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***Interactive comment on* “Evolution of aerosol chemistry in Xi’an, inland China during the dust storm period of 2013 – Part 1: Sources, chemical forms and formation mechanisms of nitrate and sulfate” by G. H. Wang et al.**

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Anonymous Referee #1

General comments: In the current work a semi-continuous observation on aerosol chemistry in Xi’an, a mega-city near Loess Plateau, was performed by characterizing the hourly collected TSP samples during a dust storm event. Moreover, size distributions of inorganic ions, WSOC and WSON in the dust storm period were also investigated. Hourly changes in aerosol compositions including chemical forms of nitric and

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sulfuric salts were explored. Kinetics of nitrate and sulfate formation during the dust storm event and the post-event were discussed. Finally, the authors proposed a mechanism for the nitrate formation on the dust surface. The results of this paper are quite interesting. Their findings on chemical forms of nitrate and sulfate in the dust particles and size distribution patterns of nitrate, sulfate and ammonium for first time revealed the infant state of atmospheric ageing process of East Asian dust in the area near the dust source regions, which is very helpful for researchers to improve their understanding on the full image of physicochemical evolution of Asian dust from the desert to the continental outflow region. The work was well designed. The organization of the paper is in good format, and related discussion is reasonable. Therefore, I believe this paper should be accepted by the journal after a minor revision. Following is the detailed comments. Response: We thank the reviewer for the comments, and have carefully revised our paper. See the details below.

Detailed comments. Comments: 1) Page 17442, line 3, of East Asian dust ageing process is better than "... of dust ageing process...". Response: Suggestion taken. Please see the revised manuscript page 3, line 65.

Comments: 2) Page 17444, lines 1-5, can author give the specific numbers of concentrations of sulfate and nitrate in 1997 and 2012, could author give a brief explanation why sulfate has sharply decreased in the city? Response: Suggestion taken. We have added the concentration numbers into the text with a brief explanation. See page 5, line 117-119.

Comments: 3) Page 17444, line 4, gas not gases; lines 7, "...10-30% of the dust mass...", give the reference; line 8-9, should be HNO₃(g), which is more accurate. Response: Suggestion taken. See page 5, line 123-124. We found the original statement "...10-30% of the dust mass..." , which we cited, is not correct. Calcite is the fourth abundant mineral in Chinese clay, but the content of calcite in east Asia dust is the most variable (McNaughton et al., 2009). From Liu et al (1985), we found that the content in East Asian dust should be 3.6-21%. Thus, we revised this sentence (see

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page 5, line 123).

Comments: 4) Page 17444, line 20-22, It's better to change as "We first investigated. . . Then we identified...", which is consistent with the following statements. Response: Suggestion taken. See page 5, line 134-136.

Comments: 5) Page 17444, line 25, delete the "dust". Response: Suggestion taken. See page 6, line 139.

Comments: 6) Page 17445, what is the brand of the size-segregated sampler, I think this information is important. Response: Suggestion taken. We have added the information into the text. See page 6, line 150.

Comments: 7) Page 17447, line 8-11, this sentence is a little bit of confusing to me. Please re-write. Response: Suggestion taken. We re-wrote the sentence. See page 8, line 195-198.

Comments: 8) Page 17449, line 5, should be originated not originates; line 11, anthropogenic sources not species. Page 17451, line 4, NaCl, not NaCl-. Response: Suggestion taken. See page 10, lines 242, 248-249, and page 12, line 293.

Comments: 9) Page 17452, line 7, what is the meaning of the slope 0.28, if it means the 1:1 molar ratio of NH_4^+ to NO_3^- , i.e., the value of $0.28=18/64$, please clarify. Response: Yes. The slope of 0.28 is corresponding to the 1:1 molar ratio of $\text{NH}_4^+/\text{NO}_3^-$, because here we used the mass concentration. To avoid any potential confusing problem, we modified the statement as "nitrate and ammonium mass concentrations not only displayed the same size distribution patterns during the whole sampling period but also strongly linearly correlated each other during the dust storm and transition periods with a slope of 0.28 that is equal to the 1:1 molar ratio of NH_4^+ to NO_3^- . . .". See page 13, line 325-330.

Comments: 10) Figure 2b, the maximum of EC in the dust storm period is around $30\mu\text{g m}^{-3}$, but in Table 1, the range is $0.0\text{-}3.2\mu\text{g m}^{-3}$, is this number wrong? Response: We

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corrected this mistake. It should be 0.0-32. See page 22, line 727 (Table 1).

Reference: Liu, T.: Loess in China, China Ocean Press, Beijing, 1985.

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