

## Response to RC1:

This study provides many valuable information on the molecular-level PM<sub>2.5</sub> components during different levels of haze events with high-time resolution. It analyzed a wide range of individual components of PM<sub>2.5</sub>, which allows a detailed study of various sources at the same time. The radio carbon measurements suggest a greater contribution from fossil fuels to WSOC, while the contribution of non-fossil fuels increased with increasing haze pollution, coinciding with elevated biomass burning (BB) during that time. This new finding highlight BB may be an important driver for heavy haze formation, despite great contributions of fossil fuel sources. This manuscript presents many interesting results that will deepen our understanding of haze evolution. This work is worth being published in the journal of ACP.

We appreciate the reviewer's feedback on the manuscript, and we carefully reviewed the comments and addressed each individually below, highlighting changes made in the revised manuscript.

Here are some minor comments below:

In Figure 4, I noticed that sugars and sugar alcohols have high concentrations during the last two periods, with levels relatively higher than those of anhydrosugars. Could you explain why this is the case?

The elevated levels of sugars and sugar alcohols in the last two episodes are likely due to the increased wind speeds which enhanced resuspension of biogenic detritus and soil microbes containing abundant sugars and sugar alcohols.

This study conducted <sup>14</sup>C analysis on WSOC. Why did the authors choose WSOC over other PM<sub>2.5</sub> components?

Actually, we did <sup>14</sup>C analysis on total carbon (TC) as well. However, this study focuses on WSOC, as the main organic components we selected are water-soluble, aligning well with WSOC. Furthermore, there are more studies on <sup>14</sup>C analysis of TC than on WSOC. WSOC also has direct and indirect impacts on global climate change by absorbing sunlight and altering the hygroscopic properties of aerosols. By conducting <sup>14</sup>C analysis on WSOC, the contribution of fossil fuels and non-fossils to haze pollution can be accurately examined. This information is helpful for climate and air pollution studies.

The sampling period is from December 31 to January 2. Why was this specific period selected? Does it overlap with the Spring Festival or any holidays?

To be honest, we did this sampling campaign based on weather forecast about air quality. Moreover, due to our curiosity about how PM<sub>2.5</sub> components and sources change with haze evolution, we decided to launch intensive PM<sub>2.5</sub> samplings at high time resolution. The whole sampling period does not overlap with the Spring Festival but with New Year's Day. However, since fireworks are banned in Nanjing, they did not affect the results of this study.