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Comment

***Interactive comment on “Diurnal variations of residential particulate wood burning emissions and their contribution to the concentration of Polycyclic Aromatic Hydrocarbons (PAHs)” by L. Poulain et al.***

**Anonymous Referee #1**

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Poulain et al. paper presents a comparison of on-line and off-line measurements on NR-PM1 aerosol in a mid-level mountain area in Saxony (Germany). The source apportionment study is performed using HR-TOF-AMS data and PMF analysis together with tracers from filters. The main focus is in the impact of residential wood burning and PAHs in the NR-PM1 fraction.

The work is based on a classic approach of PMF analysis and external tracers. There is an interesting comparison between off-line and on-line data (as total monosaccharide anhydrides and methyl-nitrocatechols). The experimental section and the PMF

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analysis are briefly treated. More details are needed in those two sections.

The written English is quite poor in some paragraphs and should be revised. A good number of typos should be corrected (end of my comments).

General comments and questions:

1) More details are needed in 2.2.1 section. Page 11584 line 12-15. The ambient humidity was on average 89%. This does not mean that the same RH is found in the sampling line and before the AMS orifice. Which is the residence time of the particles in the sampling line, which is the humidity just before the inlet? This is important in choosing CE values. The RH can highly change if the sampling flow is slow and the outdoor and indoor temperatures are very different. Please comment on this and add details.

2) More details are needed in the PMF section. They are presented without any type of quality details (Q/Q<sub>exp</sub>, errors matrix calculation and so on). There is a total lack of discussion about the many possible solutions from PMF analysis. How many FPEAKs and SEEDs have been tested? Which solutions have been chosen and why? Need of some critical discussion about the many possible PMF solutions.

3) Table 1 and figure 1. NR-PM1 sulphate is 26% and nitrate 21%. This means that they equally contribute to the inorganic PM1 loading. Sulphate is not dominating the inorganic fraction as the authors state.

4) Figure 2. The section about diurnal profiles is quite confusing and not convincing. Organic loading is almost the same during working days and week-ends from fig2 left plots. I would expect some difference, since human activities are enhanced during the working days. Your BBOA with higher values in the early morning and late evening should not be connected to residential wood-burning instead of wood decoration factories, unless those factories have highest productivity at 8h00 and 19h00-20h00. If HOA is associated to both vehicle exhaust and residential heating, should it be possible to

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differentiating the two using different tracers correlation plot? (ex. NO<sub>x</sub>, CO and so on. See DeCarlo, ACP, Milagro, 2010). Which is the time series correlation (regression plot) between BBOA and HOA data? Could you use this to separate the two HOA contributions? How can the authors state that m-cresol could be related to SV-OOA when they do not measure it at all? You measure only C<sub>x</sub>H<sub>y</sub>O<sub>z</sub>N<sub>w</sub> which is associated with BBOA.

5) Since a HR-TOF AMS allows evaluating O/C ratio why the authors did not presented them for the different factors and compared to published data?

6) P. 11588 last paragraph: the authors state that OH chemistry can explain the SVOOA. If OH is processing semi-volatile species you should see a diurnal cycle of this fraction and a SVOOA type material arising in the middle of the day (if you had enough photochemistry and OH around). It is not the case during working days. How much Ox (O<sub>3</sub>+NO<sub>x</sub>) and photolysis were present in March? The discussion and diurnal pattern of LVOOA do not confirm this. You say that is it probably produced during burning processes and this is why it has the same time evolution of BBOA. I think there is some contradiction between what you show in fig. SI2, what you say in p. 11588 and 11590.

7) P. 11591 line 16-27. If the PAHs arise from residential heating why they exhibit 20-45 minutes short-term events? Heating a house should take longer? More details are needed.

8) P. 11592 line 16. How did the authors decided that PAH/BBOA=0.03 is a good ratio for separating PAHs from wood burning and other PAHs sources?

Small details and typos:

1. Table 1 there must be an error in the total PM<sub>1</sub> filters the sum should be 5.15 and not 15.18 as written in the first line.

2. P. 11586. "Two-thirds of weekend appended during lower particle concentration pe-

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riods” should be rephrased. Append=add. I guess the authors wanted to say “happen or occur”.

3. Page 11587. Line 9-11. It is a little confusing. I will rephrase it as follows “ the corresponding BBOA factor was identified by comparing its factor mass spectrum with the one published by Lanz et al 2007 (Fig. S2 in the Supplement) and with the time series of the AMS-HR K+ signal (Fig.3)”

4. P. 11587 line 28: “ using wood burning and liquid fuel for domestic heating are emitted at the simultaneously” delete “at the” in bold

5. P. 11588. Take away a dot before Weimer et al.

6. P. 11590 line 8. Rephrasing suggested “Most of the time HOA and BBOA profiles correlate, suggesting that HOA is mostly correlated with residential heating”.

7. P. 11590 line 15: take away the ; and put a comma before diurnal.

8. P. 11592 line 28. Rephrasing suggested “. . .PAHwb was assumed to contribute to about 62% of the total particulate PAHs mass concentration”.

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