

Interactive comment on “Long range and local air pollution: what can we learn from chemical speciation of particulate matter at paired sites?” **by Marco Pandolfi et al.**

Anonymous Referee #2

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General Comments:

The manuscript “Long range and local air pollution: what can we learn from chemical speciation of particulate matter at paired sites?” provides a detailed discussion on the PM chemically speciated data from European paired monitoring sites. Positive Matrix Factorization (PMF) and Lenschow’s approach were applied to assign measured PM and source contributions to the different spatial levels. Long-term data allows the analysis on the annual cycle of the contributions to PM from the common sources and those detected only at subsets of paired sites. The experiment design and data analysis presented were well done. The paper is relevant to the field of the journal and presents

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some potentially interesting results that merit publication. However, the manuscript was not well written and required substantial improvements, especially some careless discussion.

Specific comments:

- 1) Too many abbreviations appear in this manuscript, making it really hard to follow. For instance, “photochemistry (PHO) and coal combustion (CC)” are not necessary.
- 2) The abstract and conclusions are verbose. More attention should be paid on the new results or insights of the present study, rather than the apparent results.

Introduction:

- 1) The introduction did not appropriately summarize the previous studies, and most of the related studies were missing. This impedes the reader’s understanding of the context.
- 2) It would be helpful that scientific questions related to the topic are mentioned in the Introduction.

Methodology:

- 1) How to perform PMF, is there any bootstrapping results for this study?
- 2) It is not clear to me why the authors apply different methods to construct uncertainty matrix for different sites.
- 3) The authors likely devoted too much space to describe the monitoring site. I also am not certain that it is really a necessity.

Results:

- 1) The authors stated that “At all sites the SSA source profile (and consequently the SIA source profile in DE) showed relatively high contents of organic carbon (OC), which was attributed to the condensation of semi-volatile compounds on the high specific surface

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area of ammonium sulfate". It needs more evidence, otherwise such conclusion makes no sense. Moreover, they also stated that "The chemical profiles of this source (NSA) were also enriched in OC." in Line 434.

2) "Photochemistry (PHO), showed high mass contributions of NH_4^+ and SO_4^{2-} and WSOC as well as high species contributions of oxalate." Was this factor corresponding to any indicator of photochemistry? This factor may also be attributed to aqueous processing.

3) The author devoted too much space to discuss "The summer to winter ratio" for each source contribution. However, I think the summer-to-winter ratio did not provide any additional information for most of the source contribution, and thus it is recommended to be shortened or removed.

4) "This sulfate represents direct SO_3 emissions from the ship that appear as particulate sulfate at the sampling sites." Any further evidence? Any direct measurements of SO_3 emissions?

Minor Comments

1) "Three additional common sources were detected". I do not think it is appropriate to use "detect" herein. Corrections are required throughout the current manuscript.

2) "Based on the present analysis, an improvement of air quality in the 5 cities included here could be achieved by further reducing local (urban) emissions of PM, NO_x and NH_3 (from both traffic and non-traffic sources) but also SO_2 and PM (from maritime ships and ports". This is not unique for this study.

3) "There are various modelling approaches to disentangle the local/remote contribution to urban air pollution." References would be helpful here.

Language requires improvement. Here I give some examples:

Line 438: "The Mineral source (MM) source"

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Line 470: "...by exchange with NO_3^- during transport. . . "

Line 534: "were considered as a natural sources"

Line 764: "because the measurements of methane sulfonic acid" methane sulfonic acid?

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