

Interactive comment on “A high-resolution emission inventory of primary pollutants for the Huabei region, China” by B. Zhao et al.: Reply to Anonymous Referee #2

We thank the anonymous referee for his/her comments. Below are referee comments and author responses.

Referee comments

The authors developed a high-resolution emission inventory of air pollutants for the Huabei region in China for the year 2003. The emission inventory is essential and important data for atmospheric science community as well as policymaker and the topic certainly is suitable for ACP. The manuscript presents the sophisticated methodology based on region-specific activity data and emission factors, estimated results and the comparison with other inventories. The author’s inventory has some advantages in the spatial distribution (high-resolution of 0.1 deg) and in the input data (emission factors by local measurements, information for large point sources, and activity data from local districts). However, this manuscript doesn’t include the important scientific results and the new findings for the ACP publication. I regret to say that the current manuscript needs to be improved in two aspects at least to be qualified science paper in ACP: (1) demonstrating clearly the scientific advance in the improvement of emission inventory due to the methodology and input data used in the work; (2) adding the more discussion of the comparison with other inventories and the implication of their differences. In conclusion, I am recommending the major revision of this manuscript in the following points.

Author Responses

We thank the referee for positive consideration of our manuscript, especially for recognizing the advantages of our inventory. According to the referee’s suggestions, we have made major revisions to improve the manuscript. We have added a new section (3.3) to demonstrate the contributions of point sources to the total emissions, and we have also rewritten Section 4.2 to estimate the uncertainties in our emission inventory by investigating the differences in our estimates from the EDGAR-CIRCE and INTEX-B

inventories (methodology used in other works, as Ma and van Aardenne, 2004), including the increases in energy consumption from 2003 to 2005/2006.

Someone might think that the inventory development, except for the measurements of emission factors, dose not contain so much science but only data statistics. However a concise and fine-resolution regional emission inventory is essential for air quality and atmospheric chemistry research. It has been widely recognized that the emissions in China, including the Huabei region, have changed dramatically year by year during the 2000s. As recognized by the referee, our inventory has been developed based on region-specific activity data and emission factors and has some advantages in the spatial distribution (high-resolution of 0.1 deg) and in the input data. By comparing our inventory with other inventories EDGAR-2005 and INTEX-B-2006, we show large differences between the three inventories even though the trends in the energy consumption have been filleted out. Our research will provide the valuable scientific dataset and important information for model studies related to the changes in air quality in Huabei.

We should point out that the database of our emission inventory was ready as early as in 2007 (Zhao, B.: Investigation of air pollution emission sources in North China, M. S. thesis, Chinese Academy of Meteorological Sciences, Beijing, 2007). Unfortunately, this study was not recognized and cited due to the lack of publications which could prove the quality of the work. Additionally, as reply to the referee #1, the fact that this emission inventory refers to the year 2003 does not mean that our inventory work is too old to be valuable. In this study we do want to make comparisons with other inventories than EDGAR-2005 and INTEX-B-2006. However, this is not practical mainly due to either incomplete dataset available or lower grid-resolution for those inventories. We would suggest that more detailed comparisons be carried out in the future and would like to provide more detailed data for anyone who will be able to lead such kind of comparison work.

Referee comments

(Major comments)

(1) One of the advantages of the author's work is the inclusion of estimation for the

emissions from lots of LPSs (Large Point Sources). In general the LPSs have a large contribution in total emissions for SO₂ and NO_x in the area, while their contribution may be relatively small for other pollutants. I recommend that the authors demonstrate the contribution of LPSs in total emissions in Huabei for each chemical compound.

Author Responses

We have added two figures (Fig. 5 and Fig. 6) into the revised manuscript to demonstrate the contributions of the LPSs to the total emissions for each pollutant in the region. Detailed descriptions and discussions can be seen in a new section: “3.3 Point source emissions”.

Referee comments

(2) Second advantage of this work is the use of region-specific emission factors from Jiang and Tang (2002) and others. What is difference between the author’s emission factors and those in the previous works, such as INTEX-B, EDGAR, and REAS? In addition, the implication of differences should be discussed in more detail.

Author Responses

We give a discussion on the difference in the emission factors between the different inventories in the fifth paragraph of the revised manuscript: “Emission factor uncertainties are generally the largest source of uncertainties in the emission estimates. For example, the SO₂ emission factors of”. The paragraph has been also largely extended and restructured, following the comments of referee #1 as well.

Referee comments

(3) In the section 4.1 the authors compared the author’s inventory with other inventories. An important problem is that the base years for three inventories discussed in this manuscript are different. Actually, the pollutant emissions in China was increased dramatically from 2003 to 2006 (or 2005) shown in Zhang et al. (2009; ACP) for NO_x, Lu et al. (2011; ACP) for SO₂, and Lei et al. (2011; ACP) for PM. For this reason, the inter-comparison of emission inventories for different base year should be more careful. On the other hand, there are some emission inventories for

the year 2003 or 2004 in provincial level of China (e.g. Ohara et al., 2007; Lu et al., 2011). I am recommending the comparison with these inventories.

Author Responses

We realized that the base years for the three inventories discussed in the manuscript are different when doing comparison. We just want to show the differences between the inventories so that a modeler may be careful to explain their modeling results when using a specific inventory for different years. Even scaled to the same year by the increases in energy consumption, the differences between these inventories are still very large. We have done extra work to investigate the differences in our estimates from the EDGAR-CIRCE-2005 and INTEX-B-2006 inventories. We make use of the ratios of the energy consumption in 2005 and 2006 to the energy consumption in 2003, which can be considered as indices for the relative increases in the emissions from 2003 to 2005 and 2006. Please see the section “4.2 Uncertainty analysis” as well as Fig. 9 for detail. We did not find the data in provincial level of China in the paper of Ohara et al., 2007.

Referee comments

(4) In the last part of section 4.1 the authors conclude that “these kinds of differences ..., and could be caused most probably by different emission factors used in the estimates”. The authors should discuss about the main reason of differences in more detail and in a scientific sense.

Author Responses

This sentence has been removed in the revised manuscript. We have performed extra work on comparison work and have given more detailed discussions. Please see the section “4.2 Uncertainty analysis” as well as Fig. 9 for detail.

Referee comments

(Minor comments)

(1) Fig. 2: We can't find the emissions from power generation, oil and solvents, and manure which are shown in Table 11. Why ?

Author Responses

As stated in our manuscript, power generation and manure have been classified into

industrial section and civil section, respectively.

(2) Table 11: “Industril processing” should be “Industrial processing”

Author Responses

Thanks. We have corrected it.

(3) Fig. 5: This figure is unclear. The authors should be improved to be more visible.

Author Responses

As can be seen in “Figure captions”, this figure consists of two plots. We will ask the editor to put them into two separate pages.