**Atmospheric
Chemistry
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Discussions

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Interactive comment on "Receptor modelling of both particle composition and size distribution from a background site in London, UK" *by* D. C. S. Beddows et al.

Anonymous Referee #2

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GENERAL COMMENTS

I recommend this manuscript for publication in ACP.

The contents are relevant and of interest to the scientific community. The manuscript is well-organized and the findings are presented in a clear manner. There is a lot of work behind the manuscript presented and the conclusions are meaningful for the scientific community. Both the PM10 and the particle number sources in the London urban background have been identified and quantified. To this end two years of measurements were carried out, both for PM10 chemical composition and for particle number

size distribution. The sources have been identified and quantified using Positive Matrix Factorisation (PMF). A combined PMF was also carried out. Nevertheless, some improvements should be made before the work is published in ACP. Please find some suggestions below.

1. The size range covered by NSD does not reach 10 μm, hence it is obvious that the NSD source apportionment cannot identify the coarse sources, such as marine and crustal. As it is written now it seems that the only reason for not identifying these sources with the NSD data is that some sources are more important for mass and others for particle number, which is true, but if one does not measure at all in a size range, it does not matter how important is the source, it is impossible to see it. This could be pointed out already in the abstract.

2. The investigation of back-trajectories and their relation with the variation in source contributions could be improved. Now only the days with maximum contribution of one of the factors are investigated. What happens with the second-highest day? And the third? Now, only info from Table 2 is shown for the days with the highest (>P90) contribution of each factor. The authors could classify every day of the sampling period based on the back-trajectory and calculate the average source apportionment for each type of back-trajectory. This would confirm (or not) the explanations that are now given in the manuscript about the relation between air mass origin and source contributions. This comment applies for both the PMF results from the chemical and the NSD datasets. The comparison that is now made in page 10136 between the back-trajectories for the day with highest contribution from each source depending on the database (chemistry or NSD) may change if a broader set of data is considered (as opposed to only the day with the highest contribution).

SPECIFIC COMMENTS

3. How often were the 24h samples collected? Daily?

4. Page 10128, line 21. Please clarify what do you mean by "where data from the

URG was not available laboratory based ion chromatography measurements on filters (Tissuquartz™ 2500 QAT-UP) from a Partisol 2025 were used". Do you mean lost samples? Concentrations below detection limit? Or species that can not be analysed by URG?

5. Page 10128, line 23. Please clarify "Data capture over the two years ranged from 48 to 100 % as different sampling instruments varied in reliability". There are different things to report. First: the sample collection: did you aim to collect samples daily? How many valid filter samples were collected? Second: the chemical analysis: from the collected samples, how many were analysed successfully? Explain better why do you have different % of valid samples for each species. A short explanation on the limitations of the analysis is expected, because you actually use the same URG.

6. Page 10129, line 3. Please explain which sampler (and with which inlet size cut) you used to collect PM samples on quartz filters for subsequent EC and OC analysis.

7. Page 10129, line 6. You could say something more than only 'similar'. Add the reference for the EUSAAR_2 thermal protocol: Cavalli et al., 2010.

8. Page 10129, line 7. Please provide the size range from the SMPS and the time resolution.

9. Page 10129, lines 11-12. Please explain which sampler did you use and with which inlet size cut to collect PM on Teflon-coated glass fibre filters

10. Page 10130, line 15. It is not really true that the explained variation values show which constituents are the most important in each factor. What do you mean here with 'important'? It is rather that the source for which the EV is very high for one species is the most important source for this species. And it is true that it helps identifying the sources, but maybe the authors want to re-write the sentence.

11. Page 10130, line 18. Please re-write. The measurements are not made by the factors or sources. You can introduce the term 'contribution' here.

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12. Supplement: you wrote that you use SMPS+APS data, but you do not report any APS data in the main manuscript.

13. Supplement: please check thoroughly. Some typos/mistakes have been found. E.g. page 4: "within each factor as defined the in parametric form"; "For a given p factor solution there a (p+1) 'factor' is outputted..."

14. Supplement: there are two Figures S1.

15. Supplement: explain what is FKEY and why you need to apply it.

16. If CWOD is OA from wood burning, if you use both OC and CWOD for your PMF, you are using as an input something that is not independent, given that part of OC is CWOD. Why don't you use hence CWOD and then an estimation of non-wood-burning OC as a separate variable?

17. Page 10132, line 13. Please explain better what do you mean by "consistent with exhaust emissions from road traffic resulting from factor pulling the EC and OC ratios". Consistent with previously measured EC/OC ratios closed to road traffic emissions? What do you mean by factor pulling here? If you used a constrain in the PMF for the EC/OC ratio, it should be clearly stated in the main manuscript.

18. Page 10132, line 27. You say for these factors the concentrations are higher in the cooler months, but actually for January the concentrations of non-exhaust/crustal are lower than those in Sep-Nov, why?

19. Page 10133, line 8. The higher Fuel Oil contribution in summer may also be attributed to its sulfate content, since sulfate formation can be enhanced in summer due to the higher photochemical activity in summer.

20. Page 10134, line 8. Why do the authors compare to Johnson et al. (2014)? Is there any specific similarity between Brisbane and London? There are many studies showing that shipping emissions affect ambient air concentrations of V (e.g. Pey et al., 2013; Zhao et al., 2013; Minguillón et al., 2014; Viana et al., 2014; among others).

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21.   Page 10135, line 16.   The correlations between BC concentrations from the aethalometer and the traffic contribution from NSD could be tested and reported to further confirm this factor.

22.   Page 10135, line 22.   As mentioned by referee 1, the supposed wood burning increased activity during the weekend should be better justified.

23. Page 10137, line 26. The study of the back-trajectories here could help. You may actually have nucleation under clean conditions for two (or more) types of air mass origin: marine air masses (your Aged Marine source) and other origin (your Nucleation source).

24. Page 10138. Polar plots. Where were the wind measurements carried out? At the same station as air quality measurements?

25. Page 10138. Polar plots. How did you do the polar plots for the PM10 chemical composition data? Did you use average wind for each day? Or did you use hourly wind data and plotted the same concentration for the 24 data points for a single day? Or?

26. Page 10142, line 21. The fuel oil factor was not apparent in the CMB results? What do you mean? When you mention previously which sources were included in CMB you do not mention fuel oil, hence it is obvious that it does not have any contribution, given the way CMB works. So, if it is a choice done a priori, the lack of the fuel oil source does not mean anything. Or do you mean an attempt with a fuel oil source profile was carried out with CMB and it was not well resolved?

27. Page 10143. While it is true that the combination of chemical composition of PM10 and NSD data did not added much to the identification of sources, it would be worth to highlight the conclusions one can reach from the combined source apportionment, in terms of which chemical compounds are responsible to which particle size distribution ranges, as also pointed out by referee 1.

28. Page 10143, line 22. Please clarify what this 4.5% corresponds to, is it one single

traffic source? The traffic contribution is present in three different sources, so the total traffic contribution is higher.

TECHNICAL CORRECTIONS

- Table 1. CWOD: Please correct "using uses"

- Page 10131, line 9: correct "campaign"

- Page 10137, line 12: use comma or semi-colon consistently.

REFERENCES

Cavalli et al., 2010. Toward a standardised thermal-optical protocol for measuring atmospheric organic and elemental carbon: The EUSAAR protocol. Atmospheric Measurement Techniques 3, 79-89.

Minguillón et al., 2014. Spatial variability of trace elements and sources for improved exposure assessment in Barcelona. Atmospheric Environment 89, 268-281.

Pey et al., 2013. Chemical fingerprint and impact of shipping emissions over a western Mediterranean metropolis: Primary and aged contributions. Science of the Total Environment 463-464, 497, 507.

Viana et al., 2014. Impact of maritime transport emissions on coastal air quality in Europe. Atmospheric Environment 90, 96-105.

Zhao et al., 2013. Characteristics and ship traffic source identification of air pollutants in China's largest port. Atmospheric Environment 64, 277-286.

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