

Interactive comment on “Estimation of atmospheric total organic carbon (TOC) – paving the path towards carbon budget closure” by Mingxi Yang and Zoë L. Fleming

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Yang and Fleming are to be commended for tackling the challenge of measuring total organic carbon (TOC) in a manner that promises to bypass some of the limitations of previous attempts. Having thought about this for some decades, it seems clear that a catalytic conversion technique of this kind is the only way to capture the entire range of volatilities and functionalities inherent in the family of non-methane organic compounds. The authors correctly point out that high precision measurements are the key to being able to do this, since ambient CO₂, CH₄, and CO need to be subtracted from a total signal to obtain TOC. After consideration of the details in the manuscript, I

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would like to suggest various adjustments to the inlet design/material and catalyst material/configuration to potentially improve the measurement performance and precision. Based on my previous experience designing inlets for ambient sampling, the hot catalyst surface should be the first surface that the sample flow encounters, as semi- and low-volatility VOCs and particle-bound VOCs will reversibly partition to inlet surfaces and cause delayed instrument responses and effect quantification. The authors should consider mounting the catalyst system at the front of the analysis system to minimize these effects. Secondly, we have found, in our previous research (Veres et al., 2010), that the platinum catalysts of the type used by Yang and Fleming work well for small flows, however result in undesirable flow restrictions and pressure drops when used for applications that demand larger flows. Consequently, we developed a catalyst based on platinum screens that allowed much higher sample flows (Stockwell et al., 2018). Lastly, Teflon PFA is permeable to CO₂, which results in increased instrumental error due to a drifting and flow-path dependent backgrounds that are difficult to capture. As a result, we have converted parts of the system to nonpermeable stainless steel or Synflex 1300 (sometimes called Dekabon) tubing (no endorsement implied, there are probably others that would work). We offer these suggestions, based on both our published laboratory development of similar techniques as well as our unpublished results that were core to the design processes in our systems, in hopes that it may help to further improve the promising technique described in the work by Yang and Fleming. We look forward to seeing how this technique works with an on-line CO measurement added to the experiment.

References

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