

Review ,Considering the future of anthropogenic gas-phase organic compound emissions and the increasing influence of non-combustion sources on urban air quality'

ACP-2017-761

This paper presents a detailed look at VOCs, specifically delving into their representation in emission inventories, what details are (or are not reported) relating to composition, and their ozone and SOA formation potential. The authors spend some time as well to investigate intermediate-volatility and semivolatile organic compounds that are typically not included in standard emission inventories and are exempt from emissions targets, but in need of greater attention in the future. Finally, the misattribution of some of the VOCs to fossil fuel from e.g., vehicles, while some likely originates from e.g., petrochemical processes, which also have a fossil fuel feedstock, needs to be considered in source attribution.

This paper adds interesting and novel points to the literature and is generally well written and well organized, if a bit long and drawn out at points. I would recommend publication after addressing some minor points for revision.

Comments:

L116-118: the use of the 'pp' prefix seems unnecessary given that it is then only used ca. 20 pages later and only twice. When it is initially explained here the point seems odd and unnecessary. When it is then applied much later, as a reader you have to go back and figure out where that came from so that you are clear what is meant. It would be clearer to just remove the initial text and just explain the 'products and processes' source when discussed at that one point later in the text.

Overall, the paper has both appendixes and SI. It is not clear what the criteria are for having information in an appendix versus in the SI. I would suggest to combine these all into the SI. Furthermore, there are a number of figures and tables in the SI that are referred to quite often in the text. I would suggest that the authors consider moving some of these to the main text. Supplemental information should really only be for information that provides a level of detail that most readers will not be interested in, but is important for those who e.g., might want to apply some of the methods to their own analysis or really dig into the details. For example, I would suggest moving e.g., Table S2 or Figure S3 to the main text. If there is a concern that there are too many figures/tables in the main text, you could move figure 4 to the SI, which I find adds less than some of the other figures.

L245-246: the SOA yield estimate – what is this value based on? And is this in general or specifically for the unstudied compounds? More information would be good here to clarify what is meant and where these numbers come from.

L248-250: can you give some information as to the magnitude of this? Are we talking an order of magnitude or 10%? A rough indication is fine.

L269-270: please add some more information to clarify how the composition is calculated. The source categories are based on the CARB inventory, but where is the speciation coming from? Or are you explaining what you will be doing with the speciate database and then MSDSs etc that is explored in the following sections. This isn't clear.

L313-315: Can you provide some more information as to the comparison to the speciate profiles? Percent of single-ring aromatic content is listed in the text for a couple of products and for more in Table 2, but a comparison percent is not provided for the speciate source profiles. There is a comparison listed, but this seems to be from a different source and not speciate. If this is the comparison to speciate, please be explicit about this. One could also consider adding information to the table.

L315, but also more generally (L337, L342, L371, etc): sometimes the term solvents is used, at other times consumer products, sometimes product/process-related VOCs. How these terms are used and where the overlap is or is not, needs to be defined. This would really help the clarity of the manuscript. In some cases (not necessarily how it is used here), solvents is an umbrella classification for consumer products, paints, etc. But it could also be a more limited definition.

L390: is there any indication of how much is missing. You cite how much is included, but can the missing amount be estimated at all from your analysis? Even if it is only for a couple of products or is just an order of magnitude range?

L509/Figure 5: as stated in the text and in the figure caption, the product emissions have SOA yields and ozone formation potentials on par with other major urban sources as a function of mass emitted. What about overall. It would be good to explicitly include this information based on your EI estimates here, also with a comment on whether you find the sources to be underestimated or not, as these are really some of the important implications of this work.

The last two italicized sub-sections in section 4.2 seem a bit disjointed from the rest. With the first one on off-road combustion, I see what you are getting at with this, to just show the importance of off-road in the broader context, also for products/processes, but it is quite long and drawn out. I think this could be shortened significantly and the same points made (also because this really isn't the main aim of the paper at all). Following on from that the section on modifying factors then seems pretty random and short. Could these points be integrated elsewhere? Possibly in the beginning of 4.2 as part of an intro/context for SOA/ozone formation?

L671/Inclusion of IVCOs... section: This section could be shortened a bit and made more concise.

Edits:

L144: evaporation of a solvent from a product or during a process – this is a bit awkward. From a product, is it meant here during storage? Or during use? Can this be clarified?

L168: why is 'curing' in quotes and none of the others are?

L196-197: 'other additional methods details' such as what? It would be good to mention what those are that are relevant to the text just outlined.

L230: '...the U.S. National Emissions Inventory and emission inventories from the Global Emissions Initiative (GEIA) were used for....'

L236: write out EMFAC

L237: write out LEV

L275: '...such as those discussed in section 4.' We are in section 4 and it has loads of subsections and examples, etc. so can you be more specific?

L281: here, as well as some other cases (e.g., L450), please add a 'from' before listing a % or concentration range. E.g., '... from 3-100% ...'

L308: reference Fig 3b as well as S4 because they essentially show the same thing. The only thing that S4 adds is the uncertainty(?) or standard deviation(?) associated with the compound classes. Please specify in the figure caption for S4 what the error bars indicate.

L318: add '...in the U.S.' at the end of the sentence unless this is inappropriate, in which case please specify the region.

L326: '...where provided' (currently just provide)

L426: 18-29 Gg, of how many total Gg VOC emissions per year in CA? Is this a lot or not? Context would be good to add here (even if the info is available elsewhere).

L442: larger asphalts? What is meant by this? Larger VOCs from asphalts that degrade to form smaller VOCs?

L459-460: please define 'cutback asphalt'

L461-463: how are these references also relevant for the EU inventories?

L516: is the additional 25% reduction relative to 1990, or relative to the 2015 amount?

L535: only 5% for which year?

L605: 'their emissions' can you please be explicit and mention which ones? it is not clear here.

L621: it would be good to give an e.g., and mention some of the other anthropogenic sources explicitly.

L636-637: This sentence is awkward and needs to be rewritten.

L663: might be good to reiterate the three pathways from section 2.