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 #1**

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

Referee comments

General Comments:

Air pollutant emission inventories are fundamental information for investigating pollution formation mechanism and formulating pollution control policy, and the work associated with emission inventories should be always encouraged given the fact that fundamental emission data compilation, analysis and sharing in China generally do not cause enough attentions. From this point of the view, I would like to give my favorable considerations of this manuscript. In this manuscript, the author presents a high-resolution emission inventory of primary pollutant for the Huabei region, one of several regions with serious air pollution in China, the work shown here is important for further analysis of identifying and characterizing atmospheric environmental issues in this region. However, I do have some serious challenges on this manuscript, which are shown in the Specific Comments below. Therefore, a major revision has to be made if this paper could be finally accepted for publication.

Author Responses

We thank the referee for favorable considerations of our manuscript. We have made major revisions as suggested by the referee, and details are described in our responses to the Specific Comments below.

Referee comments

Specific Comments:

1. Basically, the work shown here is the development of a regional emission inventory for the Huabei region, however, in the "Introduction" part, the authors do not provide enough description or summary how the current status and progress

associated with emission inventory work are going in this region, and why this work is important and worthy for publication. In fact, a few of inventory work for the Tianjing and Shandong in this region has been published, though they do not cover the whole Huabei areas.

Author Responses

In the first paragraph of "Introduction", we describe the background of this work and explain why an inventory for Huabei is needed. In the second and third paragraphs, we give a brief overview of global and Asian inventories that are most commonly used in atmospheric science community and highlight that the grid resolution of these inventories may be not high enough for the modeling studies focusing on the Huabei region. In the fourth paragraph, we present a summary of regional emission inventory work in China, including the work of Wang et al. (2005b) on the emission inventory for the Shandong region. Since we focus on the regional emission inventory, previous studies that are too local are not cited in "Introduction", because not relevant for this work. Note that the publications related to emission inventories in China, especially emission factor measurements, are cited in the rest sections of our manuscript.

Referee comments

2. The inventory takes the year of 2003 as a base year, it seems too old. Since emission magnitudes and characteristics may have changed a lot due to large changes in energy structure, control levels, largely increased economy and energy consumption, therefore, I have a serious doubt if or not the data can be used to support future air quality modeling, control policy formation and atmospheric environment research, given the fact that there may be a dramatic change in emission characteristics and magnitudes from 2003 to 2011.

Author Responses

We agree with the referee in that there have been dramatic changes in emission characteristics and magnitudes from 2003 to 2011 in the Huabei region. Therefore, the emission inventory for a specific year, e.g., INTEX-B-2006, cannot reliably be applied to other years. We do not agree with the referee in that the inventory for the year 2003 is too old to be valuable as we have no plan to use this inventory directly to do air quality

forecasting now in 2011. Instead, the inventory would be used for episode studies for the year 2003. As stated in “Introduction”, our object is to better understand chemical and physical processes involved in dramatic changes in air quality and climate over this part of China during the 2000s.

Referee comments

3. For the “Methodological” part, I would like to ask authors to clearly describe how you classify emission sources, and thus a relatively detailed source clarification table with sub-sector information is needed, this will be helpful for the use of the inventory and for readers to better understand if or not the inventory can reasonably cover different emission sources and assess its potential values, not just show that there are some advantages for this work, as shown in the Lines 15~24 on Page 20337. In the mean time, methods for estimating source-based emissions are not detailed, and more information in this part might be needed.

Author Responses

We think that the classification of emission sources have been clearly described in our manuscript. In the section “2.2 Activity rates”, we tell the readers what sectors and sub-sectors are considered in the development of our inventory. In the section “2.3 Emission factors”, we give more detailed information on the separation of these emission sources by providing the specific emission factors used in our inventory by Tables 5-10. The method for estimating sources-based emissions is described in the section “2.1 General description”. We think that the information provided in the manuscript has been already enough detailed for experts in the field and we do not agree in extending the text with tedious (and generally not essential) table as we would like to have a concise manuscript.

Referee comments

4. For the “Fertilizer application”, some emission factors used in this manuscript may be too obsolete, some new studies have been done recently, and may be referred to use the updated results. See Dong et al (2009) Acta Scientiae Circumstantiae, 29(8), 1611-1617 (In Chinese) and others.

Author Responses

Please note that the NH_3 emission factor used by Dong et al. (2009) was obtained by taking an average of selected literatures published in the earlier years, instead of being from their own measurements. They adopted it to estimate NH_3 emissions in a southern part of China, where the soil character could be very different from that in the Huabei region. Therefore, at present one cannot say that the emission factor they used is more suitable to Huabei. In the section "2.3.5 Fertilizer application" of the revised manuscript, we have added the following text: "Note that a lower NH_3 emission factor (0.17 g/g) for soil fertilization was used to estimate NH_3 emissions in the Yangtze Delta (Dong et al., 2009). Such difference can be attributed to both the difference in soil character between different regions and the large uncertainty in measurements."

Referee comments

5. For the "Traffic" section, vehicle type-based emission factors are given in Table 10, since gasoline and diesel vehicles have different NOx, VOC and PM emission characteristics, however, emission factors are utilized based upon vehicle size, are not differentiated on fuel types, such classifications may not be reasonable, may lead to high uncertainty.

Author Responses

We do consider the changes in the emission factors with fuel types, as stated in the section "2.3.6 Traffic": "the ratio of the large passenger and heavy goods vehicles using gasoline to using diesel fuel is 1:9, and the ratio of the middle passenger and heavy goods vehicles using gasoline to using diesel fuel is 1:3."

Referee comments

6. For "Comparison" part, the authors claim that EDGAR-CIRCE and INTEX-B inventories are underestimated in some areas. Are there any evidences to justify your claim? The authors should be cautioned in making such comparisons since "underestimated" or "overestimated" are built upon which one you assumed is more accurate. In fact, this assumption may not be correct given the fact that there are

generally very high uncertainties in current inventories including this inventory.

Author Responses

To avoid misunderstanding, we add such sentence “It should be noted that ‘underestimate’ or ‘overestimate’ is with respect to the dataset compared and we cannot establish which inventory is the correct (or closer to reality) in the present study” in the second paragraph of the section “4.1 Comparison with other inventories”

Referee comments

7. For the “Uncertainty Analysis” part, I do not think that this is a good and correct uncertainty analysis work. Please note that the purpose of performing uncertainty analysis in inventory work is not to just show how your work is better or more reliable, but to analyze which sources may lead to uncertainty in emission estimates, to qualitatively or quantitatively characterize uncertainty ranges, and to identify key uncertainty sources for guiding future emission inventory improvement. Authors are suggested to refer to the work done by Zheng (2002), Ph.D dissertation, North Carolina State Univ., NARSTO emission inventory assessment report (http://www.narsto.org), Zheng et al (2009) (Atmospheric Environment, 43(32): 5112-5122), Zheng et al (2010)(Atmospheric Environment„ 44, 1960-1969) for uncertainty analysis in emission inventory.

Author Responses

Thanks for insightful comments. We have done extra work on uncertainty analysis. We estimate the uncertainties in our emission inventory by investigating the differences in our estimates from the EDGAR-CIRCE and INTEX-B inventories, based on the methodology of Ma and VanAardenne (2004). 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. The text has been added in section “4.2 Uncertainty analysis”. It is shown that the uncertainties in the emissions are generally in the range of ±40%, depending on the species.

Referee comments

8. There are many English grammatical errors in current manuscript, obviously a native English editor is needed to help refine and improve the English of this manuscript.

Author Responses

We have tried to improve the English by ourselves, though we think that the editor Dr. T. Wang, who is handling this manuscript, would like and will be able to refine the English of the manuscript.