

# ***Interactive comment on “Atmospheric aerosol compositions and sources at two national background sites in northern and southern China”***

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1. It is difficult to compare the two studies directly since they were conducted in different years and different elevations. The authors should state clearly in the abstract that the two measurements were conducted in different years (2011 vs. 2015) and different elevations (21 m vs. 958 m) to avoid confusing the readers. REPLY: Suggestion taken. The information of sampling years and altitudes are added into the abstract.

2. Calling “Lake Hongze” as a site in northern China is not accurate, in fact, “Central eastern China” might be better. REPLY: Actually the northern China and southern China are just relative locations. Furthermore, many air mass back-trajectories for NCB shown in figure 1 were from the northern areas in China. As we mainly focus on

the regional pollutants transportation influence in this study, calling “Lake Hongze” as a northern China background site is reasonable.

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3. Abstract, the authors claimed “the most aged OA in real ambient air ever reported in the literature”, which is not correct. Please refer to Chen et al. (Geophys. Res. Lett., 42, 4182–4189, 10.1002/2015GL063693, 2015). REPLY: This sentence is deleted in the abstract and conclusion. And we modify some descriptions in Section 3.4 as below: “Note that the organic aerosol observed at SCB is very highly oxygenated compared to the ambient data ever reported in the literature, consistent with the previous finding that the atmospheric oxidizing capacity in southern China is unexpectedly high (Hofzumahaus et al., 2009).”

4. Page 2, line 14, rewrite this sentence. REPLY: Sentence is rewritten as “valuable insights on the composition, sources, and evolution processes of submicron particles in China were obtained through a dozen of field campaigns using various types of some powerful online tool.”

5. Page 2, line 29, I didn't quite understand why the regional background air pollution is a critical factor in determining urban air quality. REPLY: Previous urban aerosol studies indicated that urban air pollution is not only just from the local emissions, but also from the regional pollutant transportation. Urban air quality significantly depends on the air pollutant concentrations input into the city, which highlights the importance of investigating regional background air pollution.

6. Page 3, line 1, “other instruments” actually refers to “AE31”, I didn't see other collocated instruments. REPLY: Suggestion is taken. We use “an aethalometer (AE-31)” to substitute “other instruments”.

7. All the names of submicron aerosol species should be synchronized. For example, “ClâĂŹ” vs Chl, “Organic in Figure 2” vs. “Organic aerosol”, etc. REPLY: All corrected.

8. Page 5, line 7, flow is not correct. REPLY: Corrected.

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9. Page 8, line 10, could you give a number for the overestimation? REPLY: This information has been added into Section 3.1 as below: "This overestimation could be less than 20% according to the ambient BC size distributions measured at an urban site in South China (Lan et al., 2011)."

10. Page 8, line 11, "Figure 2c" should be Figure 2e? REPLY: Corrected.

11. Figure 3a, the vertical lines did not match the maximum sizes. REPLY: The vertical lines in Figure 3a and 3b represent the mass median diameters rather than the size peak diameters, as stated in section 3.1.

12. Why the authors use different names for OOA components at the two sites, for example, OOA1 and OOA2 at Lake Hongze and SV-OOA and LV-OOA at Wuzhishan? REPLY: This is because of the specific solutions at the two sites. According to the previous literatures (Jimenez et al., 2009; Ng et al., 2010), two types of OOAs with different O/C ratios and volatilities have been observed in many ambient datasets: the OOA with higher O/C, which is more oxidized and aged, is referred to as low-volatility OOA (LV-OOA); the OOA with lower O/C, which is less oxidized and fresher, is referred to as semi-volatile OOA (SV-OOA). This type of solution applied to organic aerosol at SCB. However, the two OOA components at NCB had similar O/C ratios but quite different time series, and thus we named them OOA1 and OOA2 to avoid meaning that they have difference in terms of oxidation states. The splitting of organic aerosol into two components with similar O/C ratios were also observed in the 2008 Beijing Olympic Games AMS dataset (Huang et al., 2010).

13. Figures 3a, add figure legend for aerosol species. REPLY: Suggestion is taken.

14. Page 3, line 8 and line 10, same latitude and longitude for the two sites? REPLY: Mistake is corrected.

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