

## ***Interactive comment on “Regional characteristics of spring Asian dust and its impact on aerosol chemistry over northern China” by Y. L. Sun et al.***

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Referee1 gave us many valuable suggestions on improving this manuscript.

Our manuscript focused on a preliminary study of regional characteristics of spring aerosol over northern China. PM<sub>10</sub> was the major pollutant of the cities over northern China in spring, so the results of factor analysis could reflect somewhat the regionality of spring aerosol over northern China. Similar results were also obtained by Wang et al., (Regional characteristics of three kinds of dust storm events in China, 2005, Atmospheric Environment, 509-520). Only six sampling sites' data could not give a thorough and detailed investigation of regional characteristics of aerosol in China, but under the situations in existence, we do believe that no research institute, even if State Environmental Protection Administration of China, can monitor the aerosol simultaneously at all cities in China. Thus, our manuscript focused a “preliminary” study of the regionality

and had shown us some valuable results on it. Totally, 455 TSP and PM<sub>2.5</sub> samples were collected intensively at six sampling sites from March 9 to April 23 in 2004 when the dust storms frequently occurred. The data from these samples provided us a strong tool to study the characteristics of spring aerosol in China. We agreed the referee 1's comments that the results from field measurements could not provide direct evidence on some reactions on the surface of dust particles and it needed laboratory studies to investigate the reaction mechanisms. Our group had done some lab studies in this aspect and got some valuable results (Zhang et al., Heterogeneous Reactions of Sulfur Dioxide on Typical Mineral Particles, *J. Phys. Chem. B* 2006, 110, 12588-12596).

The paper "The evolution of chemical components of aerosols at five monitoring sites of China during dust storms" by Wang et al., (2007) seemed to be similar to this manuscript because we used the same data. However, the two papers were much different. Wang et al., (2007) emphasized the mass concentration of PM, chemical composition (secondary and crust) and source apportionment of aerosol. This manuscript gave a detailed analysis of individual chemical species. It focused on the regionality and the impact of dust on different chemical components. Also, we used different method to investigate the impact of dust on the aerosol acidity. In the revised manuscript, we compared it with Wang et al., (2007) and cited it.

Response to specific comments:

1. The data from 13 cities could not reflect "all" characterization in northern China, but basically somewhat, it could. We also believe that no research institute can give the readers a through characterization of aerosol in northern China now. The 13 cities almost included all monitoring sites of State Environmental Protection Administration of China. We neglected Jinan when we did the factor analysis. In the revised manuscript, we added Jinan site. It showed media loading in both factor2 and factor 3. Basically, Jinan belongs to Inland-Passing Region. However, it also showed some similar variations with those in coastal areas possibly due to that they were both less affected by dust storm. Harbin is located in the far north of China and this region is not the focus of

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this study, so we didn't include it. The PM<sub>10</sub> data of 13 cities was described at section 2.2.3. PM<sub>10</sub> was the major pollutant in these 13 cities in spring, so only PM<sub>10</sub> data was involved in the factor analysis. The factor analysis was done using the software STATISTICA. We will describe it more in the revised manuscript. We also corrected the regional division in this study. Shanghai is located in the eastern China. However Shanghai was also affected by dust storm in 2004, so we included it in the discussion, but excluded it in the regional division. As the referee 1' mentioned, Shenyang is an inland big-city. Shenyang showed high factor loading in the coastal region factor, but it shouldn't belong to this region. One explanation is that Shenyang was less affected by dust storm in 2004, so it could show some similar variation of PM<sub>10</sub> with those in costal areas. Further studies were needed to improve this regional division.

2. In this study, we have six sampling sites. Though Shanghai is located in the Eastern China, it can also be affected by dust storm. Just like the references (Meskhidze, et al., 2003, GRL) which referee 2 mentioned, dust plume over the Yellow Sea in the March of 2001 contained high concentrations of both dust and SO<sub>2</sub>. It provided the evidence that dust storm was transported to Shanghai and interacts with the pollutants. Moreover, through studying the characteristics of spring aerosol in Shanghai, we can get more information of how dust storm affects the aerosol components in the areas far from dust source regions. Overall Shanghai site might not be included the regional division in this manuscript, but it's important to study the impact of dust on the aerosol components after a long transport distance. Beijing has two sites, one is urban site, and the other is suburban site. We think that the two sites should not be identical though they might experience the same effects of dust storm. As we know, the chemical composition at urban and suburban sites was different (see this manuscript), so when dust storm passing the two sites, its influence on the aerosol chemistry at these two sites must also be different. Hence, we discussed them both in this manuscript. Four or five and even more than ten sampling sites are not enough to characterize the effects of dust storm on the "five regions" in China. This study was a preliminary study. Though only 6 sampling sites were included in this study, it presented us a valuable concept that

we should study Chinese aerosol in regionality due to the significantly different aerosol characteristics in China. More work is needed to investigate this regionality.

3. Beijing and Miyun are two different sites, one is urban site, and the other is suburban site. The suburban site is far from Capital Steel Company (CSC) which is a large source of Fe in the atmosphere and less affected by it, however, the urban is more easily affected by the CSC. In Sun et al., (2004, Atmospheric Environment, 38, 5991-6004), we observed high ratios of Fe/Al at the site close to CSC than other sites which are far from CSC. The results were consistent with those in this study. As such, we deduce that high ratio of Fe/Al at Shanghai was possibly from the influence of steel works in Shanghai.

4. Median values could be more reasonable than mean values in studying the compositional difference during “the whole period” among different regions. We didn’t claim that median values were the representative parameters for non dust storm days. Actually, when studying the impact of dust on the aerosol components in different regions (i.e., difference between dust storm and non dust storm), we used the mean values to compare the difference between dust storm and non dust storm. We have clarified it in the manuscript.

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