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Atmospheric Chemistry and Physics
Discussions

Interactive comment on "Characterization and source apportionment of organic aerosol at 260thinsp;m on a meteorological tower in Beijing, China" *by* Wei Zhou et al.

Anonymous Referee #3

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This manuscript describes atmospheric submicron aerosol sources and processes based on a field on-line measurement at an altitude of 260 nm in polluted Beijing, China, along with a comparison with an in-situ ground measurement. China has been suffering from serious air pollution issues, mainly due to complex and unclear vertical-dependent chemical and physical processes of atmospheric aerosols, although the ground-based characterization has been relatively well understood. This manuscript is well-written and provides some new and interesting data sets for understanding ambient primary and secondary organic aerosol sources and processes above an urban canopy. I strongly believe those results can make some important implications for atmospheric chemistry and physics community, and even for understanding the mechanism of haze formation in China. I recommend this paper can be published in ACP after addressing a few minor areas as follows.

1. A five-factor solution for source apportionment of organic aerosol was chosen in this study, which includes three primary factors (FFOA, COA, and BBOA), and two secondary factors (LO-OOA, and OOA). The FFOA factor here involves fossil fuel combustion sources relative to traffic and coal combustion. This should be reasonable since it could not be separated even by HR-AMS PMF approach. To further support this reasonable factor of FFOA, did the authors try to check the ratio range between FFOA and delta CO (measured total CO minus background CO) at the ground site, as comparing with any previous results (e.g., HOA+CCOA vs delta CO)? Another way to check this factor, it might be possible to constrain HOA and CCOA factors only for HR-AMS data using external reference mass spectra from previous studies at the same sampling site (e.g., Sun et al., 2016 ACP). Then, the authors could make an evaluation for unconstrained FFOA and constrained HOA+CCOA.

2. Generally, ambient oxygenated organic aerosol (OOA) derived from the AMS/ACSM PMF (or ME-2) approach includes a subset of oxidized organic aerosol factors (e.g., less or more oxidized OOA). Why did not the authors use a term of MO-OOA for your "OOA" factor, as explained in page 9 lines 25-26 "…indicating that OOA was more oxidized than LO-OOA"? (I guess it might be ok if just following the f44-f43-based criteria).

3. Page 9, lines 29-31 and page 10 lines 1-5. These are an interesting finding. The authors found that LO-OOA may be a kind of SOAs from combustion-related source(s), which has a good correlation with chloride and CO, respectively. The LO-OOA concentration at 260 m can be two times higher than that at ground site during some periods. Are these able to explain that the observation at 260 m could be closer to combustion-related SOA plumes/favorable heights rather than ground site? On the other hand, does this make sense to explain the rapid transformation of partial POA into LO-OOA (freshly formed SOA) due to processes of evaporation, oxidation and/or

re-condensation (Robinson et al., 2007 Science) during transports from ground levels?

4. Page 22, Figure 1: Some RH peaks at the ground level are much higher than at 280 m, e.g., October 14-20 and Nov. 02-09, as well as some similar peaks in heating periods, but air temperature is almost same. Is it possible to find any evidence about the enhancement of SOA productions due to aqueous-phase chemistry during these typical cases, with a comparison between ground and 260 m dataset?

5. Page 24, Figure 3: What are the data points size-scaled by?

6. Page 26, Figure 5 (left panel): The factors of FFOA, COA, and BBOA were identified using the constrain mode (a-value), but LO-OOA and OOA were resolved using the PMF free mode. So, to be more directly clear for readers, the authors may consider adding the corresponding label in each mass spectrum of POA factors (e.g., constrained or a specific a-value) and SOA factors (e.g., unconstrained or free).

7. Supplement: Pages 5-6, Figure S3 (d and e): Since LO-OOA and OOA factors were resolved by the PMF free mode, whereas FFOA, COA, and BBOA were constrained. The authors may highlight that the specific a-value is for constrained POA factors, but not for unconstrained SOA factors in both LO-OOA and OOA mass spectra.

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