

## Reply on RC2

Rebecca A. Wernis et al.

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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-AC2>, 2021

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

### Main comments

While the instrument is very impressive, it is subject to the inherent limitation of sorbents, gas chromatography, and complex sampling systems. While there is derivatization of the SVOC channel, there is none on the I/VOC channel. These limitations inevitably mean that more polar species will be lost, such as multigeneration reaction products. That is fine, every instrument has its limitations, but I agree with reviewer #1 that the review paper needs to provide a more realistic assessment of the strengths and weaknesses of this instrument in the context of atmospheric chemistry. While I am sure we will learn a lot from the deployment of this instrument, it inevitably will need to be complemented with other techniques.

The discussion is focused on individual species, which are used as indicators of sources and atmospheric processes (e.g. Figure 10). However, as these authors know well, many lower-volatility species cannot be separated using traditional one-dimensional chromatography. This is clear in the chromatographs shown in Figure 7 which show large "humps" of unresolved complex mixture. The revised paper needs some discussion of this limitation; for example, including an estimate of the fraction of the atmospheric organic mass they believe this instrument is speciating or detecting.

**Thank you for raising this point. We agree that more clarification on the types of compounds this instrument can detect is warranted. We have expanded the discussion of the limitations of GC in the 3<sup>rd</sup> and 4<sup>th</sup> paragraphs of the introduction, including predictions of the quantifiable fraction of gas-phase organics and particle-phase organics of the techniques used in this instrument based on prior literature. We have also altered the language used in the final paragraph of the introduction and first paragraph of the summary section to better reflect what this instrument can and cannot measure.**

More polar species likely will be more challenging than hydrocarbons. The example calibration curves (Figure 4) are all for hydrocarbons. It would be helpful to display results for some more polar (challenging) compounds. Is the instrument response as

linear and well correlated? There is discussion in the text of instrument performance for one ketone. Figure 5 does not show many sticky compounds.

**Thanks for pointing this out. We hope that changes made in response to your previous comment as well as the other reviewer's first main comment partially address your concerns; that is, we are not claiming to be able to measure very polar compounds on the I/VOC channel. On the SVOC channel we are able to see some polar compounds due to the use of online derivatization, but that is not the focus of this paper as it has been documented elsewhere (Isaacman et al., 2014).**

**In Figure 4 the focus is on the gas-liquid comparisons on the I/VOC channel, for which we are limited by what species we had available in a gas cylinder, which were almost entirely hydrocarbons. In Figure 5 the focus is on ozone-reactive compounds.**

Minor comments

In the text you say that glass beads do not collect any organics, but in caption for Figure 2 you say they collect IVOCs. I believe the latter is correct, but the text should be made consistent.

**Thank you for pointing out this inconsistency. Reviewing the breakthrough volume for glass beads (<https://www.sisweb.com/index/referenc/glassbed.htm>) suggests a negligible amount is retained on them during sampling. E.g. for dodecanol, the least volatile compound in the sisweb table referenced that we would analyze on the I/VOC channel, the breakthrough volume on 10mg of glass beads would be 5 mL, much less than our sample volume of 1 L. We have therefore edited the Fig. 2 caption removing the mention of glass beads in that sentence.**

"Additionally, for benzene all data points had the mean of the 0 ppb values subtracted from them" I found this confusing. Presumably 0 ppb values are when you are running instrument on "zero air" or something similar.

**We have reworded this statement to read "Additionally, for benzene all data points had the mean of the zero air only (0 ppb) values subtracted from them..."**

The evidence of evaporation of tricosane in Figure 10 is a neat result.

**Thanks!**