

Interactive comment on “Five-year record of atmospheric precipitation chemistry in urban Beijing, China” by F. Yang et al.

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The authors are grateful to all the reviewers and the editor very much for their general and specific comments on our manuscript. Their detailed comments are very valuable for the improvement of the paper. We have addressed all the comments point-by-point as below. All the relevant corrections and changes are highlighted in the revised manuscript supplemented.

Referee #2 (specific comments)

1. In abstract, “Most precipitation samples had an intermediate pH (6.1-7.3) and 16% were acidic”. Please give the pH ranges of the left 16% rainfall samples. Most precipitation samples should be replaced by nearly 84% precipitation samples.

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Response: The suggestion has been taken. The sentence was reworded as “Intermediate pH (6.1-7.3) was recorded in approximately two-thirds of the precipitation samples and acidic pH (4.2-5.6) in only 16% of the samples”.

2. In Introduction part, the author should give a brief introduction of air pollution levels in Beijing in recent studies, and possible influence on acidity of precipitation.

Response: Thanks for the comment. The suggestion has been taken. We add some words about Beijing’s air pollution levels in introduction section accordingly.

3. If possible, please give a repeatability experiments result table.

Response: Thanks for the comment. The precision of ionic measurements in this study has been already addressed very clearly, including the variations in replicate measurements for each ion (see P28101 L25-27). Thus we think it is not necessary to give a table on the replicate measurements.

4. The ions concentration in Figure 5 is the annual volume-weighted or not? If yes, please describe it in MS.

Response: Thanks for the comment. The ionic concentrations in Fig. 5 are the concentration percentiles and the single volume-weighted mean of each ion. To make it clear, we specify this in the sentence on P28103 L19 “Statistics of ionic concentrations for all the precipitation samples are shown in Fig. 5” by changing it into “Fig. 5 illustrates the statistics of concentrations of ions in the precipitations, including the 10th, 25th, 75th, and 90th percentiles and VWM of each ion.”.

5. Please give the meaning of x-axis of Figure 6.

Response: The suggestion has been taken. We have modified the Fig. 6 as enclosed.

6. If possible, please describe the seasonable variation of acidity and chemical composition of rainfall samples.

Response: Thanks for the comment. The seasonal variations in acidity and chemical

composition of rainfall samples have been discussed separately in section 3.1 and 3.3.

7. The paper could have been better-written. Revising the entire MS by a native English speaker is highly required prior to publishing.

Response: Thanks for the nice suggestion. The general use of English language has been polished by a native speaker and many corrections have been made accordingly (see the highlighting revisions and changes implemented in the manuscript behind this point-to-point response).

Referee #3 (specific comments)

1. P28098 L2: it is better to change “from March 2001 through August 2005” into “from March 2001 to August 2005”.

Response: The suggestion has been taken.

2. P28102 L13-14: If possible, it is better to compare the authors’ annual precipitation volume with those reported by the local Beijing Meteorological Bureau or EPB, which can be a well reference of spatial difference of precipitation within Beijing.

Response: The suggestion has been taken. We reword the sentence “These volumes were largely lower than long-term average in Beijing (www.bjmb.gov.cn)” as “These volumes were similar to the reported range of 339-483 mm for the whole city through the years (www.bjstats.gov.cn) but largely lower than long-term average in Beijing Metropolis (www.bjmb.gov.cn)”.

3. P28102 L17-L18: the original expression should be given firstly before the simplified name of “VWM EC”.

Response: The suggestion has been taken. We change “VWM EC” into “The volume-weighted mean (VWM) of EC”. The words for the simplified form “EC” has been given when it first appears on P28101 L13.

4. P28102 L13: it is better to change “Total precipitation amount” into “Annual total

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precipitation amount”.

Response: The suggestion has been taken. We change “Total precipitation amount” into “The annual total precipitation amount”.

5. P28102 L17: the words for the simplified form “VWM” should be given when it first appears.

Response: The suggestion has been taken. See the response to point 3.

6. P28103 L13: it is better to change “and averaged at” into “with an average of”.

Response: The suggestion has been taken.

7. P28104 L7-9: a reference or the method about how to calculate non-sea salt Ca^{2+} and non-sea salt SO_4^{2-} should be given?

Response: The suggestion has been taken. We add “calculated from the ion ratio $\text{Ca}^{2+}/\text{Na}^{+}$ in seawater equal to 0.0379” and “calculated from the ion ratio $\text{SO}_4^{2-}/\text{Na}^{+}$ in seawater equal to 0.252” at the ends of “The non-sea calcium (nss- Ca^{2+})” and “The non-sea salt sulfate (nss- SO_4^{2-})”, respectively.

8. P28104 L8: the definite article is better to be added before “total calcium”.

Response: The suggestion has been taken. We add (i.e., non-sea-salt plus sea-salt calcium) behind “total calcium”.

9. P28104 L13-14: it is better to change “Compared to the long-term observation at 9 sampling sites in the Tokyo Metropolitan with precipitation pH of 4.5 during June 1990–May 2002” into “Compared to the long-term observation during June 1990–May 2002 at 9 sampling sites in the Tokyo Metropolitan with severe acid precipitation”.

Response: The suggestion has been taken. We change “Compared to the long-term observation at 9 sampling sites in the Tokyo Metropolitan with precipitation pH of 4.5 during June 1990–May 2002” into “Compared to the long-term observation from 1990

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to 2002 in the Tokyo Metropolitan area with severe acid rain”.

10. P28107 L17-18: it is better to give out the details and the source reference of SO₂ and NO₂ concentration decrease.

Response: Thanks for the suggestion. We double check the NO₂ data (it is not NO₂ but NO_x data was reported in 1998 by Beijing Municipal Environmental Protection Bureau) and make revision and add the source reference accordingly. The sentence “However, the decrease in SO₄²⁻ and increase in NO₃⁻ did not scale to or even opposed to the 58% and 11% decrease in annual mean concentrations of SO₂ and NO₂ in Beijing from 1998 to 2005” has been changed into “However, the decrease in SO₄²⁻ level did not scale to the 58% decrease in the annual mean SO₂ concentration from 1998 to 2005 (50 μg m⁻³ in 2005). What seems more surprising is that the NO₃⁻ growth was opposite to the 5% reduction in the annual mean NO₂ concentration from 1998 to 2005 (66 μg m⁻³ in 2005)”.

11. P28107 L20-21 and P28110 L22: maybe it is not appropriate to conclude a “substantial” decrease on NO₂ concentration during the past decade, please check it.

Response: The suggestion has been taken. We double check it as mentioned in the last response and change “the substantially decrease in atmospheric SO₂ and NO₂” into “more or less decline of ambient SO₂ and NO₂ levels”.

12. P28109 L18: it is better to change “and averaged at” into “with an average of”.

Response: The suggestion has been taken.

13. P28110 L2: it is better to change “from March 2001 through August 2005” into “from March 2001 to August 2005”.

Response: The suggestion has been taken.

Please also note the supplement to this comment:

<http://www.atmos-chem-phys-discuss.net/11/C14884/2012/acpd-11-C14884-2012->

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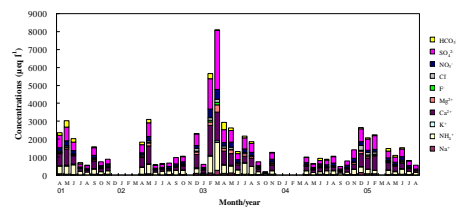


Fig. 6.

Fig. 1.

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