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Discussions

Interactive comment on "Source apportionment vs. emission inventories of non-methane hydrocarbons (NMHC) in an urban area of the Middle East: local and global perspectives" *by* T. Salameh et al.

Anonymous Referee #1

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The authors use two datasets comprised of 56 non-methane hydrocarbons, CO, and NOx measured in winter 2011 and summer 2012 at a suburban site near Lebanon in order to investigate the relative contributions of various NMHC sources in the region using positive matrix factorization. The output of the source-receptor model is used to identify the major NMHC sources by comparison to measured sources and literature values, quantify the relative contributions of each modeled source, compare seasonal differences in sources and source strengths, and compare the source factors to local and global emission inventories. Gasoline and traffic-related sources are the largest

contributors to observed NMHC levels in both seasons. The observed NMHC to CO ratios are used to compare the PMF-derived source profiles associated with on-road transportation to emission inventories. The authors have determined that the relative contribution of the on-road transportation sector to total NMHC emissions agree with the inventory; however, the overall magnitude of NMHC emissions in the inventory may be underestimated by a factor of 1.3-1.6 in the Lebanon NEI and a factor of 2.7-3.4 in global emission inventories for the road transport sector.

I recommend publication with major revisions as detailed below:

Major comments:

1. The NMHC measurements are not presented in the manuscript, only the PMF outputs are presented. In the introduction, the authors state that data in this region of the world is particularly scarce and is only limited to a few pollutants. I'm curious why the authors would not publish their measurements here, even if it appears in the supplemental material. If the NMHC measurements are published elsewhere (or will be), then it should be made more clear within the manuscript. It looks to be a very valuable dataset that would be very useful to the larger scientific community.

2. The author's state that photochemistry was negligible, but do not provide any basis for this conclusion. This is particularly important topic since the PMF results show 2 different traffic related sources in which the author's identify by day and nighttime traffic patterns. Please provide a brief description of how the author's came to this conclusion as is very important for the interpretation of the PMF results.

3. The uncertainties (i.e., the actual numbers) of each NMHC should be clearly stated in Section 2. Why did the author's not include CO and NOx (especially as NO or NO2) in the PMF analysis? It's not clear which species were excluded from the PMF analysis. For example, P26802 L10 says that species below detection limit were excluded, but P26804 L7 says they were replaced by $\frac{1}{2}$ the detection limit, while P26813 L17 states that terpenes and OVOCs were not included in the PMF analysis. Does this mean

they were measured, but excluded? If so, why? P26804 L5: What constitutes "missing data"? Were whole samples replaced by median values or only a few individual points within a sample. What percentage of the data was missing or replaced?

4. There is very little discussion on solvent use as a potential NMHC source as the PMF analysis did not resolve a factor for this potential source. Does this mean that solvent use is a negligible source in the region, as least in comparison to traffic related sources? If so, how does this compare to the emission inventory?

5. Figures 2 and 7 are extremely hard to decipher and yet they are the subject of the majority of the discussion section. In the current format, the species names are un-readable and it is very difficult to compare the contributions of the various sources to a particular compound (e.g., propane). Suggested changes include stacking the various Factor outputs (panels) vertically so that the width of the graphs can be expanded and the names of the individual species can more easily read on the bottom of the figure. Also, it would make more sense to arrange the species by chemical family (alkanes, alkenes, aromatics, etc.) rather than by retention time which has nothing to do with the source profiles or interpretation of the PMF results.

Minor comments and technical corrections in order of appearance:

P26797 L13-16: I'm not sure what the following means: "The national road inventory shows lowest (lower?) emissions than the ones from PMF but with reasonable difference (?) lower than 50%. Global inventories show higher discrepancies with lower emissions up to a factor of 10 for the transportation sector." Please rephrase.

P26798 L5: urbanization –> urban

P26798 L11: deteriorated –> deteriorating?

P26798 L24: Non-Methane Hydrocarbons does not need to be capitalized.

P26798 L24-P26800 L5: This is one massive paragraph that can easily be split into multiple smaller paragraphs that will be easier to read and digest.

P26799 L4: exhausts –> exhaust

P26800 L14: "and" in China

P26804 L1-4: Why can the integration error be neglected? What is a "coverage factor"?

Move Section 4.1 to Section 2

P26804 L23-25: Is domestic heating source included in Factor 1 (regional traffic)? This is confusing.

P26807 L14: Please describe what "hot soak" refers to.

P26807 L18: Remove "In fact," and "the" before light-duty

P26808 L1" "The fingerprint is consistent with the one of other gasoline evaporation profiles." Please rephrase for clarity.

P26810 L7: North-East –> northeast; South-West –> southwest

P26810 L11: It says that the emission increase, but does the composition change? The composition is most critical to the PMF analysis.

P26810 L24: change "suggesting the gas leakage" to "suggesting natural gas (or liquefied petroleum) gas leakage"

P26812 L30: "...but always maintained as the main contributor to NMHC emissions." This needs rephrasing or removal.

P26813 L8: "...and is associated with levels of uncertainties..." I'm not sure what this means.

P26813 L27: somehow –> somewhat

P26815 L1: "reasonably underestimates" Remove "reasonably" or rephrase.

P26815 L3: "estimated to be 29 Gg"

P26815 L22: "estimate to be 8 Gg, which is a factor of 6 to 10 lower than the annual emissions…"

P26815 L25: "factor of 2 to 3" …what?

P26815 L28-P26816 L3: This is an incomplete sentence and the meaning is unclear.