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Atmospheric Chemistry and Physics Discussions



# *Interactive comment on* "Contributions from transport, solid fuel burning and cooking to primary organic aerosols in two UK cities" *by* J. D. Allan et al.

**Anonymous Referee #2**

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This paper describes results from PMF analyses of three Aerosol Mass Spectrometer (AMS) datasets collected in the UK, two from London and one from Manchester. The authors consider the effects of rotation on the solution and use comparisons with external data to identify the best solution. They also present the range of apportionment results in addition to the "best" solution. The two London datasets were from the fall (Oct 2006 and Oct-Nov 2007). The Manchester data were from the winter. The analysis shows that POA (motor vehicles, cooking, and residential heating) contributes 50% or more of the organic aerosol. Of particular importance is the major contribution cooking aerosols at a site that does not appear to be strongly influenced by a very local source (e.g. Lanz et al. study). The linkage between this factor and frying is nice.

Finally, the authors also derive ratios of combustion OA emissions to CO.

This paper is of interest to readers of ACP and should be published after the authors address the following comments:

A major component of the paper is the apportionment of POA and states (e.g. in abstract) factor contributions relative to POA. This is fine if one has a clear idea of the POA/SOA split. However, I read through much of the manuscript without understanding this split. I think that at the beginning of the discussion you need to have a separate section that discusses this split and compares it with results from previous AMS PMF studies (the paper does have a SOA section here but that section is focused on whether there are multiple types of OOA factors and not their total contribution). Once you establish the relative importance of POA and SOA you can then focus on the different POA factors.

My impression is that in many locations OOA always seems to be the dominant factor in AMS data sets (e.g. Zhang 2007 GRL paper). Is this a correct conclusion or are the Zhang results biased because there are many more summer datasets? Are your high levels of POA ($\sim$75%) consistent with other AMS studies? If they are not that seems to be a pretty significant conclusions.

SFOA – I found this terminology a little imprecise. Maybe it would be better to call it solid fuel for domestic heating? That is a mouthful, but solid fuel by itself is misleading. For example, you don't think that emissions from solid fuel combustion for electricity generation are contributing to this factor. If someone just reads the abstract they will be left with the wrong impression of this source because it never mentions space heating.

SFOA – You seem to be identifying this factor based on the levoglucosan signature and temporal pattern. There are some HOA like aspects to the factor. What does the inventory say about the relative importance of the difference types of solid fuel combustion, wood, coal, etc?



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9, C6570–C6573, 2009

Deriving POA/CO ratios for solid fuel combustion and motor vehicle emissions provides a good test for inventories. However, the authors need to add an estimate of the uncertainty to their ratio. The values stated in the abstract have three significant digits which implies a high level of certainty. I suspect that issues with the PMF solutions and the need to subtract off background concentration create substantial uncertainty. Given these uncertainties how different are your results from previous studies.

I found the differences between REPARTEE1 and 2 analyses interesting, notably the absence of the SFOA factor and higher level of OOA in REPARTEE1. A 4 oC shift in temperature seems relatively modest to create such a big shift – no SFOA versus $\sim$ 20% SFOA. 20% does not seem like a "weaker" source. Does the SFOA contribution correlate with temperature or some other markers of residential heating emissions? Presumably there is some SFOA in REPARTEE1, but that it is not separated from OOA.

Figure 6 – I found this figure difficult to read. Comparing the median results for the studies was straightforward, but all of the dashed lines for the quartiles were a mess. E.g. I found it very difficult to distinguish between the blue and black cases. Maybe remove some of the dashed lines or break the figure into additional panels? Are the quartiles really that important?

In at least two places the authors used a phrase like biased toward POA. I thought this was pretty awkward because I often think of bias as an error. Rewording this would be good. Maybe something like split shifted towards POA or a Larger contribution of POA, etc.

Finally, I found the paper long and hard to follow in places. It presents a lot of results, some which distracted from the main focus on source apportionment. For example, the elemental analysis of the HR data from REPARTEE2 was interesting, but did not fit in well (it disrupted the flow about source apportionment). Section 3.3 seemed long and unfocused. Deleting and/or reworking some of the extraneous material and focusing



ACPD

9, C6570–C6573, 2009



on the core results would improve readability and impact.

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Interactive comment on Atmos. Chem. Phys. Discuss., 9, 19103, 2009.



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9, C6570–C6573, 2009

Interactive Comment