

Anonymous Referee #3

This paper estimated emissions from China's coal-fired power plants at unit level for a 20 year period. Compared to previous emission inventories, CPED significantly improved the spatial resolution and temporal profile of power plant emission inventory in China. The new inventory developed in this study will enable a close examination for temporal and spatial variations of power plant emissions in China and will help to improve the performances of chemical transport models by providing more accurate emission data. The paper is well structured and written. I would recommend publishing this paper after addressing some general comments and minor revisions. Before publication, making the emission inventory open to public is highly encouraged (or required?).

Response: We thank Referee #2 for the encouraging comments. All specific comments have been addressed below. Particularly, CPED has been integrated into the MEIC (Multi-resolution Emission Inventory for China) database, which is available at the following website: <http://www.meicmodel.org/>. In the Sect. 3.6 of the revised manuscript, we added a paragraph to clarify the availability of CPED.

General comments:

(1) Besides SO₂, NO_x, CO₂, PM_{2.5}, did the authors also estimate CO, VOC, PM_{coarse}, BC, OC from coal-fired power plants? Do the authors plan other papers to report other compounds? Why did the authors select the four compounds as in the paper? Please say more.

Response: We didn't provide CO, VOC, BC and OC emission estimates in this work because emissions of these species are not impacted by many of unit specific parameters such as sulfur content, ash content, etc. In this case, CPED methodology doesn't provide much more benefits on improving the accuracy of emission estimates to those species. In the meanwhile, coal-fired power plants contribute very small fraction to national total emissions (e.g., less than 1% of total CO emissions in 2010 estimated by Y. Zhao et al. (2013)). We have clarified this in the Sect. 2 of the manuscript. Power plants are significant sources of PM₁₀ emissions. We have added PM₁₀ estimates in the revised manuscript.

(2) What is difference/relationship between this study and the MEIC 1.2, 1.0 or MIX inventories? Does this paper advance those inventories? Is this paper one part of those inventories (which one)? Please specify in the paper.

Response: The CPED methodology developed in this work has been incorporated in both MEIC and MIX inventories. Briefly, the early version of CPED was used to both MEIC 1.0 and 1.2, and MIX used MEIC 1.0 for China. We have clarified the relationship in the Sect. 3.6 of the revised manuscript.

(3) Please make this inventory data set open to public, so that the scientific community is able to utilize.

Response: We have made the data open to public during the development of CPED. The early version of CPED has been integrated into the MEIC (Multi-resolution

Emission Inventory for China) database (both MEIC 1.0 and 1.2), which is available at the following website: <http://www.meicmodel.org/>. The most recent version of CPED (documented in this paper) will be incorporated to the next version of MEIC.

(4) Emissions were estimated at unit level for 2005-2010, however, priori to 2005, many parameters were extrapolated and assumed. So I suggest the authors make statements in the paper more clear about this difference.

Response: Thanks. We have clarified this in the Sect. 2.1 of the revised manuscript.

Specific comments:

(1) P18789, 1–3: what is the meaning of “because of a lack of detailed underlying data”?

Response: We replaced “detailed underlying data” with “underlying data such as detailed activity rates and local measured emission factors” in the revised manuscript.

(2) P18789, 11–12: what is the citation of “32% of CO₂, 33% of SO₂, 33% of NO_x, and 6% of PM_{2.5} in 2010”?

Response: The reference of Y. Zhao et al. (2013) has been added in the revised manuscript.

(3) P18791, 22: how much totally is the number of coal-fired electric generating units in mainland China?

Response: The total number is 7657. We have revised the statement in the revised manuscript.

(4) P18793, 11–14: Actually, the operation hour for each unit was not got from database but from disaggregation.

Response: Operation hours for each unit from 2005–2010 were obtained from database, but from disaggregation prior to 2005. While monthly profiles of each unit were derived from disaggregation.

(5) P18792–18792, Section 2.1: many data were extrapolated from years after 2000 to years 1990–2000. First, how robustness are these extrapolations? Second, the authors should emphasize emission estimates before 2000 are based on extrapolation rather than real data.

Response: Extrapolations are constrained by the provincial total coal consumptions and electricity productions, which ensures the reliability of total emission estimates at provincial level. Taking one unit as example, we have provided uncertainty estimates for the unit for both 2000 and 2010 in Sect. 4.1. Uncertainty ranges for 2000 estimates are significantly larger than for 2010 estimates (Table 6). In the Sect. 2.1 of the revised manuscript, we added a sentence to indicate the higher uncertainties in emission estimates before 2000.

(6) P18794, 20–23: “Surveys and satellite observations confirmed that some of the

early installed FGD facilities were not actually in operation prior to 2008”. Does this influence the final estimates much?

Response: The phenomenon may induce an underestimation of SO₂ emissions from 2005 to 2007. The FGD penetration was 12.2%, 29.5% and 49.9% for 2005, 2006 and 2007 respectively. Assuming 20% of FGD did not operate properly, national total emissions could increase by 2%, 4% and 9% for 2005, 2006 and 2007 respectively. In the Sect. 4.1 of the revised manuscript, we have discussed this as a potential source of uncertainties.

(7) P18797, 13–16: Do these values of “25.8 and 26.7 kg-C GJ⁻¹” differ from the values recently published by Liu et al., Nature, 2015? If yes, country-specific data are more appropriate.

Response: The coal carbon content used in CPED is very close (2% difference) to that in Liu et al. (2015).

(8) P18802, section 3.2.3: why did not the authors estimate PM₁₀? How about the changes in PM₁₀ during 1900–2010?

Response: PM₁₀ estimates have been added in the revised manuscript.

(9) P18807, section 4.2: what is the difference between this study and MEIC 1.0, MEIC1.2, MIX inventories? Please specify.

Response: See responses above.

(10) P18832, Figure 9, Figure 10, Figure 13: did you estimate emissions in Taiwan? Right now, the figures look like there are no emissions of these four compounds in Taiwan. If not, please specify and change the color.

Response: Thanks for pointing out this. The CPED database doesn't cover Taiwan. We have changed the color in Figure 9, Figure 10 and Figure 13 in the revised paper.

Reference

Liu, Z., Guan, D., Wei, W., Davis, S. J., Ciais, P., Bai, J., Peng, S., Zhang, Q., Hubacek, K., Marland, G., Andres, R. J., Crawford-Brown, D., Lin, J., Zhao, H., Hong, C., Boden, T. A., Feng, K., Peters, G. P., Xi, F., Liu, J., Li, Y., Zhao, Y., Zeng, N., and He, K.: Reduced carbon emission estimates from fossil fuel combustion and cement production in China, *Nature*, 524, 335–338, 2015.

Zhao, Y., Zhang, J., and Nielsen, C. P.: The effects of recent control policies on trends in emissions of anthropogenic atmospheric pollutants and CO₂ in China, *Atmos. Chem. Phys.*, 13, 487–508, doi:10.5194/acp-13-487-2013, 2013.