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Interactive comment

Interactive comment on "Characteristics of PM$_{2.5}$ mass concentrations and chemical species in urban and background areas of China: emerging results from the CARE-China network" *by* Zirui Liu et al.

Anonymous Referee #2

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General comment:

This paper presents three-year dataset of mass concentrations and chemical composition of PM2.5 at multiple urban and background sites in China. The chemical composition quantified includes organic matter, elemental carbon, sulfate, nitrate, ammonium, mineral dusts, and chlorine. Such spatial and temporal data are valuable addition to the literature. The manuscript is well written and organized. Therefore, I suggest publication with minor revision.

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Discussion paper

Specific comments 1. P2, Line 49-52, explain with 1-2 sentences what the difference during the evolutions of the heavily polluted events. 2. P4, line 145-160, two types of instruments (TEOM and EBAM) were used for measurements of PM2.5 mass concentrations at the different sites. The authors should provide inter-comparison results for better quality control. 3. P5, line 174, "The sampling lasted 24 or 48 h", please clarify the sampling scheme. 4. P5, line 179-190, the information about the chemical analysis is insufficient, more details about the calibration, performance such as detection limits should be provided. 5. P6-7, line 249-279, better to combine the last two paragraphs of section 3.1.1 and discuss the comparison between this study and those from the Europe, North America and the other parts of world by grouping the data into urban, rural, and background sites. Also, better to compare with literature data measured at the same sites and periods. 6. P9, line 350-352, the invisible morning peak of PM2.5 in Beijing, Shanghai and Guangzhou is interesting, which was somewhat different from the previous studies. Not clear, please explain. 7. P9, line 360-361. The discussion of bimodal pattern of PM2.5 in Lin'an is not convincing, more likely Lin'an is highly affected by the regional transportation from the YRD region, which was totally different from Namsto and Gongga Mountain. 8. P10, line 392-394, need reference here for the calculate method of Si. 9. P11, line 432-437, the explanation is not convincing, the higher fraction of sulfate in south China is more likely associated to the higher oxidation capacity in south China and therefore higher formation efficiency from SO_2 to SO_4^{2-}. 10. P11, line 456-460, what about the fraction of EC? Is it higher or lower compared with previous studies? More discussion about the comparisons with previous studies would be useful, at least for the urban sites. 11. P16, better to split section 3.3 into two sub-sections. One section focuses on the mass concentration of PM2.5 and the other on the chemical composition of PM2.5. 12. P17, line 722-724, "These results suggest the different formation mechanisms of the heavy pollution in the most polluted city clusters, and unique mitigation measures should be developed for the different regions of China." This conclusion is ambiguous, the authors should clearly state the difference in formation mechanisms, and the implications for mitigation measures. 13.

P26, Table 2, please provide the standard deviation of the concentration of PM2.5 and its components. 14. P31, Fig.5, need a clear figure caption.

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