

Reply on RC1

Rebecca A. Wernis et al.

Author comment on "Development of an in situ dual-channel thermal desorption gas chromatography instrument for consistent quantification of volatile, intermediate-volatility and semivolatile organic compounds" by Rebecca A. Wernis et al., Atmos. Meas. Tech. Discuss., <https://doi.org/10.5194/amt-2021-156-AC1>, 2021

Thank you for your insightful comments on this manuscript. Your main and technical comments are reproduced below with our responses inline in bold.

Main Comments:

Pg 3 Ln 27: The way this sentence is written, it implies the cTAG can measure all precursors and all of their related oxidation products in SOA across 15 decades of volatility, but that is not the case. The GC columns are probably quite limited in which oxidation products they can transmit. And while the GC does provide speciation of isomers, there are other instruments (CIMS or PTR) that can measure precursors and a much wider variety of oxidation products (including in SOA with FIGAERO, or some custom PTR inlets) with which you can infer some of the important speciation by comparing with previous GC studies. While the advances in this paper are certainly quite useful and fill an important niche, I suggest tempering the language here and elsewhere a bit, especially when discussing the abilities to measure the range of oxidation products.

We appreciate your comment and completely agree with these changes. We have expanded the discussion of the limitations of GC earlier in the introduction section, removed the sentence in question, and modified the remainder of that paragraph as follows: "The Comprehensive Thermal desorption Aerosol Gas chromatograph (cTAG) combines an I/VOC collector based upon the design of Gentner et al. (2012) and one channel of the SV-TAG joined together before a HRToFMS to access a broader volatility range of speciated organic compounds in a single instrument than previously achieved. Nonpolar and some polar VOCs and IVOCs as well as nonpolar and derivatization-amenable polar SVOCs are quantitatively collected, including many primary and secondary organics that lend insight into important sources and oxidation processes in atmospheric chemistry."

Pg 10 Ln 6: I don't think you need Section 3 as a separate section. When I first read it, I was confused why you weren't showing me any results, e.g. the calibration curves, how the ozone scrubber worked. Then I saw you give the results in basically duplicate sections in Sect. 4. I think it would read much cleaner if you just move the text from Sect. 3 into the corresponding spots in Sect. 4, so it doesn't seem duplicated.

We agree that the flow of the manuscript is improved by combining these sections and have made this change.

Pg 18 Ln 14: For a casual reader, it is really hard to identify the three groups of correlated compounds in this plot for two reasons. First, it's just a lot to take in. I think it would be very useful to put boxes around the correlated groups to clearly show the reader where to look, e.g., one box around the top left, one box around the correlations from undecane through phytane, and one box around the bottom right correlations. And second, you're discussing these as volatility groups in the text, but the figure doesn't have any of that volatility information. Can you include an alkane equivalent volatility scale, like you do with the dashed lines in Fig 7?

We have made the suggested changes to the figure.

Pg 20 Ln 12: Here is another example where "organic compounds" is too broad, and I think you will help the reader by specifying the subset of compounds that can be measured, e.g., nonpolar, weakly polar, unoxidized and lightly oxidized, etc.

Pg 20 Ln 14: There are certainly other instruments that can measure VOC emissions, reactive intermediates, and secondary products at greater than hourly resolution on a single instrument. Even if you add the qualifier of "speciated", you should again temper the language by explaining the subset of compounds that can be sampled in relation to what is out there in the atmosphere. I'm not trying to put down the GC measurements, I just think there is no reason to overstate the capabilities. The GC is certainly useful for atmospheric measurements, and the reader will be better served by having a clear idea of the cTAG's capabilities and limitations.

Thank you for highlighting these two sentences as needing changes. We have modified the language to read "The Comprehensive Thermal Desorption Aerosol Gas Chromatograph is a novel instrument capable of measuring nonpolar and some polar organic compounds as well as some more oxidized semivolatile organics from C5 through C32 alkane-equivalent volatility on two separate channels connected to a single HRTofMS. This set of quantifiable compounds encompasses many key VOC pollutants, reactive intermediates, and secondary products, all captured at hourly time resolution. The expanded range of measurable compounds allows for more robust source categorization, with detailed chemical specificity of each identified source category."

Technical Comments:

Pg 5 Ln 11: Here you say the glass beads do not trap I/VOCs, but in the Fig. 2 caption you say the IVOCs are captured on the glass beads. Doesn't matter scientifically, but make sure these are consistent.

Thank you for pointing out this inconsistency. We have edited the Fig. 2 caption removing the mention of glass beads in that sentence.

Pg 11 Ln 24: When you say "this technique is effective for some sesquiterpenes as well", it reads like you're saying the sodium thiosulfate is effective for removing sesquiterpenes, since the previous sentence was about ozone removal. I believe you mean sodium thiosulfate is effective for removing ozone artifacts while sampling sesquiterpenes? Please reword.

We have reworded this statement as follows: "Pollmann et al. (2005) demonstrated that this technique is effective at preventing ozone reaction artifacts for some sesquiterpenes as well as the previously studied

monoterpenes and hydrocarbons."

Pg 13 Ln 10: The "10" line number is somehow in the middle of the table.

Thank you for pointing this out. This looks like a bug in the conversion from MS Word to PDF. We will make sure this issue is fixed for the final submission.

Pg 13 Ln 24: It would be helpful to quote your usual sample volume here.

Done.

Pg 17 Ln 12: Since you're saying here that the data in Fig 7 come from these several locations, you should probably specify here or in the figure caption which panels (a-f) came from which locations.

We have added the locations in the Fig. 7 caption.

Pg 17 Ln 16: Need to define BTEX and PAH.

Done.

Pg 17 Ln 18: Use "SVOC" instead of "SV" to be consistent.

Done.

Pg 18 Ln 7: Do you have a citation or evidence for conversion of phthalic acid to phthalic anhydride on the collection cell? Maybe not necessary but could be good to document.

We do not have a citation for this, but our group has observed this using an authentic phthalic acid standard and this interpretation has been our standard practice. We have altered the parenthetical statement to read "We have found through laboratory testing of an authentic phthalic acid standard that phthalic acid converts to and is detected as phthalic anhydride in cTAG."

Pg 19 Ln 1: In Fig. 7, you should switch your labels to read "I/VOC channel" instead of "VOC channel" to be consistent with the earlier text.

Done, thanks.

Pg 24 Ln 1: Some journals require all data to be publicly available at the time of publication, e.g., with a doi instead of just upon request. Perhaps the authors will consider adopting this standard even if AMT does not require it, in order to encourage high standards of research in the future.

Thank you for this suggestion. We will consider adopting this practice in the future, but for this publication our data will remain available upon request, which is sufficient to comply with AMT guidelines.