

## ***Interactive comment on “Properties of aerosols and formation mechanisms over southern China during the monsoon season” by Weihua Chen et al.***

**Anonymous Referee #2**

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In this study, size distributions of chemical components of aerosols were observed at three stations located in urban, suburban, and background areas. Results were thoroughly discussed from various aspects. I think this is a nice paper, but I feel the explanations are not enough or not adequate. They should be modified before this paper is accepted for publication.

A lot of previous studies are adequately referred. But, what are new findings of this study? Results of this study may be easily imaginable based on previous studies referred in this paper. The importance and significance, and the differences from previous studies should be more insisted in the introduction.

I think one problem of this manuscript is that the overall observed data are not shown

C1

and not discussed. Are all the data obtained for the target two months those shown in Figure S1? If so, this figure should be shown in the main text and overall explanation for them are necessary at first. If it is missing, I have an impression that only the day which are easy to add explanations are picked up for analyses.

Specific comments are as follows.

Line 58-60 Cohen and Wang (2013) appear twice.

Line 60-62 It may be difficult for some readers to understand modes listed here. It is better to briefly explain their definitions. Actually, this sentence is obvious because the four modes listed here (Aitken, condensation, droplet, and coarse modes) cover almost entire aerosols.

Line 61-62 I suppose that new particles via nucleation form in the Aitken mode, and not in the condensation mode. Do “new particles” mean those form on existing aerosols via condensation of gases?

Line 65 “Different” source types from what? What are differences?

Line 75-76 Pierson and Brachaczek should be (1998), not (1988).

Line 138 What do “6 sets” correspond to? There are 7 cut-off diameters.

Line 142-143 I could not understand why number of samples becomes these number. The sampling campaign was performed for two months. 24h sampling was performed every other day in GZ and ZH. So maximum number of samples is around 30, isn't it? 48h sampling was conducted every day in JFM. Does it mean two sampling instruments were used to obtain a sample for 48h every day? How the total number of samples in JFM becomes 140 only for two months? How many days the samples were properly collected and missing? Please add more explanations to understand overall pictures of the samples used in this study.

Line 144 Detailed information of the in-lab chemical analytical techniques is described

C2

in Zhang et al. (2013a), but at least it is necessary to mention also here which species were analyzed in this study.

Line 145-147 The background literatures should be explicitly shown here, especially for the definition of droplet particles.

Line 155 Is it possible to ignore effects of other ions? Is it just because only these three ions were detected? Weren't other ions used in AIM-II model, either?

Line 176-183 Differences between HYSPLIT and FLEXPART are described, but what is a specific reason why these two models were used in this study? What are expectations from these two models in the context of this study?

Line 198-200 Does it mean that the percentages of all the samples collected at all the locations fall within such the narrow range? That is kind of incredible. Or just the averaged values shown in Table 1 fall within this range? That is nonsense. The percentages calculated for each sample should be discussed here.

Line 203 What does "the majority of individual chemical species" mean? A reason of this question is because it is unclear which species were detected in this study.

Line 207-208 Again, which are "detected chemical components"?

Line 215-216 References of "the nature of the sources" should be shown here, especially for shipping sources. Are there any references showing shipping sources are dominant around this region?

Line 217-218 I suppose mobile vehicles are not main sources for sulfate. What is "high temperature industry"?

Line 220-221 How can rapid oxidation of precursor species be a reason of differences between urban and background sites? I suppose the phase equilibrium should be also one of important reasons of differences because nitrates would move to gas phase while transported to background areas.

### C3

Line 263-265 The percentages shown here are against what?

Line 265-266 Droplet mode nitrate is formed similarly to sulfate. Does it mean that nitrate is also formed via aqueous reactions? If so, what kind of aqueous reactions? If not, why nitrate is included in the droplet mode?

Line 289 What is coarse OC with a possible source of biological aerosol? Any references?

Line 298-301 I could not understand this sentence. How the author judged the average size was small, the particles were relatively young, and indicative of new particle formation? Are all of these coming from the fact that droplet mode sulfate accounted for about two thirds of the total mass concentration of sulfate? More detailed explanations are necessary to reinforce this discussion.

Line 306-308 That is true for selected days. But, how about for days not selected? Low cloud cover 60-70% and higher relative humidity were observed only for the days selected here?

Line 335 Are the words "Accumulation mode" and "condensation mode" used for the same meaning?

Line 352 Is it possible to judge that fine mode chloride and sodium are coming from sea salts? Are there any anthropogenic sources of chloride and sodium in the fine mode? If chloride and sodium in the fine mode are emitted separately from difference sources from sea salts, discussions on chloride depletion in the fine mode in this paragraph is not appropriate.

Line 362 What does "calculated ammonium" mean? How was it calculated?

Line 381 What is another important non-linear effect? It is unreasonable to discuss reasons of percentage differences only based on humidity. A lot of other factors like emission sources on pathways should be considered.

### C4

Line 403 Please add the definitions of Sulfur Oxidation Ratio and Nitrogen Oxidation Ratio, and their importance in the context of this study.

Line 439 I cannot understand discussions around here. Why can discussions in this paragraph be a reason of long-range transport? As mentioned in the line 425-426, wind speed was very low. Isn't it possible to explain high concentrations and aging under stagnant air around urban area? Do the discussions in this paragraph enable to clearly distinguish effects of stable air and long-range transport?

Line 485 Is this paragraph saying that MODIS fire hotspots are not useful to see effects of biomass burning?

Line 494 The EOF technique may be useful, but it means that it is better than the MODIS fire hotspots discussed in the previous paragraph? What is a specific reason?

Figure 2 Please specify which species use the left and right Y-Axes.

Figure 4 Why do these figures look different from other species shown in other figures? They should be consistent.

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