Responses to Reviewer's Comments

I have reviewed the previous version of the manuscript which was submitted for ACPD. I suggested that the author re-work on their analysis to identify new findings of this severe haze event in view of several recent publications on the same case. While the authors did include these references in the introduction, they did not change much the main content of the paper. While the paper present some new and valuable data, their main conclusions are similar to those references and to those previously studied haze events in Beijing. In summary, in its present form, the paper does not have sufficient new findings to justify its publication at ACP. I encourage the author to re-examine the data, focusing on some new and important topics which have not been studied before, or carrying out much more in-depth examinations of previously studied topics.

We'd like to thank for the reviewer's comments. In the revised manuscript, we have added more data and performed additional data analysis. More findings are presented and they are summarized as below:

1. Hourly measurements made by ACSM (Aerosol Chemical Speciation Monitor) were added to explore the evolution of secondary aerosol formation. Specifically, the partitioning of acidic aerosol in the salt phase and free acid phase was discussed under different humidity conditions. Please refer to Section 3.4 for more details.

2. Most literatures on this severe haze focused on the abundant chemical species of aerosol, i.e. organics, sulfate, nitrate and ammonium. In this study, we added the analysis of trace metals (including both mineral and pollution elements) to supplement the process analysis on explaining the evolution of aerosol levels during the study period. The advantage of using trace metals is due to their primary emission sources rather than the complex secondary formation pathway. Thus, by using different trace metals as chemical tracers, it is easier to apportion the main emissions sources at different stages of the pollution episodes. Please refer to Section 3.3.2 for more details.

3. We use wind rose to identify three typical atmospheric processing conditions, i.e. cold front, local processing and regional transport. It is assumed that the chemical tracer ratio, i.e. $([X]/Al)_{cold}$ and $([X]/Al)_{local}$ could be used to represent aerosol chemical characteristics during cold fronts and local processing. By using a new developed algorithm, we have estimated the contribution from regional transport to some selected species. Please refer to Section 3.6 for more details.

Other changes:

To make the manuscript more focused on explaining one severe haze episode, some contents from the original manuscript now have been removed, e.g. the long-term trends of surface PM_{10} and column AOD in Beijing in Section 3.1, and the “Impact of relative humidity on aerosol chemistry” in the original Section 3.4.