

Atmos. Chem. Phys. Discuss., referee comment RC1
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Comment on acp-2021-253

Anonymous Referee #1

Referee comment on "Measurement report: Receptor modeling for source identification of urban fine and coarse particulate matter using hourly elemental composition" by Magdalena Reizer et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2021-253-RC1>, 2021

General comments

The manuscript presents one month of hourly measurements of major and trace elements in PM_{2.5} and PM₁₀ in Warsaw, Poland, in February and March 2016. The data are thoroughly discussed, and three different receptor models are applied to determine the sources and origins of the elements. Five sources in PM₁₀ and seven sources in PM_{2.5} are found, demonstrating the advantages of high time resolution for appropriate source identification. Furthermore two cases of Saharan dust transport are discussed..

The structure of the manuscript, the results and the presentation of the material are very detailed and carefully worked out. The topic is relevant and well worth publication in ACP. I would, however, suggest a few minor changes and additions before publication.

Specific comments

The advantage of +/- hourly time resolution of elemental concentrations is nicely demonstrated, but biased towards Streaker sampling and PIXE analysis. Recent studies with XRF method have also achieved hourly resolution and size segregation for source apportionment, e.g. see references for Beijing and Delhi in Rai et al. (2021):

Rai, P., Slowik, J. G., Furger, M., El Haddad, I., Visser, S., Tong, Y., Singh, A., Wehrle, G., Kumar, V., Tobler, A. K., Bhattu, D., Wang, L., Ganguly, D., Rastogi, N., Huang, R. J., Necki, J., Cao, J., Tripathi, S. N., Baltensperger, U., and Prévôt, A. S. H.: Highly time-resolved measurements of element concentrations in PM₁₀ and PM_{2.5}: comparison of Delhi, Beijing, London, and Krakow, Atmos. Chem. Phys., 21, 717-730,

10.5194/acp-21-717-2021, 2021.

In Figs. 4 and 5 the right hand axes are labelled as 'contribution [%]', while in the captions you call this 'explained variation'. Would it not be more consistent (and more correct) to just use 'contribution' in both places?

In Fig. 6 the traffic source area is quite different from the road salt source. Shouldn't we expect more similarity between the two factors, as in both cases probably resuspension would be the mechanism for 'creating' the sources? Or is deicing salt not evenly distributed along the Warsaw road system? Please discuss this a bit more.

Fig. 8 shows trajectories originating in or crossing over parts of the Sahara desert and ending above Warsaw in 1500 and 3000 m asl. It is not straight forward that PM arriving at these elevations is measured with ground-based samplers, and possible downward mixing processes should be discussed in more detail. This is especially the case on 18 Feb, where at 500 m asl the airmass is advected from SE, indicating a completely different source location than the Sahara. While I find these two cases interesting and plausible, a strong connection is not given. I recommend adding one or two sentences discussing the uncertainties (Saharan dust composition, vertical mixing from upper layers, concentrations aloft).

In Fig. 9, I do not see an advantage of comparing the elemental time series in ng/m³ with the PMF time series in arbitrary units, as the main elements comprising the soil dust are those in eq. (8), so we basically just add O (in stoichiometric ratios) to these elements. It should be possible from a linear regression to estimate the fraction of the two (I guess it would be something around the value of 2). With respect to the Saharan dust, it would be the same to just compare the five relevant elements, not their oxides, as long as we do not have quantitative information on the amount of dust (mass) transported.

Technical corrections

L118 device (delete s)

L121 substrata (insert s)

L126 beam (delete s)

L131 write Micromatter in one word

L141 Reorder the sentence. Write '... is a widely used (...) multivariate factor analysis model in air quality studies based on ...'

L142 weighted least squares fit (add an s)

L369 Can you explain the term 'bioavailable' a bit better? The way you use it, it appears to be something like a quantitative entity with a time dependence.

L373 ... emitting a substantial amount ... (insert a)

L377 ... attributed to wood combustion ... (delete the)

L387 In the case of the coarse ... (insert the)

L393 ... the pattern of the source ... (insert the)

L504 ... points towards two ... (insert towards)

L516 ... all ranges of wind ... (insert s)

L518 ... are used for the maintenance ... (replace to with 'for the')

L533 write '...of the sources identified by PMF for....'

L592 widely (instead of wide)

L633 ... receptor modeling based ... (insert ing)