Atmos. Chem. Phys. Discuss., 10, C14089–C14092, 2011
www.atmos-chem-phys-discuss.net/10/C14089/2011/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Quantifying the uncertainties of a bottom-up emission inventory of anthropogenic atmospheric pollutants in China" *by* Y. Zhao et al.

Y. Zhao et al.

yzhao@seas.harvard.edu

Received and published: 23 February 2011

We thank reviewer #2 for the comments and suggestions. Our brief point-by-point response to those comments follows:

1. The provincial differences are well captured in our study for power plants, the most important source of atmospheric pollutants in China, as we are able to evaluate this sector on a unit-by-unit basis. In the revised manuscript, we provided such information in a new table (Table S3) in the supplementary materials. Due to limited data, however, we cannot evaluate industrial and residential sources by province, and thus the national average is applied. As we stress in the revised manuscript, more detailed investiga-

tion of regional differences is needed to further reduce the emission uncertainties for sectors other than thermal power generation.

2. We agree with the reviewer that the uncertainties of activity levels for industrial and residential sectors were somewhat underestimated. In the revised analysis, we modified such assumptions with consideration of additional literature including Zhang et al. (2007) and IPCC (2006). The activity level data for industrial, residential fossil fuel, and biomass sectors were assumed to have coefficients of variation (CV) of 10%, 20%, and 30% respectively, in accordance with implications of Zhang et al. (2007) and IPCC (2006). We then reran the Monte Carlo simulations with revised uncertainty assumptions. The results indicate that while the revised uncertainty of activity levels contribute more to the uncertainty of emissions, the differences are insignificant for most sectors and species.

3. We agree with the reviewer that the uncertainty of emission factors for non-road sources were probably underestimated in the original analysis, for most of the cited reasons (noting that new regulations implemented since 2007 would have little if any impact on the emissions of 2005). Lacking direct field measurements from China, in the revised analysis we subjectively assumed lognormal distributions with CV of 100% for emission factors of non-road sources, and reran the Monte Carlo simulation. The results confirm that the uncertainties of emission factors of non-road sources dominate the uncertainties of transportation sector for all species.

4. In the revised manuscript, the 95% CIs around the central values for beta, gamma, weibull, and logistic distributions are provided in Table S4 and S6 in the supplementary material. We note that not all distributions employed in this work are symmetric, i.e., the central value is not necessarily the average of lower and upper bounds. For example, there are a series of field measurements for BC/OC emission factors of residential coal stoves and all species emitted by open burning of biomass. Due to irregularity of the resulting data or lack of adequate sampling, however, the results cannot be easily fitted to distributions, and uniform distributions are assumed for those emission factors. The

medians of those results, which are used as central values of the distributions, are not necessarily the averages of minimum and maximum field test results, which are used as lower and upper bounds of the distributions. This is clarified in Sections 3.1 and 3.2 in the revised manuscript.

5. We checked the assumptions of each probability distribution and reran the Monte Carlo simulation. The new results are much more consistent, as summarized in Table 1 and Figure S2, although some inconsistency for BC does remain. As discussed above, the main reason is that the central values for emission factors of residential coal/biomass burning are not the midpoints of upper and lower bounds of the assumed uniform distributions.

6. We agree with the reviewer, and a new paragraph comparing the central values of emissions by different studies is added in the beginning of Section 4.5 of the revised manuscript. A new figure (Figure 4 in the revised manuscript) shows that most estimates by other researchers are within the 95% CIs provided in this work, except for SO2, NOX, and BC emissions by Ohara et al. (2007). The likely reasons for the relative large discrepancies between Ohara et al. (2007) and this work are then discussed.

7. The titles for subplots of Figure S2 are included in the figure caption.

Reference

Intergovernmental Panel on Climate Change (IPCC): 2006 IPCC Guidelines for National Greenhouse Gas Inventories, IPCC National Greenhouse Gas Inventories Programme, 2006.

Ohara, T., Akimoto, H., Kurokawa, K., Horii, N., Yamaji, K., Yan, X., and Hayasaka, T.: An Asian emission inventory of anthropogenic emission sources for the period 1980-2020, Atmos. Chem. Phys., 7, 4419-4444, 2007.

Zhang, Q., Streets, D. G., He, K., Wang, Y., Richter, A., Burrows, J. P., Uno, I., Jang, C. J., Chen, D., Yao, Z., and Lei, Y.: NOx emission trends for China, 1995-2004: The

view from the ground and the view from space, J. Geo. Res., 112, D22306, doi: 10.1029/2007jd008684, 2007.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 29075, 2010.