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Interactive comment on “Source apportionment of PM₁₀ in a North-Western Europe regional urban background site (Lens, France) using Positive Matrix Factorization and including primary biogenic emissions” by A. Waked et al.

Anonymous Referee #1

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This manuscript described PM₁₀ and its chemical constituent concentrations measured in Lens, France over a one year period from 9th March 2011 to 6th March 2012 using filter samples. Filters are analyzed for inorganic ions, organic carbon, elemental carbon, several sugar alcohols and levoglucosan, major and trace elements. Positive matrix factorization (PMF) and potential source contribution function (PSCF) were used to identify 9 different source factors and their corresponding source regions. Factors identified are fresh sea salt, primary biogenic emissions, mineral dust, biomass burning, oil combustion, traffic emissions, nitrate-rich secondary aerosol source, sulfate-rich

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secondary aerosol source and aged marine source. Of these factors, the ones showing clear seasonal variation are those associated with dust, primary biogenic, biomass burning and sea salt emissions along with and sulfate and nitrate-rich factors. The authors provide detailed discussion of different PMF factors and their contribution to annual and seasonal PM₁₀ concentrations at this site. Finally, they show that primary biogenic emissions can contribute substantially to PM₁₀ mass during summer. This manuscript is within the scope of the journal and I recommend its publication in ACP. Specific comments that need to be addressed are below.

Major comments:

1. In section 3.3.3 and 3.3.4 the authors comment that the direction and hotspots from the PSCF analysis for primary biogenic and biomass burning factors could be calculation artifacts. Can the authors provide more explanation for this argument? Since according to the weighting function low number of back trajectories associated with high concentrations is down weighted anyway and account for a lower fraction of the PSCF values in Fig 7. How can then the authors justify the PSCF analysis for other PMF factors? Please elaborate.
2. Pg 25352, L 12-14: How can the authors claim that SOA is mostly linked to sulfate-rich and nitrate-rich organics that are originating from anthropogenic sources? While the contribution of nitrate-rich factor to OC is small most of the year except for in spring, photochemical processing of biogenic VOC to SOA is known during summer, as is the formation of ammonium sulfate. So, can it be argued that the OC associated with sulfate-rich factor is just photochemical processing in the atmosphere of VOC (from both biogenic and anthropogenic sources) and therefore a clear source of organics associate with sulfate-rich factor is not possible?
3. Pg 25352, L18-21: Can the authors rephrase this sentence? It is not clear what the author's main point is.
4. Pg 25353, L 5: " These discrepancies are firstly due ...". Which discrepancies are

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the authors referring to?

5. Pg's 25353-25354: The paragraph starting with "Indeed, biomass burning emissions..". I understand that the authors are trying to convey that using a large number of biomass burning tracers could help in better resolving the biomass burning contribution and other sources during winter. What is not clear is the discussion of nitrate-rich factor, semi-volatile nature of OA and its contribution to OC. In fact, nitrate-rich factor has minimal contribution during fall and winter seasons. I suggest rewording this paragraph.

6. General comment: Why is nitrate higher in spring? and not in winter when ammonium nitrate formation is efficient and volatilization from the aerosol is low.

Minor comments:

1. Were PM10 samples collected daily during this study period? First sentence of sections 2.1 and 2.2 implies that PM10 samples were collected daily. Or did the authors mean filters were collected every third day for 24 hrs?

2. Which meteorological fields were used for PSCF analysis?

3. Pg 25333, L 8: Change "under Python" to "using Python".

4. Pg 25336, L 9: Change "were slowly increased" to "increased".

5. Pg 25336, L 27: Delete "number of".

6. Pg 25337, L 16: Change "injected" to "used".

7. Pg 25339, L 10: Change "dispatched" to "divided" or "separated".

8. Pg 25339, L 14-15: Please rephrase the last sentence "Finally, introducing..".

9. Pg 25342, L 5: Change "largely decreasing" to "are lower".

10. Pg 25343, L 20: Change "shares" to "fraction".

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11. At several places in the text the authors cite different regions of Northern Europe (ex. Nord Pas de Calais etc.). It would be good to also include the general direction from the site as this would help readers who are not familiar with regions in this part of the Europe (world).

12. Pg 25349, L 23: The authors say that aged marine source shows strong seasonal variation but from Fig 4 it seems like this factor is lower only during spring and it pretty constant during the rest of the year. Its contribution to PM10 is slightly higher during summer but there is no strong seasonal variation as the authors suggest.

13. Pg 25355, L 6: global chemical composition of PM10 in Lens?

14. Fig 4: Adding PM10 mass concentration beside each pie chart might help the reader quickly estimate the contribution of each factor in terms of mass concentrations.

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 25325, 2013.

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