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Interactive comment on “Impact of Gobi desert dust on aerosol chemistry of Xi'an, inland China during spring 2009: differences in composition and size distribution between the urban ground surface and the mountain atmosphere” by G. H. Wang et al.

Anonymous Referee #2

Received and published: 30 September 2012

The manuscript by Wang et al. conducted the synchronous measurements of aerosol composition and size distributions at a ground site and a mountain site in the free troposphere in central China during the spring of 2009. The results were compared with their previous observations at Mt. Hua to investigate the aerosol chemistry differences in the two different environments. In particular, the impact of dust storm from Gobi deserts on the aerosol chemistry at the two sites was discussed in detail. The data is very interesting and unique. Some important findings are reported. For example,

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the authors found that the heterogeneous formation of nitrate could result in urban fine particles more acidic during dust storm, which is surprising. Such finding might have important implications since the NO_x level in China continues to increase in recent years, and the nitrate chemistry would become more important than before. It's also interesting that the WSON and organic matters were enhanced during dust storm. The long-range transport of dust with high WSON, thus, might have a potential impact on the productivity of marine phytoplankton. Overall, this study increased our understanding of aerosol chemistry between the ground surface and the free troposphere over central China. It should be accepted for publication. The referee #1 has given detailed comments on this manuscript, I, here, have a few comments listed below.

1. Page 21357, line 12-15. It appears that the increased nitrogen-containing species during the dust event is primarily from Gobi desert, are any other sources for WSON?
2. Section 2.1, How about filter blanks in this study? A brief description is needed.
3. Page 21371, line 2-6, Could authors give more explanation how the water-soluble organic nitrogen compounds were adsorbed onto dust?
4. Section 3.3. The results that fine particles in Xi'an during the DS II episode became more acidic are very interesting. The authors claimed that such phenomenon was observed for the first time in China. I am wondering if there are any lab studies on heterogeneous reactions, e.g., HNO₃ + dust, to support your conclusion.
5. Page 21363, paragraph 3. Cloud processing at the summit of Mt. Hua should be very important for the sulfate formation, which might also explain the lower ratio of NO₃/SO₄ observed at Mt. Hua than the ground site.
6. Page 21357, line 8, Suggest to replace “event” by “dust event” in the text, which is clearer to readers.

Interactive comment on *Atmos. Chem. Phys. Discuss.*, 12, 21355, 2012.

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