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Comment on acp-2021-197

Anonymous Referee #2

Referee comment on "Characterization of non-refractory (NR) PM₁ and source apportionment of organic aerosol in Kraków, Poland" by Anna K. Tobler et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2021-197-RC2>, 2021

This article aims at apportioning the main constituents of submicron organic aerosols in Krakow, Poland, using state-of-the-art monitoring methodologies, from winter 2018 to spring 2019, i.e., before the ban of solid fuel combustion within the city is coming into effect. The manuscript can represent a substantial contribution to scientific progress in the fields of air quality and atmospheric chemistry, notably bringing new method and data. It is very well written and rather well structured, though maybe slightly too much concise. I would recommend its publication in ACP after the following major revisions:

- Quantification issues (i.e., concentration absolute values) could be of further particular interest when it will come to evaluate the impact of the ban of solid fuel on OA ambient air concentrations. In this view, the quality control of ACSM measurements could be reinforced here by mean of comparisons with independent co-located measurements, mainly with available PM_{2.5} monitoring data (which shall be added into Figure 1a and 1b). RF and RIE values retrieved from regular calibrations could also be presented and discussed as supporting material. Similarly, it should be stated more clearly than eBC concentrations are (apparently) used as provided by the AE33 instrument, i.e., no further application of any correction factor. This is possibly leading to some kind of 'underestimation' of the OA/eBC ratios presented in Table S1, when compared to other studies, e.g., in Europe.
- Authors are nicely explaining Line 247-250 that: "Although the aethalometer model (Sandradewi et al., 2008) was developed for environments dominated only by two combustion sources, namely traffic and biomass burning, the model still works well enough to separate liquid (traffic) and solid fuels (biomass burning and coal combustion)". One can further argue that liquid fuel combustion is not necessarily related to road transport only. For these reasons, eBC_{tr} and eBC_{wb} could be replaced by eBC_{lf} (for liquid fuel) and eBC_{sf} (for solid fuel) throughout the manuscript. This might probably be mimicked then in many further studies using the so-called Aethalometer model.
- To avoid this paper being seen mainly as a technical (or methodological) paper, subsections 3.2.1 and 3.2.2. (as well as Figure 5) should rather be discussed within section 2 and/or in supporting material. Moreover, to go more clearly beyond a measurement report, the seasonal origins of OOA sub-fractions could be investigated and discussed in more details.

Other comments:

- Lines 52-53 are mixing type of fuel and type of activities. Does "coal" means heating here ? and/or what type of emissions and (combustion ?) processes are linked to "steel, cement and metal industries" mentioned here ?

- Line 81-82: not clear why this change of set-up (AE33 upstream and then downstream the ACSM sampling line, including dryer) was achieved, and if this might have any influence on eBC quantification (?).

- Line 100: can be changed into: "... the method proposed by Middlebrook et al. ... ". And, line 101, not clear why CE of 0,5 instead of 0,45, as also proposed by Middlebrook et al.

- Line 194: "... this variation is expected [or assumed, or ..] to be associated ..."

- Line 233: "Since the coal profiles may strongly depend on the type of coal". This is also true for biomass burning aerosols. Sensitivity tests could be conducted using other BBOA profiles than the one proposed by Ng et al. for US.

- Line 348-349: not quite clear why relatively high OA/eBC ratios are possibly revealing other eBC sources, nor what type of eBC emissions from industrial activities are suggested here (liquid or solid fuel burning ?).

- Scatterplot between eBCsf and the sum of BBOA + CCOA may be presented and further discussed.

- Line 350: a deeper investigation of combined PMF analysis mixing ACSM+AE33+X'act datasets already available for the period March-April 2019 might also bring valuable information for this purpose ?