

Interactive comment on “Size distribution, mixing state and source apportionments of black carbon aerosols in London during winter time” by D. Liu et al.

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Liu and coauthors describe SP2 measurements of BC size-resolved number and mass concentrations and mixing state at an urban site in London in the summer and winter seasons. Traffic emissions were identified as the predominant source in summer, while solid fuel combustion for home heating also contributed significantly to BC number and mass concentrations in the winter. A new data analysis approach, based on examining the relationship between BC core diameter and single particle scattering, is used for the first time to apportion the contributions of these two sources to BC measured by the SP2 instrument. Traffic-related BC exhibits smaller core diameters and coating

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thickness, while solid fuel BC is characterised by larger cores and thicker coatings. Due to the larger core size, the solid fuel contribution to total BC mass is higher than its contribution to total BC number concentration. Air masses of differing origins were also associated with different solid fuel contributions to BC mass and number concentrations detected in London. The two-dimensional separation of the two sources in core size/scattering space is quite convincing as shown in Fig. 5. The new approach was also demonstrated to perform as well as BC apportionment using multiwavelength aethalometer data and MLR analysis involving AMS organic aerosol factor temporal data associated with each source. Overall, this paper describes a robust alternative to using multiwavelength aethalometers, radiocarbon analysis or routine off-line speciation based PMF to apportion BC or EC in urban environments. This article should be suitable for publication subject to some minor revisions as outlined below.

General comments:

Title: I would suggest removing the letter ‘s’ after apportionment and aerosol. Also, were the measurements not performed in both summer and winter?

Was an SP-AMS available during the Clearflo campaign? It seems like a comparison between SP2 apportionment and SP-AMS full mass spectra or PMF factors would be relevant and useful here.

It is confusing at times whether the summer data are analysed here or not. For example in Fig. 6 they are included. Why refer to these data as a separate study throughout?

Figure 3: middle and bottom panels appear to have different air mass origin assignments at times.

Section 3.3: last paragraph needs to be rewritten as it is confusing in its current form. There is nothing wrong with the approach but the impact is reduced.

Page 16318, line 20-25: I don’t think the relative importance of local sources and processing can be assessed here.

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Conclusions: Rewrite last paragraph to improve grammar and impact.

Specific comments: Page 16293: line 22, replace 'or' with 'and' before easterly

Page 16294: line 1-2, replace hyphens with words to separate the air masses and value ranges, it is quite confusing in the current style.

16294, line 25: should be 'targeted'

16296, line 6: fix multi wavelength

16299, line 10: What is NK?

16299 and References: Best not to give a publication year for articles not reviewed or published yet. Simply 'in preparation' is fine

16302, line 3, should be 'beyond the scope'

16303, line 17, add 'countries' after Benelux

16305, line 1-5 is stated as a fact but should be rephrased as a hypothesis

16306, line 18: should be 'given that'

16307, line 24: replace sector with factor

16312, lines 1-3. Removing this line would be better as whether or not this compensation is happening cannot be determined

16312, line 4, mean mass median?

16312, line 6: Is the standard deviation really this low (around 1%)?

16312, line 23: receptor site?

16313, line 9-14: this sentence is difficult to follow

16314, line 4: Hyphenation makes this confusing

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16319, line 5: Traffic-related?

Figure 6, the error bars are $+\sigma$, no negative are shown. And the geometric mean is a factor of 10 higher than the median? Or maybe this is the standard deviation of the mass value at this diameter?

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