

Atmos. Chem. Phys. Discuss., referee comment RC2
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Comment on acp-2021-393

Anonymous Referee #2

Referee comment on "Annual exposure to polycyclic aromatic hydrocarbons in urban environments linked to wintertime wood-burning episodes" by Irini Tsiodra et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2021-393-RC2>, 2021

General comments

This study investigated the sources of ambient carbonaceous aerosol, particularly PAHs, in the area of Athens, Greece. The authors made good use of filter-based measurement methods for PMF analysis with organic molecular markers to link PAH concentrations and composition with specific sources, e.g. biomass burning. The analysis is thorough and generally clear. A few issues should be addressed: (a) figure quality could be improved, (b) the authors should more clearly state the novelty of the study relative to previous studies in the region, and (c) ACSM data should be discussed in more detail and in the context of the filter samples.

Specific comments

All figures: The figures are pixelated and hard to see/read – please save the images in higher resolution

Seasonal trends: How does Dec/Jan 2016-2017 compare with Dec/Jan 2017-2018 in terms of PAH concentrations, source contributions, etc.?

Lines 74-84: There have been several previous studies of ambient air quality in Greece and how it is impacted by domestic biomass burning in particular, as the authors reference earlier in the introduction. Please explicitly state the novelty of the present

study: other than being more recent, how do the sampling techniques/locations/times and analyses employed provide new insight? This would also be a good opportunity to discuss the use of complementary filter-based and online (?) techniques and what additional insight these provide, as using both of these is a strength of the study.

Lines 128-133: Describe ACSM monitoring in more detail. Was this conducted at the same site as the filter sampling? What were the sampling dates/duration?

Lines 133-136: Describe the method used to apportion BC into fossil fuel and wood burning contributions, as this is a secondary calculation for interpretation rather than primary data from the instrument

Lines 180-183: Include numbers from this study for reference, and change "which however included 7" to "7 of which were"

Figure 1: Stacked bar plots with this many different categories/colors do not provide useful information. I recommend presenting the individual PAH concentrations in a table, which would facilitate direct comparisons with other data sets in the future. The barplot could instead show monthly averages of HMW/MMW/LMW PAHs using the same colors as in the pie charts below, which would provide the reader with an overview of both absolute and relative concentrations of general PAH categories.

Lines 234-242: Why is the ACSM data only discussed here? If it is included in the manuscript, it should be discussed further: for example, how the ACSM SoFi and filter-based PMF source apportionment compare, and the temporal trends in ACSM data. Which ACSM sources would likely include PAHs based on chemical signatures, and do these source contributions correspond to PAH concentrations? Also, clarify exactly what m/z 60 and 73 are thought to represent (for readers less familiar with AMS data). Do they correspond with filter-based levoglucosan measurements?

Lines 293-295: How was CO measured?

Figure 3: Given that the carcinogenic risk of PAHs is summarized in the analysis as BaP equivalents, what is the purpose of showing both "c" and "d" pies (carcinogenic PAHs and BaP_{eq})? Though individual PAHs have differing degrees of toxicity, the numbers end up being very similar between c and d, so it doesn't seem necessary to present both in the main manuscript. Individual pies for OC and EC apportionment would be more interesting from a chemical perspective. It would also be helpful to label each pie with a short title, in addition to the more detailed descriptions in the figure legend.

Technical corrections

Line 26: Change "effective" to "present"

Line 27: Change "lead" to "leads"

Line 32: This refers to total measured PAHs? Clarify

Line 41: Add "such as" before "power and industrial plants"

Line 46: Change "Particular PAH members" to "Several PAHs"

Line 49: BaP equivalents? Clarify.

Lines 54-56: Wouldn't it make sense to cite Saffari et al 2013 here, too?

Lines 178-180: Need references

Lines 329-330: Change "time-series" to "from non-local sources" (I believe that is what this is referring to, but currently it is unclear)

Line 336: change "lighter members" to "LMW PAHs"

Lines 382-383: "transport" should be followed by a semicolon (;), not a comma (,) and "its variability and origin" should be "their variability and origins"

Line 414: Shouldn't BaP_{eq} be written with a subscript, i.e. BaP_{eq}? (here and throughout the rest of the manuscript)

Line 441: Do "GAA" and "central Athens basin" refer to the same region? If not, clarify, and if so, be consistent