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Interactive comment on "Asian emissions in 2006 for the NASA INTEX-B mission" *by* Q. Zhang et al.

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This paper presents an Asian emission inventory for major air pollutants in year 2006. It has also updated the 2001 inventory using several improved methods. This updated emission inventory is much needed for addressing regional air quality, atmospheric chemistry and climate change in Asia, in view of the rapid changes in air-pollution emission since 2000. The improved methodologies allow more accurate estimates of emissions in Asia. The manuscript is well organized and clearly written. I have following comments and suggestions for the author to consider.

The current inventory did not update the NH3 emission in China assuming that agricultural activities have not changed significantly since 2001 (without supporting information). However, a major source of NH3 is livestock whose emission may have increased with the rising standard of living. Thus the NH3 emission in the current inventory may have been underestimated.

Response: We made a decision early on in the INTEX-B program not to include updates to methane and ammonia emissions. The major reason was that we did not expect these emissions to have changed much in recent years. They are not driven by the same kinds of economic forces that have caused the large upsurge on emissions of some species in Asia since 2000. The REAS inventory presented the recent trends of CH4 and NH3 emissions in Asia (Ohara et al., 2007). They estimated that CH4 emissions in Asia were 89.9 Tg in 2000 and 90.3 Tg in 2003, an increase of just 0.4 percent in three years; and NH3 emissions in Asia were 28.1 Tg in 2000 and 28.4 Tg in 2003, an increase of 1.0 percent in three years. We have added this reference into the revised paper. (Ohara, T., Akimoto, H., Kurokawa, J., 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.) Also, neither NH3 nor CH4 were high priorities of the INTEX-B mission (Singh et al., 2006). It was not expected that ammonia would be measured on-board the aircraft, and even though CH4 would be measured, it was not an important species in the chemical modeling world due to its long lifetime. (Singh, H. B., Brune, W. H., Crawford, J. H., Fuelberg, H., Jacob, D. J.: The Intercontinental Chemical Transport Experiment - Phase B (INTEX-B): An update, 2006.) Therefore we were advised by INTEX-B science team leaders to treat these two species as of lowest priority in developing the new INTEX-B emission inventory. For these two reasons we determined to hold their emissions constant at TRACE-P values.

A major difficulty in developing emission inventories is to obtain relevant data, which is particularly the case in China. More elaborate discussion should be given on the source of data for the parameters used in estimating provincial emission (Formula (1) and (2)). Large sources such as power plants and large factories are relatively easy to identify, but how are small- to medium-sized industries identified? Does the penetration of pollution-control technologies (thus the emission factors) vary from region to region?

Response: Generally, fuel consumption by sector and industrial production by prod-

ACPD

9, S2701–S2704, 2009

ucts (A in Eq. 1) can be accessed from various public statistics at the provincial level. However, the distributions of the combustion technologies in each sector and the processing technologies in each industrial product (X in Eq. 1) are generally not available from governmental statistics. In this work, these data were collected from a wide range of unpublished information developed by various industrial associations and technology reports. For large emitting sources (power plants, cement plants), the penetration of new pollution control technologies varies among provinces, and we are able to retrieve them from plant-specific databases; but for small-sized industries such information is usually not available. In these cases we used nationwide penetration fractions, with adjustments for a few well-developed regions, such as Beijing and Shanghai, where local information could be found. In the revised manuscript, we have added a new table (Table 2) to summarize the data sources of key emitting sectors in China.

It would be good to give an uncertainty in the emission estimate for each pollutant in terms of percentage, as has been done in the TRACE-P inventory. This would alert the users to use the emission data with different levels of confidence based on the uncertainties. While the author pointed out the general consistency between the emission and the satellite data for limited pollutants, it is important to call for more evaluations of this new inventory.

Response: We have conducted an uncertainty analysis for China using exactly the same method as was used in the TRACE-P inventory (propagation-of-errors method) and added it to the text. This analysis shows improvements to the accuracy of the emission estimates since TRACE-P. It is impossible for us to conduct such an analysis for the whole of Asia, since we use several local emission inventories and their uncertainties are not known. However, in order to add confidence to the present inventory estimates, we have added a new section to the paper that reports on the results of related INTEX-B and other studies that have used this inventory. This new section is called "Applications and Evaluations of the Inventory", and it summarizes the relevant studies and the implications for the present inventory.

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9, S2701–S2704, 2009

Minor: Page 4090, line 23: change "raise they" to "they raise".

Response: This has been corrected.

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9, S2701–S2704, 2009

Interactive Comment