Reviewer comment on

Insights into aerosol chemistry during the 2015 China victory day parade: results from simultaneous measurements at ground level and 260 m in Beijing

By Zhao et al., Atmos. Chem. Phys. Discuss., doi:10.5194/acp-2016-695, 2016

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General comments:

This manuscript reports results obtained during a field campaign undertaken at Beijing during five weeks in summer 2015. Measurements took place during and after a period of strict emission controls implemented by the Chinese Authorities to ensure good air quality in Beijing during the China victory day parade. Results clearly show an improvement of the air quality during the emission control period.

The methodology presented in this manuscript is very similar to the "APEC Blue" paper published recently by the same group (Sun et al., 2016): a high-resolution time-of-flight aerosol mass spectrometer (HR-ToF-AMS) deployed at a ground site, an aerosol chemical speciation monitor (ACSM) at 260 m on a meteorological tower, and a comparison of the particle concentration and chemical composition during and after the emission control period. However, the air quality issues faced by the inhabitants of Beijing are really impressive, so this kind of studies is of prime importance to assess the efficiency of the emission controls implemented by the Chinese Authorities. I warmly recommend the publication of this manuscript after the authors address the following comments.

Specific comments:

1) The authors used two different instruments measuring particle size distributions, i.e. the AMS and the SMPS. Each time that the authors give a particle diameter, I think it would be important to mention whether it corresponds to mobility diameter (D_m) or vacuum aerodynamic diameter (D_{va}).

2) Page 6, line 23: the authors used the chemical composition of the AMS to calculate the density. I'm wondering whether they also made the scatterplot of the AMS total mass vs. SMPS volume. If the size cut-off of the instruments is not the same, they can use the PToF data of the AMS, and integrate the AMS size distributions over the same size range as the SMPS.

3) Page 6, line 25: for the density of organic aerosols, the authors used the value given by Turpin and Lim (2001) (1.2 g/cm^3). However, they can also use the formula given by Kuwata et al. (2012) to calculate the density of organics by using elemental ratios (O/C and H/C).

4) Page 8, lines 23-26: the authors mention that the nitrate contribution to PM_1 was higher at 260 m than at ground level, and suggest that this result might be due to favorable gas-particle partitioning of nitrate with low temperature at 260 m. However, according to Table 1, the difference of temperature between ground level and 260 m was less than 2°C. Is this sufficient to have a significant impact on the gas-particle partitioning of nitrate?

5) Page 9, lines 19-31: there is a long discussion about the more oxidized- and less oxidized-OOA. The main problem here is that two important data are missing in this manuscript: the volatile

organic compounds (VOCs) and the solar radiation. Without this information, we don't have any idea on the reason for which the MO-OOA was significantly lower during the emission control period. This could be due to the reduction of VOCs emissions (as mentioned several times by the authors) but also to reduced photochemistry.

6) Page 12, line 15: the authors mention that the diurnal patterns observed for ammonium, nitrate, and chloride were mainly due to temperature dependent gas-particle partitioning. Another explanation is the dynamics of the boundary layer height between day time and nighttime, which has also the effect of increasing the concentrations of these species during the night.

7) Table 1: to make this table complete, the authors may include results for HOA and COA immediately after POA.

8) Figure 2: the wind pattern can be very different between the ground level and 280 m. Therefore, I'm not sure whether it's a good idea to show the wind direction and wind speed from two different altitudes in the same panel. I suggest to show these two data measured at the same altitude (either ground or 280 m), if it's available.

9) Figure S8: in panel b), does the SMPS data start at 15 nm (as mentioned in the legend) or at 10 nm (as mentioned in the figure caption)?

Technical comments:

10) Page 1, line 21: while ~~its~~their contribution

11) Page 5, line 12: were also deployed on the roof of ~~an~~ another two-story building

12) Page 7, line 15: was also consistent with previous observations

13) Page 11, line 7: and also the different~~ce~~ size distributions

14) Page 14, lines 23-25: It appears that photochemical produc~~i~~tion of less oxidized SOA was the dominant SOA formation mechanism during the control period, while aged SOA was 25 more significant after the control period

References:

Kuwata, M., Zorn, S. R., and Martin, S. T.: Using Elemental Ratios to Predict the Density of Organic Material Composed of Carbon, Hydrogen, and Oxygen, Environ. Sci. Technol., 46, 787-794, 10.1021/es202525q, 2012.

Sun, Y., Wang, Z., Wild, O., Xu, W., Chen, C., Fu, P., Du, W., Zhou, L., Zhang, Q., Han, T., Wang, Q., Pan, X., Zheng, H., Li, J., Guo, X., Liu, J., and Worsnop, D. R.: "APEC Blue": Secondary Aerosol Reductions from Emission Controls in Beijing, Scientific Reports, 6, 20668, 10.1038/srep20668, 2016.

Turpin, B. J., and Lim, H.-J.: Species Contributions to PM2.5 Mass Concentrations: Revisiting Common Assumptions for Estimating Organic Mass, Aerosol Sci. Technol., 35, 602-610, 10.1080/02786820119445, 2001.