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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Total Observed Organic Carbon (TOOC): A synthesis of North American observations" *by* C. L. Heald et al.

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In their paper the authors combine observations of organic substances in the atmosphere to derive a proxy for Total Organic Carbon (TOC), which they call Total Observed Organic Carbon (TOOC). Based on this they look into the dependence between TOOC and several important atmospheric trace components and identify the main contributions of individual components or groups of components to TOOC.

In my opinion one of the most important aspects of the paper is that the authors present strong arguments for studying TOC. I tend to agree with the overall conclusion that serious efforts to completely understand atmospheric TOC are required if we want to predict the consequences of future changes in trace gas emissions, may they be technological and economic developments or the consequence of climate change.

Most atmospheric chemists will be aware of the basic problem that there is a gap between TOC and TOOC, although not everyone may agree on how important filling this gap may be. The authors mention two possibilities to narrow this gap. One possibility is to develop experimental methods to measure atmospheric TOC. The other possibility, using the authors' words, is to "include as comprehensive as possible suite of organic measurements" in atmospheric trace gas studies.

The usefulness of the first approach is limited by the inevitable problem that any experimental method measure TOC will result in an operational definition of TOC, and thus not necessarily be a valid "true TOC" measurement. Nevertheless, based on the tremendous advances analytical techniques made during the last decades, it may well be possible to develop instrumentation, which is sufficiently inclusive to provide a useful approximation for TOC. The present lack of TOC data to some extent may be due to the extreme difficulty in making such measurement, but it also may be the consequence of investing insufficient resources and efforts into development of such techniques.

The concept of combining measurements of individual components of TOC to determine TOOC values also has its merits; the presented impressive list of components included in TOOC is testament to the rapidly increasing ability of the atmospheric chemistry community to analyze the organic components in the atmosphere and I am certain that we will see further substantial progress in the future. Although currently progress in measuring components of TOC is not primarily driven by the intention to minimize the gap between TOOC and TOC, it will nevertheless reduce the magnitude of the unknown part of atmospheric TOC. However, this may not necessarily answer the question at which point the gap between TOOC and TOC has become sufficiently small to be ignored for the practical purpose of relating changes in trace gas emissions with relevant consequences for our environment.

Developing TOC measurement techniques and comparing with TOOC may be one, possibly the only, way to answer this question. This is the one aspect in which the paper did not fully meet my expectations. While the authors make a strong point for the

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usefulness of TOOC, I miss a more detailed discussion of how to obtain more insight into the actual magnitude and importance of the “TOC-TOOC gap”.

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