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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 #2

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This paper utilizes PMF to identify the sources of hydrocarbons in 2003-2009 measured at a rural site (Hohenpeissenberg). This study can be important to help interpretation of the measured data sets and also other remote measurements of VOCs. PMF is a widely used tool to conduct VOCs source apportionment, but PMF results may need to be interpreted with caution. This study aim to explore the possibility of using PMF results at this remote site. It is an important and interesting work, but it cannot be published in ACP before some major revisions are made.

(1) This paper brings out that PMF assumption is violated at a rural site. The authors also state that photochemical aging of VOCs can distorts PMF results to identify the

possible emission sources of NMHCs (Yuan et al., 2012). But the paper did not pay many efforts to discuss this problem. The methods used in Yuan et al. (2012), e.g. contributions dependence with hydrocarbon reactivity, using two profile ratios to derive their photochemical relationship, are not mentioned or conducted at all. It would be interesting whether the methods are useful at this remote site and whether the methods will support the authors' conclusions.

(2) The authors spend several paragraphs in Section 3.2 to describe each factor in detail, which make the reader aware of all of the details. This is the good way to do it. However, Section 3.3 and Section 3.4 provide very little information for the PMF results. These two sections can be both described by one or two sentence. However, this information may be useful for some readers. Thus, it is recommended moving these two sections into supporting information. Thus, it leaves more room for result of other investigations, such as those from comments #1. The 4th paragraph in the conclusion section is very interesting and it should be expanded and included in the discussion part (not just in conclusions).

(3) The authors only used 13:00 CET measurement data. I am very interesting to see the results of using only 1:00 CET data or using all of the data. Whether you will see similar factors and similar contributions. Little difference should be expected, since there is not local source even the mixing layer is much shallower in the night.

(4) The two terms "factor profile" and "Contribution of each factor to the species" is better to describe Fig. 1, Fig. 5 and Fig. 7. Also, most of PMF studies normalize the apportioned mixing ratios (left part of Fig. 1) to get the factor profile.

(5) Biogenic factor: I agree with you that Factor I is related to biogenic activities, at least partially. Based on the description of this factor, I think two conclusions should be made clearly in the end of the two paragraphs: (a) The factor may represent biogenic sources, but mixing with other sources is also present; (b) If the authors want to use this factor as biogenic factor, the contribution of biogenic source would be overestimated (at least by

a factor of 4-5). This overestimate is based on the profile: the factor only contributes 14 pptv of isoprene, but it contributes 49 pptv of ethane. I do not expect 4 times of ethane coming from plant emissions. This may reflect the difficulty of separating biogenic and anthropogenic sources by PMF, as discussed in Section 4.2 in Yuan et al., 2012.

(6) Remote sources: I also agree with the author about this factor. This factor should represent continental background or North Hemisphere background. Is that possible to compare the resolved concentrations with the background values measured at other remote sites (such as in the middle of Pacific/Atlantic ocean).

(7) I do not totally agree with the authors about the assignment of factors II, III, IV and V. I would think PMF just grouped the species into four different subsets. The lifetime of the four groups are: Factor IV>Factor V> Factor III>Factor II. I think it is fine to define them as short-lived and long-lived, but assigning them into combustion and evaporative sources are ambitious and also meaningless. Some evidence against with the authors' arguments: (a) Both of the two factors (Factor III and Factor V) show some correlation with CO or/and NOx/NOy, indicating some combustion sources are mixed in the two factors. (b) Toluene has similar lifetime as ethene and xylenes have similar lifetime as propene. Toluene and xylenes should also be emitted from vehicles but they are present low in Factor II, thus Factor II may be just a subset of combustion emissions. Thus, these factors should be assigned to specific sources with caution, until there is more information to support that. The results from Comments #1 may be able to get some insights.

Minor comments: (1) CO is spelled out in P8154 L12, but CO is already present in the above paragraphs. Other species are not spell out. PAN is spelled out in the introduction, but the abbreviation is not shown (P8146 L11).

(2) P8157 L3. 'Relative contributions are the fractions of each substance contributing to each factor" should be ". . .. of each substance attributed to each factor".

(3) Section 3.2.2: What are the meanings of the percentage numbers in the parenthe-

sis.

References:

Yuan, B. et al. VOC emissions, evolutions and contributions to SOA formation at a receptor site in eastern China. Atmos. Chem. Phys. 13, 8815-8832, doi:doi:10.5194/acp-13-8815-2013 (2013).

Sauvage, S., Plaisance, H., Locoge, N., Wroblewski, A., Coddeville, P., and Galloo, J. C.: Long term measurement and source apportionment of non-methane hydrocarbons in three French 20 rural areas, Atmos. Environ., 43, 2430–2441, 2009.

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