Response to Anonymous Referee #1:

Review of "Size-resolved source apportionment of particulate matter in urban Beijing during haze and non-haze episodes" by Tian and co-authors.

Tian et al. present size-resolved chemical composition of aerosol particles during haze and non-haze episodes in Beijing. In addition a source apportionment analysis is performed to the data. The authors present valuable data, however, the data treatment is unclear and need to be clarified before publication in ACP. The English grammar needs to be revised by a native.

Reply: Thanks for your suggestions and comments below, which will strengthen the quality of our manuscript. We have revised the paper accordingly. Also the revised version was edited by several native speakers at AJE to further improve the language.

P9411-L2: The references of Paatero and Tapper, (1994) or Paatero (1997) are probably more appropriate to refer to the PMF technique.

Paatero, P., Tapper, U., 1994. Positive matrix factorization: a nonnegative factor model with optimal utilization of error estimates of data values. Environmetrics 5, 111-126.

Paatero, P., 1997. Least square formulation of robust non-negative factor analysis. Chemometrics and Intelligent Laboratory Systems 3, 23-35.

Reply: Thanks for the advices. These references were added in the revised paper.

P9412 – L14: Change the section title to "PM mass concentrations and chemical composition".

Reply: Done.

P9419–L23: Other runs of the PMF model did not result in additional sources or different sources between size fractions? The use of both size fractions is not

providing additional insights, since the same sources were identified in both fractions…

Reply: Thanks for your advices. In the original manuscript, the PMF was applied separately to $PM_{2.1}$, $PM_{2.1-9}$ and each size fraction (<0.43, 0.43-0.65, 0.65-1.1, 1.1-2.1, 2.1-3.3, 3.3-4.7, 4.7-5.8, 5.8-9 and >9 μm). And there were only 52 samples for each run. In order to improve the quality of the source apportionments, in the revised version the PMF analysis was performed respectively for the fine mode (the input data included the mass concentrations and chemical species in particles with size bins of <0.43, 0.43-0.65, 0.65-1.1 and 1.1-2.1 μm) and coarse fractions (the input data included the mass concentrations and chemical species for particles in size fractions of 2.1-3.3, 3.3-4.7, 4.7-5.8, 5.8-9 and >9 μm) (Contini et al., 2014). The new runs identified different sources between fine and coarse fractions. For example, mineral dust from both road dust and sand were identified in coarse fractions but only the former was identified in fine fractions. In addition, the contribution of all anthropogenic-related sources increased from non-haze to haze days. We believe the new findings were more reasonable compared with the original version. We have added more discussions on the improvements of PMF results in the revised paper. See Sect.4.3.1.

P9420 – L3: Rephrase this statement. This is confusing since this source is named as SIA.

Reply: Thanks for your advices. "SIA" was changed to "secondary inorganic aerosol (SIA)" in the revised manuscript.

P 9420 – L8: As concentrations

Reply: Done.

P 9421 – L5: Add a reference about K^+ as a tracer for biomass burning.

Reply: Done.

P 9421: It would be interesting to study the seasonality of the sources identified in both fractions. This exercise can offer additional insight into the results.

Reply: Thanks for the insightful suggestion. We have discussed the seasonality of the sources identified in both fine and coarse fractions in the revised manuscript. See Sect.4.3.1.

P9424 – L23: All anthropogenic-related sources increased during haze days except industrial pollution. Do the authors have any explanation for this?

Reply: We agree with the reviewer that the results regarding industrial pollution in the original manuscript were unreasonable. In the revised manuscript, haze and non-haze days were reclassified based on visibility and RH together, and then PMF analysis was improved and performed respectively for the fine and coarse fractions. The results showed that the contribution of industrial pollution on haze days was also higher than that on non-haze days.

P9422 – L14: How the results shown in Figure 7 are obtained? The PMF analysis was performed in the fine and coarse fractions, how is then extrapolated to 11 size fractions?

Reply: Sorry for the confusion. In the original manuscript, the PMF was applied separately to $PM_{2.1}$, $PM_{2.1\text{-}9}$ and each size fraction (<0.43, 0.43-0.65, 0.65-1.1, 1.1-2.1, 2.1-3.3, 3.3-4.7, 4.7-5.8, 5.8-9 and >9 μm), so source apportionment results for 11 size bins were showed in Figure 7. To further improve the accuracy of the results from the PMF model, however, in the revised manuscript, the PMF analysis was respectively performed in the fine (the input data included concentrations of mass and chemical species for particles in size fraction <0.43, 0.43-0.65, 0.65-1.1, 1.1-2.1 μm) and coarse fractions (the input data included concentrations of mass and chemical species for particles in size fraction 2.1-3.3, 3.3-4.7, 4.7-5.8, 5.8-9 and >9 μm) (Contini et al., 2014).

P9423 – L21: The section title “Back trajectory cluster analysis”

Reply: Done.

P9425 – L12: The different chemical constituents are included in the fine or coarse particles. This sentence needs to be rephrased.

Reply: Thanks for your advices. “In addition to the fine and coarse particles” was changed to “In addition to size distributions of particles”.

Figures:

- Improve the readability of all figures.

- Y axis: units should be between brackets, e.g. (μg/m^3) instead of /μg/m^3.

Reply: Thanks for your advices. We have redraw all the figures and the units for Y axis were all between brackets now.

Figure 5: Include the % of species in this graph and include comments about this in the manuscript.

Reply: Done.

Figure 6: Apart of the relative contribution (%) of each source to each fraction, show the mass concentration of the sources in μg/m3. It might be the case of a source increasing its contribution from haze to non-haze days but not its absolute mass concentration, for example.

Reply: Thanks for the valuable suggestions, which were implemented.

Reference:

Contini, D., Cesari, D., Genga, A., Siciliano, M., Ielpo, P., Guascito, M. R., and Conte, M.: Source apportionment of size-segregated atmospheric particles based on the major water-soluble components in Lecce (Italy), Sci Total Environ, 472, 248-261, 2014.