

### Responses to Anonymous Referee #3

We thank the reviewer for the insightful and valuable comments. Our specific responses are addressed below and colored by blue. Changes made to the manuscript are in quotation marks.

This manuscript presents a comprehensive measurement study at Seoul during wintertime using a suit of on-line instruments including a HR-ToF-AMS. It is found that the mass concentration of submicron aerosol was high and exceeded the national air quality standard. The chemical species showed evidently diurnal variation suggesting the local and/or regional sources which mainly derived by local weather condition or regional weather systems. The study also found important primary sources and secondary formation pathway for organic aerosol which is important for mitigation for the government. The manuscript is general well done and the data processing is reasonable and thoughtful. The topic of this study is also fitted in the topic of this special issue of ACPD. I recommend it is accepted after a minor revision as followed.

1. The elemental ratio of S/C is generally not used in the reported data because the correcting factor of S/C for ambient data was not well done.

S-containing organic ions (i.e.,  $C_xH_yO_zS_q^+$ ;  $x > 0$ ;  $y \geq 0$ ;  $z \geq 0$ , and  $q > 1$ ) were clearly determined and properly fitted. It is true that no correction factor is available for the AMS measured S/C ratio, the S/C data determined from analyzing the HR-AMS data can nevertheless provide useful information about the temporal and diurnal variations of the S/C ratio in organic aerosol. For clarification, we have added the following sentence at the last paragraph of the section 2.3.1: “Note that there could be biases in the S/C ratios since no correction factor is available.”

2. Please clarify how PAH was determined? Is it based on default fragmentation or W-mode data?

Thanks, as suggested by the reviewer, relevant discussions on PAH estimation has been added at Page 6, line 4-5 as follows: “Furthermore, the total concentrations of particle-bound polycyclic aromatic hydrocarbons (PAHs) were estimated using the method described in Dzepina et al. (2007). However, instead of apportioning the unit mass resolution (UMR) spectra, PAH-related ions were determined via fitting the high-resolution mass spectra (W-mode) (Xu et al., 2014). In addition, a RIE of 1.35 with respect to nitrate was applied to calculate mass concentrations of PAHs from AMS data (Dzepina et al., 2007)”

3. Page11, line 16-18: does any reference to support this point?

A study conducted by Ge et al. (2012) reported similar observations as ours. We now cite this reference in the revised text.

Ge, X. L., Zhang, Q., Sun, Y. L., Ruehl, C. R., and Setyan, A.: Effect of aqueous-phase processing on aerosol chemistry and size distributions in Fresno, California, during wintertime, *Environ. Chem.*, 9, 221-235, 10.1071/en11168, 2012

line 25-28: please cite this reference:

Xu, J., Zhang, Q., Chen, M., Ge, X., Ren, J., and Qin, D.: Chemical composition, sources, and processes of urban aerosols during summertime in northwest China: insights from high-resolution aerosol mass spectrometry, *Atmos. Chem. Phys.*, 14, 12593-12611, 10.5194/acp-14-12593-2014, 2014.

[This reference has been added.](#)

4. Figure 9: please remove “high-resolution mass spectra of” in the caption.

[Thanks, it has been corrected.](#)

5. Figure 10: add “+” in each category family.

[Thanks, it has been corrected.](#)

## References

Dzepina, K., Arey, J., Marr, L. C., Worsnop, D. R., Salcedo, D., Zhang, Q., Onasch, T. B., Molina, L. T., Molina, M. J., and Jimenez, J. L.: Detection of particle-phase polycyclic aromatic hydrocarbons in Mexico City using an aerosol mass spectrometer, *Int J Mass Spectrom*, 263, 152-170, 2007.

Xu, J., Zhang, Q., Chen, M., Ge, X., Ren, J., and Qin, D.: Chemical composition, sources, and processes of urban aerosols during summertime in northwest China: insights from high-resolution aerosol mass spectrometry, *Atmospheric Chemistry and Physics*, 14, 12593-12611, 10.5194/acp-14-12593-2014, 2014.