

The paper by Wang et al. reports on the growth in NO_x emissions in China as caused by (new) power plants in the period from 2005 to 2007. The authors construct a new bottom-up inventory using recent knowledge on electricity production in China, and test the success of this inventory in predicting accurate NO_x emissions by evaluation against tropospheric NO₂ column observations from OMI. The consistency between the increases in the bottom-up inventory and the OMI observations (with the GEOS-Chem model as an appropriate intermediate) suggest support for the new inventory. The paper is generally well-written. Yet I couldn't help feeling that I've seen these, or in any case very similar results already before. Zhang et al. [2009]; Lin and McElroy [2011] are two examples that come to mind, and in any case the results obtained in this paper ought to have been compared in perspective of the work by Lin and McElroy.

Response: We thank the reviewer for the valuable suggestions. We compared our findings with Lin and McElroy (2011) in the revised manuscript. Lin and McElroy (2011) used thermal power generation (TPG) as the proxy of economy. This does make sense because a large fraction of electricity was used by industries. They found that the changes in OMI NO₂ columns are consistent with changes in TPG, and further concluded that OMI NO₂ observations are capable of detecting the variations in NO_x emissions stimulated by economy change. However, the contribution of power plants to the overall emission changes was not separated in Lin's work. In our work, with the help of high-resolution power plant emission data and OMI observations, the contribution of power plants to the changes of NO₂ concentrations was successfully identified.

Besides discussing the Lin and McElroy results, what is also missing from the paper is a statement on what the power sector is actually contributing to overall NO_x emissions over China. Now we only read that the new power plants are responsible for 10-18% of the total NO₂ in 2007. But how has the overall share of power plant pollution been changing? Is power generation the driver of increases in pollution over China, or are the increases in power plant pollution merely in step with the overall increases in NO₂ over China in 2005-2007? Table 1 provides these numbers for the bottom-up inventories, but are those numbers consistent with OMI NO₂? I strongly encourage the authors to also answer these questions.

Response: We thank the reviewer for this insightful comment. In the revised manuscript, we quantified the contributions of power plant emissions to NO₂ columns in China, by comparing the results from two GEOS-Chem runs (with and without power plant emissions). We found that the share of power plant pollution was increased in Inner Mongolia and Southwest China during 2005-2007, where power plants dominated the increase of NO_x emissions. The share of power plant pollution remained stable in other regions because emissions from other sectors also grew fast (see Fig. 11 of the revised manuscript). We found that changes of NO_x emissions in bottom-up inventories are consistent with OMI NO₂ over polluted regions. For

instance, OMI observed 23% and 38% increases in NO₂ columns in North China and Inner Mongolia during 2005–2007 respectively, comparable to the anthropogenic NO_x emissions growth of 28% and 38% growth in those two regions.

One interesting new point that the authors bring up is that the addition of new power plants changes the NO₂ profile shape over polluted regions, with potential impacts for NO₂ retrievals. To their credit, the authors have tried to quantify that not taking into account plausible changes in profile shapes would lead to biases on the order of 5-15% in NO₂ retrievals. Of course such an estimate is accompanied by other uncertainties (changing aerosol load, vertical profile issues) but it provides a good start for future investigations into this issue.

Response: We appreciate this kind comment. In this work, we only demonstrate that the changes in profile shapes would possibly impact satellite retrievals in polluted regions. We will investigate this issue by using high-resolution models in our future work.

Specific comments

P50, l24: please specify what ‘gce’ stands for.

Response: Changed to “gram coal equivalent”.

P53, l16-18. I disagree with stating that the DP_GC product is ‘an improved OMI product’. It has not been proven that this is actually an improvement, except maybe against the columns derived in the paper by Lamsal et al., which depend on similar GEOS-Chem assumptions as the DP_GC product. I suggest to use wording such as an ‘alternative product’.

Response: Thanks for pointing out this. Changed as suggested.

P56, l11: please explain, for the unfamiliar reader, what CEMS stands for.

Response: The full expression for “CEMS” (Continuous Emission Monitoring System) has been clarified in the introduction section where it appears for the first time.

Section 3.2: I suggest to provide the readers with an uncertainty estimate of the bottom-up ‘power plant NO_x emissions’.

Response: Quantitative uncertainty analysis has been conducted using a Monte Carlo approach. The overall uncertainty of this inventory is estimated to be -19 to 20%.

On page 61, the paper is difficult to digest. The authors take us on a tour through

China, and quite a tour it is. I agree with the other reviewer (point 2) that the geography should be clarified.

Response: Geographical locations were clarified in Fig. 2 as suggested by the other reviewer.

On page 61, we go from Inner Mongolia, through a number of provinces, into southeast coast regions, where the situation is ‘complex’. The part that follows is highly speculative and doesn’t really help in better understanding of the discrepancies between the model and OMI NO₂ columns (lines 13-29).

Response: We have shortened this paragraph to make the statements clear and objective.

Page 62, lines 1-13, also long-winded and mainly speculative. I suggest to at least shorten this.

Response: This paragraph has been shortened as suggested.

Fig. 11 caption: I don’t see any grey bars in the Figure.

Response: Corrected.

References:

Zhang, Q., Streets, D. G., and He, K. B.: Satellite observations of recent power plant construction in Inner Mongolia, China, *Geophys. Res. Lett.*, 36, L15809, doi:10.1029/2009gl038984, 2009.

Lin, J.-T., and McElroy, M. B., Detection from space of a reduction in anthropogenic emissions of nitrogen oxides during the Chinese economic downturn, *Atmos. Chem. Phys.*, 11, 8171–8188, doi:10.5194/acp-11-8171-2011, 2011.