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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Can Positive Matrix Factorization identify sources of organic trace gases at the continental GAW site Hohenpeissenberg?" *by* M. Leuchner et al.

Anonymous Referee #1

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The authors perform PMF analysis on 7 years of in-situ, daily NMHC measurements from a site in Southern Germany. They perform some tests of the PMF model assumptions to evaluate the robustness of the results and the appropriate number of factors they use. They interpret the resulting factors qualitatively in terms of a combination of source profiles and compound lifetimes.

It appears the main findings are 1) the PMF analysis leads to plausible results that bear a general resemblance to various emission sources; 2) the abundance of the longer-lived compounds was higher than the shorter lived compounds; 3) anthropogenic NMHC were higher in winter than in summer; 4) isoprene is higher in summer and

has high reactivity.

One could certainly learn something useful with this type of long-term dataset . . . for instance, emission trends, possible seasonality in emissions for various compounds, etc. But the analysis here doesn't provide any of that. In the end it's not clear that we've learned anything here that wasn't already known. As such I don't believe the paper rises to the level of meriting publication in ACP.

Specific comments.

8156, 15 and subsequent discussion throughout the rest of the paper: 'short-lived compounds emitted at constant rates throughout the year . . . would be factors of about 7 higher in winter than summer'. This will clearly depend on the lifetime of the compound at hand. Later on you apply this reasoning to interpret the seasonal cycle for different compound groups in terms of whether there is a likely seasonal cycle in emissions (i.e. if the winter:summer ratio differs from 7, which is the OH ratio). This is a nice idea, but what is needed here is a simple box model calculation of the summer:winter ratio you would expect as a function of lifetime, given constant emissions. For instance, later (8160, 26) you apply this reasoning to the "remote" factor. However ethane is the main compound for this factor, and it is almost inert in winter (lifetime 450 days at OH = 1e5 molec/cm3). Clearly the steady-state argument is not valid here. It also seems that this type of analysis is much better suited to the compounds themselves than the factors, because of the dependence on lifetime.

A couple other points to consider for that type of analysis: rate constants also vary with temperature (not just OH); and prevailing transport patterns (i.e. air mass origin) will likely differ seasonally.

8161, 24: 'long-lived evaporative compounds had factor 7-9 higher mixing ratio contributions in winter than in summer, although their atmospheric turn-over remained the same all over the year'. What is being said here? That alkanes have the same loss rate in summer as winter??

8146, 10: ‘and in particular NMHC’ . . . why in particular? Are NMHC the main category of VOC contributing to ozone production compared to OVOC?

8146, 19: ‘expected a strong increase of biogenic NMHC emissions caused by temperature stress’ . . . not clear what the context is here.

8146, ‘while in urban areas they (biogenics) play only a minor but non-negligible role’. Surely this would depend on the urban area, wouldn’t it? What about a city like Atlanta?

8160, 24: ‘ethane appears as an indicator for aged air masses’. This is phrased a bit oddly. Surely ethane is present in pretty much all air masses. It’s really the absence or low abundance of other (shorter-lived) compounds that indicate aged air masses . . . only the longer-lived compounds like ethane are left.

8151, 12: ‘obtained reasonable agreement’ . . . what does ‘reasonable agreement’ mean in this context?

8159, 23: ‘aromatics possibly had larger fetch areas during winter due to the longer life-times’ . . . why ‘possibly’? Doesn’t this stand to reason?

8154, 12: ‘CO is a product of incomplete combustion’ . . . it is also produced photochemically in the atmosphere.

8154, 14, ‘NO and NO2 are mainly emitted by combustion engines’ . . . what about power plants etc?

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 8143, 2014.