

Interactive comment on “Comprehensive two-dimensional gas chromatography (GCxGC) measurements of volatile organic compounds in the atmosphere” by X. Xu et al.

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We appreciate the comments by P. Ciccioli and A. Lewis. The comments by P. Ciccioli raise some issues, which can be summarized as (1) GC×GC versus GC-MS and (2) ignorance of previous achievements. It seems to us that some parts of our paper has been misunderstood by P. Ciccioli. We would like to make the following comments, which hopefully can remove any misunderstandings.

(1) GC×GC versus GC-MS

In our paper, we do not state that our method (i.e. GC×GC) is superior to GC-MS. However, we do address the superiority of GC×GC over 1D-GC in terms of separation. Since our paper does not present any comparison of GC×GC with GC-MS, there is no such thing as we “intentionally avoid to cite literature showing that conventional GC-MS

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allows to identify and quantify more than 650 components in a single sample".

As we are confronted with the GC×GC versus GC-MS issue, here we would like to express our opinions about the two methods. Because MS is both a detection and a separation technique (through m/z), GC-MS can be viewed as a kind of two-dimensional method (see e.g. Philips and Beens, 1999). In this context GC-MS can be compared with GC×GC. Indeed we believe that GC×GC is a more powerful separation technique than conventional GC-MS. This is not groundless, but supported by literature. Comments by A. Lewis, a user of both techniques, already provide some arguments for GC×GC. Schoenmakers et al. (2000) compared the separation power of GC×GC with that of GC-MS. In conclusions of their paper, they state:

"In summary, as a separation technique for complex hydrocarbon mixtures, GC×GC is currently almost as powerful (at the class level) or more powerful (at the more-detailed levels) than GC-MS is ever likely to become. In addition, GC×GC has great advantage due to its potential for quantitative analysis. Because FID can be used, GC×GC is much more robust, reliable and reproducible."

On the other hand, we are not ignoring the strengths of GC-MS in VOC measurements. GC-MS can assist compound identifications, but GC×GC not. That is why we used TOF-MS for initial identification.

Quantification of atmospheric VOCs is a subject of our paper, too. We have been using FID for detection. The advantages of FID are discussed in the last paragraph of Section 2.3 in our paper. In view of the high separation power of GC×GC and the universal nature of FID, we believe that a GC×GC-FID system better serves our purpose, i.e., simultaneously quantifying as many atmospheric VOCs as possible. This statement should not contradict the fact that some VOCs can be better measured using GC-MS.

(2) Ignorance of previous achievements

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In his comments on our paper, P. Ciccioli states that we try to promote our work while trying to ignore what has been successfully achieved in the last 30 years. We are very sorry that he has gained such impression.

It is true that we did not check thoroughly whether or not the compounds in our identification list (Table. 2) had already been found in air by other scientists. Indeed we believe that most of them (if not all) have been detected at different sites by scientists using other techniques. Because of this we do not state in our paper that we first detected any of these compounds in ambient air. We present the list in Table 2 just as identification results, with the hope that they can be of interest for the future users of GC×GC. Some references are cited in Table 2 because they provide RIs that confirm our identifications. Other existing (very numerous) papers that report identified atmospheric VOCs, including the paper suggested by P. Ciccioli (Ciccioli et al., 1999), are not cited. We do not think this is an ignorance of achievements in the last 30 years since the purpose of our paper is not to tell the readers which compounds have already been found by other scientist and which not.

To avoid further misunderstandings we will add a paragraph at the end of Section 3.2. We will cite some previous studies and emphasize our points.

Reference

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