

Interactive comment on “ α -pinene secondary organic aerosol at low temperature: Chemical composition and implications for particle viscosity” by Wei Huang et al.

Anonymous Referee #1

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Review of ACP-2017-793 - α -pinene secondary organic aerosol at low temperature: Chemical composition and implications for particle viscosity

This is a concise manuscript that presents necessary research into the T_{max} interpretation from particle measurements utilising the FIGAERO ToF CIMS. I feel the results represent the work and analysis accurately, although I would suggest the following 2 points should be further investigated, as well as additional comments below.

1) I feel the application of a maximum calibration is inadequate for this work, or should be further investigated. The compounds measured are neither known to possess the maximum sensitivity nor in any way validated by calibrations presented. The further

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discrepancy with minimal mass loadings between the AMS OA and CIMS CHOI further support inaccuracies in this determination. N₂O₅ has been determined to possess the maximum sensitivity in the CIMS (Lopez-Hilfiker et al., 2015) which possesses no similar functionality or mass. Calibration of a compound which can represent the products is necessary to validate any quantification from the CIMS measurements.

2) A variation of RH and temperature is interpreted to change the T_{max} of thermograms from CIMS. It would be possible to calibrate for inactive or isotopically labelled species in varying temperatures and RHs to isolate these variables and prove via independent tests that they are indeed responsible for variations in T_{max} through changes in viscosity.

Line 13 – Change comma to semi-colon: Karlsruhe Institute of Technology; the Aerosol

Line 21 – insert “the” with “the filter for gases or utilising the filter for gases”

Line 45 – replace like with “such as”

Line 46 to 48 – Very short sentences. I advise to rephrase or extend

Line 56 – VOC should be VOCs

Line 60 - Give a range of upper contribution of SOA from monoterpene oxidation products

Line 63 – Superscript radical charge

Line 66 – use O₃ instead of ozone as already defined previously or maintain ozone throughout

Line 77 – “SOA is a highly dynamic system” – It does have a highly dynamic system but is phrased badly

Line 85 - I would restructure sentence not to start with “E.g.”

Line 125 – Temperature should be temperatures

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Line 130 – Instead of “right next to” describe distance or rephrase

Line 159 – Relative humidity (RH) has been defined a number of times in the paper so the acronym can be used throughout rather than repetition

Line 177 – Can a correlation be quantified between AMS and SMPS?

Line 179 - 180 Capitalise all or none of the letters used for the instrument acronym

Line 181 – Restructure sentence

Line 191 – Why was the maximum sensitivity attributed to these products? Furthermore, was a calibration performed to define this or merely taken from another CIMS sensitivity?

Line 192 – Were any backgrounds performed with no alpha pinene and varying ozone concentrations to quantify background oxidation of the chambers?

Line 195 – How was this calculated- can this temperature account for change in properties of deposited compounds on the filter? Can it be described how this was accounted in the interpretation of the results?

Line 205 – Please provide a validation as to why the measurements were not wall loss corrected and why this is interpreted as not necessary

Line 213 to 214 – The AMS observes a lower limit range of total organic mass (67.5) than the CIMS (97.8), which I cannot see possible. I disagree with applying a maximum sensitivity, which I describe below, but also this surely should then result in a minimal concentration. Here it seems the CIMS can overestimate the low concentrations and underestimate/represent the high concentrations. The selective ionisation and change in sensitivity, as stated on line 221, would make the CIMS mass always less than the AMS as the maximum sensitivity is applied.

Line 224 – There must be more validation of applying the maximum sensitivity to all products. I would like to see a calibration of an available compound which is of similar

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mass or structure to that of the products observed. The maximum sensitivity is usually applied to halogens or non-collision limited species. None of this has been exemplified here and I would therefore guess that this plays a much larger error in the concentration reported from the CIMS.

Line 240 – The loss due to evaporation could be quantified to a more accurate extent by running a double filter measurement by placing a filter further upstream of the current collection point. By performing a collection and desorption with two and one filters in line, some state of loss due could be accounted for.

Line 256 – Change biggest to largest or highest

Line 272 – Can error bars be added to this to illustrate a significant change between experiments

Line 294 – Thermograms has already defined, as well as T_{max}

Line 370 – I agree with all interpretation with respect to T_{max} variation, although I would like to see this determined under controlled conditions. Would it not be possible to calibrate for a compound, for instance a C10 deuterated carboxylic acid loaded into the chamber with varying mass loadings, RH and temperature. I feel there could be more work after the campaign on repeating T_{max} variation due to the factors determined to be significant as found by the chamber experiments.

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