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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Modelling carbonaceous aerosol from residential solid fuel burning with different assumptions for emissions" *by* Riinu Ots et al.

Anonymous Referee #2

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The paper contains interesting information on important sources of emissions in a major urban area. I have one major concern, but after attention to the points below this paper should be suitable for publication on ACP.

My main worry concerns the assumption that the SFOA (and other POA) emissions are inert. In most VBS modelling studies such emissions are allocated to a number of VBS bins, and allowed to evaporate and react with OH. Further, the results presented for London in Xu et al. (2016) do not show any large SFOA contribution to the low-volatility OM mass, suggesting that the high fractions found in Young et al were of semi-volatile OA. Assuming inert emissions will tend to overestimate the PM concentrations

associated with this POA. The authors should re-visit and investigate the implications of their inert assumption.

Connected to this, what is the likely status of the emission measurements behind the SFOA inventory for the UK? Do the techniques used to produce the emission factors include condensables? With so much focus on one emission category, and the fact that condensables are a 'hot' topic (Denier van der Gon et al, 2015, Ciarelli et al., 2017), the authors should inform the readers more about such properties.

This issue of volatility and associated uncertainties seems to be ignored throughout the manuscript.

Other comments

Page 2, L10. The Bergstrom reference is a PhD Thesis. Give the published papers instead.

Page 2, L5-15. What about emissions from cooking?

Page 2, L16. What is the 'Great London Smog' - give a reference.

Page 2, L33. I believe Belgium has also included condensables in their emissions estimates, which brings me back to the point raised above.

Page 3, Sect. 2.1: The text should give some details about the SOA framework used here. What assumptions are made about SVOC, IVOC, and aging? What was done for ASOA and BSOA?

Page 3. The statistics given for model performance are useful, but they seem only to refer to London. How about elsewhere, since this paper deals with the UK as a whole?

Page 4, Add the ion labels for SO4, NH4 and NO3. (For example NO3 is a gaseous compounds important for night-time chemistry, whereas I think the authors mean the nitrate ion.)

Page 5, L4 claims that Ots et al. (2016a) showed that modelled SFOA were substantially underestimated at North Kensington, but according to Table 3 of that paper the SFOA PMF factors were convolved with the OOA2 factors.

Page 6, Fig. 2. Units of Mg/km2 would be easier for comparison with other studies.

Page 11, Sect 3.2. Measured profiles of SFOA result from a mixture of emissions profiles, atmospheric dispersion, and PMF interpretation. The model should capture the first two, but I wonder how much PMF contributes. For example, if the diurnal emissions profile is responsible for the concentrations profile, why would SFOA emissions peak around midnight for N. Kensington?

Page 12, L13 and associated text and Figures. Were these "exceptional" concentrations also seen for other pollutants, for example NO2. Would model performance for other components help the analysis here? (Also, the word exceptional seems a bit excessive here. Are such concentrations really so infrequent?)

Page 21. The WRF model is also open source, and details should be included here. I think section 5 and 6 could also be merged, since the code is mentioned in both. Currently it is confusing though, since Sect. 5 says code should be obtained from www.emep.int, but Sect. 6 says code is from the University of Edinburgh.

Appendices: This type of information is typically provided as Supplementary material.

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