporate. Then some chemical changes

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such as those in figure 6 could arise for this reason, etc. The paper should include a prominent table of pros and cons of each approach.

25120-22, my understanding is that most experiments in the past have used dry ammonium sulphate, rather than aqueous AS. For example see papers by Odum et al.

25121-10, use of pure component organic seeds, or of mixtures of a few components, is dismissed without sufficient discussion. Some disadvantages are given, but as discussed earlier the SOA seed also has some disadvantages. It is my impression that use of simpler OA seeds has not been explored all that much in the literature, and deserves further study. This type of seeds should be added to the table suggested above.

25122-18, as this paper seems to be the first one about the Manchester chamber, more detail is needed about how the lights were tuned and evaluated.

25122-22, some HEPA filters are known to give off large amounts of VOCs that could make SOA. Has this effect been evaluated? The brands and model numbers of the charcoal, purafil, and HEPA filters should also be given, or a previous paper cited if it exists. For the same reason a diagram of the chamber should be given.

25124-5, need error bars representing the variability of temperature and RH during experiments

25124-12, the type of NO_x detector used is known to have artefacts due to NO_y species (see for example Dunlea et al., Atmos Chem Phys 2007). Has this effect been evaluated or corrected for in any way?

Recent results suggest that the NO₂/NO ratio may be an important parameter in some SOA chemistry (Chan et al. Atmos Chem Phys 2010) so it is recommended that this value is varied in future experiments

25124-25, what is N6.0?

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25125-7, what are the units of 1/4 ? Is that really ID and not OD? (The latter is much more common)

25126-18, more detail on Peltier units is needed

25128-11, MW should probably be MB

25129-16, an SMPS & an Aerodyne MS were used here, can the authors derive density from those measurements as others have done?

25130-9, volatilisation may have occurred over longer time scales and this needs to be acknowledged

25132-14, particle losses should be discussed more clearly here

25132-17, my understanding of the Ziemann results is that species of intermediate volatility may be most affected. Species of very low volatility will partition to particles very quickly and not have time to get to walls. Species of intermediate volatility will stay longer in the gas-phase -going in and out of particles- and will have more of a chance to reach walls. This effect will depend on the particle surface area concentration.

25133-17, the work of Li et al. was not mentioned before. The contrast needs to be expanded upon at this point.

25133-26, it is confusing to talk about the [detailed composition] here, when only rough patterns are discussed for the most part

25134-16, change [correlates] to [qualitatively correlates]

25134-20, no evidence is given about 350C being insufficient to volatilise some of the b-c SOA. How is this known?

25135-1, is it really proper to shift all the peaks by 23 Da? Electrospray still makes other adducts such as those formed by protonation. This may then introduce a large error.

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25135-3, the evidence for the statement in the sentence starting by [using] is not given and needs to be.

25135-24, what about N being present in the SOA? There are high levels of NO_x in the chamber so some organic nitrates will be formed. This seems too rough and simplified.

25136-5, the word [exactly] should not be there. The electrospray signal does not scale with concentration at all in many cases. Some species may not be ionised at all, while species that are easy to ionise will have intense signals despite low concentrations.

25136-9, can the authors compare these results with those from the AMS? Many people are presenting O:C ratios based on the AMS based on a 44 correlation. It is very important to compare both methods.

25136-17, it is not clear here whether the O:C / GF relationship is qualitatively or quantitatively the same as in Jimenez et al. A graph would be best. Otherwise the statement needs to be labelled as qualitative

25148, the size of the particles in the upper graph needs to be given in the caption

25149, figure 5 is very difficult to read. A white background should be used instead of a blue one. Axes are needed. Zooming in the region of interest would help

25150, all the labels in figure 6 are tiny and difficult to read

25151, labels of figure 7 are too small, and a different colour contrast is needed (white for no signal instead of dark blue)

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 25117, 2010.

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