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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Aerosol composition, sources and processes during wintertime in Beijing, China" *by* Y. L. Sun et al.

Anonymous Referee #1

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This paper by Sun et al. reported a wintertime study in Beijing by an aerosol chemical speciation monitor. The authors had a thorough analysis of the chemical composition, diurnal variations, day-night variations, and sources and processes of organics aerosols, and then compared with the results obtained in summer. Very different composition and diurnal variations of aerosol species between summer and winter were observed. Also the roles of aerosol species in PM pollution are quite different between summer and winter. Compared to the dominance of secondary organic aerosol (OA) in summer, primary organic aerosol (OA) dominated OA with coal combustion OA contributing the major fraction during wintertime. The meteorology plays an important role in PM pollution. In particular, fog processing to form secondary inorganic products dur-

ing high RH periods is important. The paper is quite clearly written and was easy to review. This paper could be published on ACP after addressing the issues below. Detailed comments: 1. The coal combustion organic aerosol (CCOA) is interesting. The identification of this factor is important. However, the authors inferred this factor mainly based on the comparisons with biomass burning OA from previous studies. The mass spectra of coal combustion OA and biomass burning OA might be quite different, so I am wondering if the authors can provide more evidence, like mass spectra of CCOA from Chinese coal stoves. 2. The authors use NO3- / SO42- to explore the RH effects on formation mechanisms. I note that the nitrate concentration is often ∼twice higher than sulfate in both summer and winter, which is not typical in Beijing. Although ACSM shows good agreements with TEOM measurements, I am still interested if the authors have other measurements, like filter packs, PILS etc. to compare with ACSM NO3- and SO42-measurements. 3. In the abstract and the text, the author concluded that high concentration of sulfate under high RH condition is due to fog processing, what is the mechanism? With respect to the aqueous phase formation of sulfate, there are many literature reporting the formation mechanism, could the authors give more detailed mechanism explanation, which is very helpful for readers to understand the current heavy PM episode in Beijing. 4. I also found that the organic fraction in the current study was the major species in both summer and winter, accounting for around 50% of the total measured compounds, which is in contrast to the case reported previously by Zhang et al 2007 in GRL (GRL 34, L13801, doi:13810.11029/12007GL029979, 2007), their results showed that organic matter is relatively small, accounting for <30% of the total mass. Could the authors give some explanation for such aerosol composition changes in Beijing during the past years? And what is its implication? 5. I noted that in this paper, and also in many other ACSM measurements, there is no data about bisulfate HSO3-, I am not sure if this means that bisulfate is negligible and/or cannot be detected due to the instrument limitation? Since the author argued that aqueous-phase oxidation of SO2 to produce SO42- is important in Beijing especially in winter, one would expect that bisulfate is probably abundant in aerosol-phase.

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