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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Emissions of non-methane volatile organic compounds from combustion of domestic fuels in Delhi, India" *by* Gareth J. Stewart et al.

Anonymous Referee #1

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In this work, the authors measured emission factors of volatile organic compounds (VOCs) emitted from combustion of a variety of fuels commonly used in India. This is an important topic for both atmospheric chemistry and human health, since domestic fuel combustion is associated with one of the leading causes of morbidity and mortality globally. The authors used a comprehensive suite of analytical techniques, and measured emission factors for a wide array of VOCs. In particular, the combination of PTR-MS and multiple GC techniques is highly complementary and provides detailed information about the emissions. In addition, the fuels studied are very commonly used in India and would provide important data and insights. From experimental design to data analysis and interpretation, this work is of the highest quality and potential impact.

I recommend publication in ACP, and my suggestions and comments here are minor and for reference only.

One of the major strengths of this study is its direct relevance. The authors stated that they used "expert local judgement to ensure conditions replicated real world burning conditions". It is unclear what that means from a technical standpoint. Precisely what variables are replicated to reflect local practices? (e.g. fuel types, forms of fuel, humidity etc.) How should future studies replicate the results presented here?

In multiple instances, the authors noted that PTR-MS measured higher amounts than GC techniques for the same compounds, and attributed to "unidentified isomers". I am curious to learn more about this issue. If a particular PTR-MS m/z is assigned to a compound that has multiple isomers, and in GC there is an associated peak (which represents one of the isomers), shouldn't the comparison be made between PTR-MS m/z and the sum of all isomers measured by GC (i.e. sum of multiple peaks)? If the "unidentified isomers" are not observed by the GC, that would imply these "unidentified isomers" are chemically different from the proposed compound, and therefore PTR-MS is actually misidentifying these isomers.

It is not surprising that cow dung cake and municipal solid waste had the highest emission factor, but what is the typical quantity burned? I imagine the fuel wood would be much more commonly used. It might be useful to clarify whether with the high emission factors of cow dung cake and municipal solid waste translate to higher contributions of VOCs.

Figure 3 shows an interesting trend: there seems to be two rather distinct phases of burning in A and B. Was this typical of all burns? If so, why is that the case, and what do these phases represent?

Minor comments:

Line 37: "400 Tg yr^-1" and "annually" in line 38 are redundant

Line 110: due to

Line 131: unclear what 6000-7000 kt yrˆ-1 is referring to. Is it total VOCs?

Line 162: range of

Line 181: does the quartz filter potentially remove gas phase species such as IVOCs?

Figure 1: I understand that the x-axis is referring to longitude, but I initially mistook it as ion.

Line 306: Since this is the results section, the title “Chromatography” is not very helpful. I suggest a more descriptive title.

Figure 2: Are the units of the color scale arbitrary? Are each of the samples obtained with the same volume of air sampled? If so, it might be useful to clarify and emphasize that, because if the color scales and the air volume sampled were the same, then solid waste and cow dung are indeed emitting more VOCs.

Figure 3: it is not directly obvious to me that from Region A to C the average m/z is increasing. Perhaps show the median mass, or overlay these diagrams, or stack them vertically with a common x-axis?

Line 380: How is ACES an abbreviation of broadband cavity-enhanced spectroscopy?

Line 383: 1 +/- 30% can be misleading. I suggest 1+/- 0.3

Line 387: “These previous comparisons underline the challenges faced with quantitative NMVOC measurements. . .” this sentence seems to contradict the previous sentences. It seems that correlation coefficients are generally >0.8 in the literature, which is the same as what was obtained in this study. It seems to be this level of consistency is to be expected. (Perhaps that’s what the authors mean?)

Figure 7 may be too detailed and many of the labels are far too small to see. I struggle to see the message conveyed by these figures. I suggest showing figures that support

the discussion in 3.4 and minimize information overload. Line 528: “however” might not be the best conjunction. “But” is more grammatically correct.

Line 547: Since IVOCs are being reported, what is the typical PM concentration? Are the PM concentrations high enough for IVOC to partition into the particle phase?

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