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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Distinctions in source regions and formation mechanisms of secondary aerosol in Beijing from summer to winter" *by* Jing Duan et al.

Anonymous Referee #2

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In this study, the authors performed four-month measurement of the chemical composition of PM1 in Beijing, with an Aerosol Chemical Speciation Monitor (ACMS). PMF analysis is applied to study sources of organic aerosol. The authors perform routine analysis to study the regional vs. local sources of PM1, seasonal variation of PM1, and gas-phase vs. aqueous-phase formation pathways of organics and sulfate. The analysis procedure has been widely used in the literature. There have been numerous studies with ACSM or AMS to study the same topic in the same area (as summarized in Table 1). My overall impression is that this manuscript fails to establish enough novelty to distinguish itself from previous studies. Thus, I would not recommend this manuscript for publication in its current state.

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Discussion paper

The discussions on regional SOA factor (RSOA) and local SOA factor (LSOA) suffers major flaws in its logical flow. To start with, it is not justified why these two OA factors are classified as regional and local. In section 3.3, the authors simply state that two oxygenated OA factors were identified and they are local SOA and regional SOA, but no justification is provided. Moreover, the assumption that the one factor is regional and the other factor is local is applied throughout the manuscript to infer the sources of sulfate (P9 L25-35), OA (P11 L1-5), and PM1. However, this assumption is not justified yet! In P10 L1-15, bivariate polar plots of SO4 are used to discuss the sources of SO4. The results are reasonable. However, the sources of SO4 need to be established first and further used to infer the sources of LSOA and RSOA, instead of the other way around.

I also have concerns on the SO4 discussions. (1) It is important to note that particle liquid water content is a better proxy for aqueous phase reaction than RH. It has been well-established that the particle LWC not only depends on RH, but also on particle composition. (2) Figure 3a suggests that regional transport is the major source of SO4 in later summer. However, the good correlation between SO4 and Ox in figure 6 suggests SO4 may be locally formed. How to reconcile this difference?

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