

***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 #1

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The paper presents the first long-term datasets from the “Campaign on atmospheric Aerosol REsearch” network of China (CARE-China), including three years of observations of online PM_{2.5} mass concentrations (2012-2014) and one year of observations of PM_{2.5} compositions (2012-2013). The average PM_{2.5} concentrations at 20 urban sites was three times higher than the average value from the 12 background sites. The PM_{2.5} concentrations are generally higher in east-central China than in the other parts of the country due to their relative large particulate matter (PM) emissions and the unfavourable meteorological conditions for pollution dispersion. The seasonal variabil-

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ity of the PM_{2.5} shows high values in winter and low values during summer at urban sites. Bimodal and unimodal diurnal variation patterns were identified at both urban and background sites. The chemical compositions of PM_{2.5} at all urban sites are organic matter (OM), SO₄²⁻, mineral dust, NO₃⁻, NH₄⁺, elemental carbon (EC), Cl⁻ at 45% RH and residual matter (20.7%). Similar chemical compositions of PM_{2.5} were observed at background sites but were associated with higher fractions of OM and lower fractions of NO₃⁻ and EC. Significant variations of the chemical species were observed among the sites. The PM_{2.5} chemical species at the background sites exhibited larger spatial heterogeneities than those at urban sites. Six pairs of urban and background sites from each region of China were selected, and the differences in the chemical compositions of urban and background sites were analysed. It is suggested that there are different contributions from regional anthropogenic or natural emissions and from the long-range transport to background areas. Notable seasonal variations of PM_{2.5} polluted days were observed, especially for the megacities in east-central China, resulting in frequent heavy pollution episodes occurring during winter. General comments It is concluded from the similar evolution of the PM_{2.5} chemical compositions on polluted days at the urban and nearby background sites that there are significant regional pollution characteristics of the most polluted areas of China. Following this it is stated that the chemical species dominating the evolutions of the heavily polluted events were different in these areas, indicating that unique mitigation measures should be developed for different regions of China. This is not conclusive and must be explained in more detail: What means “significant regional pollution characteristics of the most polluted areas of China” together with “chemical species dominating the evolutions of the heavily polluted events were different in these areas”? What means “unique mitigation measures should be developed for different regions of China”? This more precise description is required due to the conclusion that the analyses provides insights into the sources, processes, and lifetimes of heavily polluted events. The paper addresses relevant scientific tasks. The paper presents novel concepts, ideas and tools. The scientific methods and assumptions are valid and clearly outlined so that

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substantial conclusions are reached. The description of experiments and calculations allow their reproduction by fellow scientists. The quality of the figures is good. The figure captions should be improved so that these are understandable without the overall manuscript. The related work is well cited so that the authors give proper credit to related work and own new contribution. The title as well as the abstract reflects the whole content of the paper. The overall presentation is well structured and clear. The language is fluent. The mathematical formulae, symbols, abbreviations, and units are generally correctly defined and used. Specific Comments Different instruments for measurements of PM_{2.5} mass concentrations are applied at the different sites and well described. But what shows an intercomparison of these different types of instruments? Chapter 4 is a summary with some conclusions. More detailed conclusions are possible and should be drawn. Technical corrections Unaccounted and residual matter is for the same in chemical composition. This should be explained – what does it mean? Some free spaces are missing in the figure captions.

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