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Reviewer Comment on amt-2021-156

Anonymous Referee #2

Referee 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-RC2>, 2021

Review of "Development of an In Situ Dual-Channel Thermal Desorption Gas Chromatography Instrument for Consistent Quantification of Volatile, Intermediate Volatility and Semivolatile Organic Compounds" MS No.: amt-2021-156

This paper describes the design and testing of an automated instrument for field measurements of a broad spectrum of organic compounds from VOCs to SVOCs. Given the importance of atmospheric organics, this instrument will be a useful addition to many field studies. The new instrument combines many previous "TAG" technologies developed by this group over 15 years that have been described in previous papers.

The paper describes the instrument, results from experiments to characterize a variety of performance characteristics from compound breakthrough to ozone scrubbing, and some sample field data. The experiments appear to be carefully performed and the paper is clearly written. I recommend the paper be published after the authors have address the following comments.

Main comments

While the instrument is very impressive, it 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 atmospheric chemistry. While I am sure we will learn a lot from the deployment of this instrument, it inevitably will need to be complimented 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.

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.

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.

"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.

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