

Comment on amt-2022-53

Anonymous Referee #2

Referee comment on "Source apportionment of black carbon and combustion-related CO₂ for the determination of source-specific emission factors" by Balint Alföldy et al., Atmos. Meas. Tech. Discuss., <https://doi.org/10.5194/amt-2022-53-RC2>, 2022

The manuscript titled "Source apportionment of black carbon and combustion-related CO₂ for the determination of source-specific emission factors" by Balint Alföldy et al. introduces a method combining the Aethalometer model with the multi-linear regression analysis (AM-MLR) to provide the source-specific emission ratios (ERs), and emission factors (EFs) using the carbon content of the corresponding fuel. The study is interesting in terms of delineating the fossil fuel (FF) and biomass burning (BB) contribution of the real-time measurements of BC and CO₂ concentrations. A study of this kind is vital for better characterization of urban anthropogenic emissions. Although the authors have attempted to present the results in the best possible way, the manuscript lacks clarity on some of the aspects (including corrections) listed below:

Line 69: Correct 'adaption' with 'adaptation'.

Line 115: Is the multiple scattering parameter ($C=1.39$) dependent on the type of filter tape alone or do any other factors also influence the same?

Lines 104, 107, and 110: The sampling inlet altitudes above the ground (8 m, 3 m, and 10 m) are different in different locations with known background conditions. Is there any basis for choosing the different sampling inlet altitudes above the ground? How did the authors estimate the optimal altitude of sampling inlet in different locations?

Line 116: Will the wavelength-dependent Mass Absorption Cross-section parameter (MAC) provided by the manufacturer be applicable in all background conditions of sampling? Did the authors attempt to determine the wavelength-dependent MAC values to check the consistency with the values given by the manufacturer?

Line 118: Can we use the same flow rate and time resolution for the three chosen locations with varied background sources of influence and for different altitudes of sampling inlets?

Line 119: Provide reference to "... real-time loading effect correction ...".

Line 156: Can you please illustrate the integrative or derivative way of calculating the concentration ratio of two particular components of the plume?

Line 164: What is the threshold R² correlation value considered in this study? What is the basis for choosing this value?

Line 174: What is AMAC? Please provide reference to the conversion factor for converting CO₂ concentration from ppm to mg m⁻³.

Line 193: What do you mean by multi-linear regression analysis (MLR)? Provide a reference to the method.

Line 201: Do you apply the MLR method during a plume event? Until this line, there is no

mention of how the plume event is detected or identified.

Equations 3 & 4: For which wavelength do the BC^{FF} and BC^{BB} correspond? Provide clarity.

Equation 4: What are the units of BC^{FF} , BC^{BB} , CO_2^{bg} , and CO_2 ? Do they have the same units?

Line 210: What are the upper and lower bounds of the ER^{FF}/ER^{BB} ratio?

Figure 4: If the wide distribution of Emission Ratios (ERs) is because of varied number of sources and the actual composition of the traffic,

Line 349: What do you mean by "... different BC release relative to CO_2 emission"?

Figure 5: It would be nice if the diurnal variations of ER^{FF} and ER^{BB} are included for the other two locations (TRO and SKY) too.

Line 353: It was mentioned that ER values at BTC and TRO locations can be narrowed by data filtering based on the time. Can you please elucidate what data filtering you are referring to? Please provide clarity. On the subsequent line 356, you were referring that the same filtering was performed for the TRO location while no filtering was applied for SKY location since the ER values did not show a diurnal variation. This means that if the diurnal variation is not seen, then the data filtering is not performed. Can you please provide the physical basis and accuracy for following this type of approach?

Line 380: The usage of 'artefact' in the statement is unwarranted/unclear.

Line 385: "Lower EFs than those corresponding to individual sources published in the literature". How accurate are your EFs estimated with the AM-MLR method? It would be nice if the authors have attempted to test the AM-MLR method first with the individual defined sources (as per the literature) to ascertain the consistency of estimated ERs with those already reported. This will ensure the accuracy of ERs estimated with the AM-MLR method.

Line 391: Correct 'modus' with 'modes'.

Lines 439-440: It was stated that AM-MLR method cannot uniquely identify EFs from pure wood combustion (ideal case) but instead refers to the EFs of the general domestic heating including non-smoking sources as well.

Lines 494-496: I don't find any relation between ERs and distance of sources in the manuscript. Is this a speculative result?