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Interactive comment on “High solubility of SO₂: evidence in an intensive fog event measured in the NCP region, China” by Q. Zhang and X. Tie

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Received and published: 26 April 2011

Reviewer 1

We thank the reviewer for the careful reading of the manuscript and constructive comments. We have revised the manuscript following his/her suggestions as is described below.

This manuscript presents very interesting findings from a field measurement campaign in North China. By analyzing SO₂ and CO measurement data for a typical fog event at a surface site in Tianjin, China, the authors found that aqueous reactions of SO₂ in the droplets of fogs play important roles to enhance the solubility of SO₂, and they

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proposed an "effective " Henry Law constant of SO₂ for model calculations. This paper is well-written and scientifically important. This referee would like to recommend its publication on Atmospheric Chemistry and Physics if the authors can carefully address the following issue.

Fig.2 shows that an extremely high CO concentration with a range from 2 to 10 ppmv during the study period. It is difficult to understand that what sources can cause such high CO concentrations but 20–40 ppbv of SO₂ (during non-fog period) in the suburban/rural site with a distance about 30 km away from Tianjin. Also, it should be noted that there are some scattered but well-organized data points below the CO time series in Fig.2. Is there a possibility of zero calibration has not been well-corrected? Since the author used CO profiles as an indicator to show that air masses haven't change a lot during the fog event, the data quality should be double checked.

Res: This measurement site is located a very polluted area, about 30 km from a mega city (Tianjin, China). The air pollution is very high in this city, and there are several papers that have already described the high pollution in this city (e.g., Han et al., 2009). We also state in the manuscript that during the fog period, the winds were very weak, which enhanced the concentrations of CO and SO₂. As a result, 2-10 ppm of CO and 20-40 ppbv of SO₂ were measured in the site.

In the revised manuscript, we use a re-analyzed CO data (more robust than the previous data), in which the zero calibration has been corrected. As a result, the scattered points are removed in the re-analyzed data. The contributors for the data re-analysis are included as co-authors.

Please also note the supplement to this comment:

<http://www.atmos-chem-phys-discuss.net/11/C2261/2011/acpd-11-C2261-2011-supplement.pdf>

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 2931, 2011.

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