

Interactive comment on “High Time Resolution Source Apportionment of PM_{2.5} in Beijing with Multiple Models” by Y. Liu et al.

Anonymous Referee #2

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General comment: The manuscript examines the influence of combining multiple models to better estimate the sources and regions of pollution in Beijing during winter, 2016. This is achieved by introducing the ambient concentrations of carbonaceous species (OC and EC), inorganic ions and selected metals to PMF model to apportion PM2.5; along with the foot print analysis and NAQPMS model. While PMF was the key model to apportion PM2.5 sources, further details about the optimum solution of PMF need to be discussed systematically, such as; the examination of the optimum factor solution, factor analysis, and the uncertainties associated with the estimation of each factor. I think it is important to add these details to the supplement and refer to them in the main text, as needed. Also, many of your comparisons with the previous study need to include more details, such as size fraction of PM, type of receptor model used and

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weather organic tracers were used or not, time resolution, which month, year, etc. Beside these two major comments, I recommend accepting this manuscript for publication after corrections as detailed in the following.

Technical comments:

1. Page 1, line 25: Subscript PM2.5 to PM2.5
2. Page 1, line 26: Define “receptor model” and replace the name with the new sentence in the same line
3. Page 2, line 39: Why you have chosen to report 11% of the dust contribution only? I recommend adding the percent contribution for the major sources or each analyzed footprint, systematically.
4. Page 2, line 48: Insert a citation after “...life and human health”.
5. Page 2, line 51, Coal combustion can also be considered as industrial source. Please be more specific here.
6. Page 2, line 51: It sounds like there are many sources related to traffic. I suggest replace “traffic sources” with “traffic-related sources”, after visiting the two papers you have cited here.
7. Page 3, line 62: “The model can...”. Which model you are referring to? Please specify.
8. Page 3, line 77: Insert citation after “...in previous studies”.
9. Page 5, line 106: “The room”. Which room you are referring to?
10. Page 6, line 130: Here you report that XRF was used to quantify metals. I see that you need to add an excel sheet or a table to the supplement that shows: measured concentrations, uncertainties of the measurements, and the detection limit. Also, it should include PM2.5, EC, OC, SIA. These data are important for the science community to replicate the PMF result. Also, in many places later you report the averages of a certain species without the standard deviation and/or the range of that average, which

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can also be extracted from the suggested table.

11. Page 8, line 181: Add a comma after “5 km”.

12. Page 8, line 181: Add a space after “x”, and before “2.5”.

13. Page 10, line 229-232: you have calculated the concentration of mineral species (Al, Si, Fe) based on Ca concentration, and the composition of urban soil. Does this typical urban soil was affected by regional and local pollution? During summer or winter? During hazy or non-hazy effect? And what is the estimated uncertainty in this calculation (estimation).

14. Page 10, line 230-232: Belong to the method section. Please move them.

15. Page 10, line 234: You have stated that Al and Si might be underestimated. Why? And by how much? Please provide supporting details.

16. Page 10, line 241: Here you compare the average OC/EC ratio with Yan et al., 2015. Can you be more specific about the time resolution, duration, months, and/or any special pollution events.

17. Page 10, line 242-243: Is the concentrations of SO_4^{2-} (23 ± 20) $\mu\text{g}/\text{m}^3$ significantly higher than that for NO_3^- (22 ± 23) $\mu\text{g}/\text{m}^3$? For me they look the same, taking the high variation of the concentrations, as they are reported. Please check these comparisons here and in other places along the manuscript. Also, discuss what is the potential reason for this observation based on previous PM2.5 studies conducted in Beijing during winter.

18. Page 10, line 246: Insert a citation(s) after “...in winter in Beijing”

19. Page 10, line 246-247: What type of combustion source are usually attributed to K and SO_4^{2-} , please be more specific and include a citation.

20. Page 10, line 249-250: “...the contribution of sulfate increased significantly (up to 24%), compared to what? Please be more specific here. I think you want to say that

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sulfate is the major component when $\text{PM2.5} < 50 \mu\text{g}/\text{m}^3$.

21. Page 10, line 249-250: You are using SO_4^{2-} and sulfate back and forth. Choose one term and stick with it.

22. Page 11, line 254-255: Insert citations after “...tracers of biomass burning and coal combustion”, and after “tracers of dust sources”.

23. Page 11, line 270: Add a “comma” after Ba.

24. Page 12, line 277-278: Add an estimation for the of cooking sources to PM2.5 in Beijing during winter, based on studies utilized organic tracers during winter. And discuss weather it is a minor or major source.

25. Page 12, line 287: Add a SD for the average value of 75 $\mu\text{g}/\text{m}^3$. Or you can report the average PM2.5 during the four haze episodes $> 98 \mu\text{g}/\text{m}^3$ to be consistent with the table.

26. Page 14, line 348-349: Here you almost restated the previous paragraph (line341-345). I think it is not necessary.

27. Page 15, line 271: We can control precursors of secondary sources, but not the secondary sources. Please modify accordingly.

28. Page 20, line 523: Fix (PM2. 5). Extra space

29. Page 20, line 532: Capitalize the first word of the title only.

30. Page 22, line 569: Sulfate and nitrate (check technical comment #21).

31. Page 24, Figure two: I suggest naming them a and b. Also, please explain the what the white bars represent?

32. Page 26, Figure 4: The right side of the Y-axis shows more than 100%. These are % of what?

33. Page 27, Figure 5: Move the boxes of PMF source identifiers to the left side of

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the figure and locate them under source apportionment results only. Also, it would be better if you rename these figures as a, and b.

34. Page 28, Figure 6: same comment as for (technical comment #32).
35. Page 29, Figure 7: Check technical comment # 33.
36. Page 30, Figure 30: Add r and p value for the correlations. And discuss in the text.

Interactive comment on Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2018-1234>, 2018.