**Atmospheric
Chemistry
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Discussions**

Interactive
Comment

Interactive comment on "Long-term measurements of particle number size distributions and the relationships with air mass history and source apportionment in the summer of Beijing" *by* Z. B. Wang et al.

Anonymous Referee #1

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General comments: In this manuscript the long-term measurement of particle number size distribution was reported in Beijing. Back trajectory analysis was used to investigate the impacts of air mass origins on particle concentrations. PMF model was applied to apportion the particle sources. Particle number concentration and size distribution are important to human health, air quality, weather, and climate. It is crucial to investigate the particle number size distribution in a long-term to have a better understanding of the particle pollution and its impacts. As host of Olympics, Beijing implemented several emission control measures to reduce the air pollution. To evaluate the effec-

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tiveness of control measures, it is important to investigate not only the reduction of mass but also the reduction of particle number. Source apportionment can provide direct evidence of the reduction of various sources. However, the data analysis in this study was rather shallow. Some of the conclusions conflicted with the previous studies, but the authors did not offer convinced explanations. The English should be well polished. There are many grammar errors and inappropriate sentences. Insufficient writing would reduce the readability of the manuscript. I only list some of those language errors. I suggest that the manuscript should be major revised before publication can be considered in ACP. Specific comments: Abstract: some results and conclusions conflicted with the previous studies. More convinced explanations are needed. e.g., line 15, air mass origin is always an important role for particle pollution; line 19, the secondary pollution was enhanced in August 2008. In addition, the sources that different factors stand for are needed to be well interpreted. I am a bit disappointed that the authors completely ignored the discussions of the fine particle mode (i.e., 3-20 nm). This mode is essential to the total aerosol number concentrations (i.e., Atmos. Chem. Phys. 10, 4953, 2010; Chem. Rev. 112, 1957, 2012; Science 328, 1366, 2010). Since their measurements did cover the particle size down to 3nm, it would be highly desirable that the trend of fine particle mode is discussed during the period of 2004-2008, which has not been previously reported. Introduction: the introduction is deficient. The authors need to summarize not only what the previous work did but also what their results and main conclusions. Page 5168 Line 7: inappropriate word, use "negligible" Page 5168 Line 29: grammar error "had been" Session 2.2: two different instruments were used, so inter-comparison is needed. Session 2.3.2: statistic results of the PMF model are needed. Why to choose five factors. How results will change when use different F-peak value and initial input. What are the sensitivity analysis results? Page 5174 Line 9: "Meteorological conditions did not. . . " It is not true. The meteorological conditions in August were quite different from 2004 to 2008. Session 3.1: As an important session of this manuscript, particle size distribution should be well discussed here, not only to show some numbers but comparing and explaining the

differences. Page 5175 line 9-10: It makes no sense. The air quality has nothing to do with vehicle population but vehicle in use. This sentence is of no use. In addition, the detailed control measures during Olympics should be briefly described here to make it clear to audiences who are not familiar with the control policy. Page 5176 line 15-19: It cannot conclude that the air mass was not the key factor. Actually, meteorological condition is always an important factor for air pollution. The results of this work only can imply besides meteorological condition, other factors can also impact the air quality. In addition, wind speed is also an important factor. The authors should do the cluster analysis separately of 2004-2007 and 2008. Comparison of these results can probably give better explanation. Page 5177 line 4-6: Again, it's not true. Page 5177 line 26-27: "suggesting . . ." I don't really know the meaning of this sentence. Session 3.3: the sources that each factor represents for should be better analyzed: Factor 1, in spite of exclusion of the new particle formation events, the nucleation process is always happening in the atmosphere. The diurnal variation of factor 1 does not have rush hour peak. To the contrary, factor 1 was higher in daytime, indicating it may relate to photochemical process. Thus factor 1 probably represents the growth of newly formed particles. Factor 2, the first peak appears at noon time, but how to explain the second peak? Previous studies indicated there is no evening peak in Beijing. Even if there is evening rush hour, the particles from traffic cannot be aged after sunset when there is no sun light. Page 5178 line 21:" besides traffic" did the author mean traffic emission is also included in this factor? Page 5179 line 1-10: Factor 4: several studies confirmed that in August 2008, the secondary formation was enhanced. The result of this work conflicts the previous results. Explain why. Page 5179 line 10: "oxidation capacity" does the authors mean oxidability? Page 5179 line 16: what's the meaning of "steady" here? Line 27: "significant cluster"? Page 5180, line 1: "The results show. . .", line 13: "we also applied. . ." grammar error. Figure 2 is in consistent with figure 5. The size distribution in figure 5 has a strange shoulder, as well as figure 4.

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