Anonymous Referee #2

*China is experiencing dramatic changes in economy and energy structure. Due to the poor air quality in developed regions, a series of emission control measures have been taken and changes in air pollutant emissions could be expected. Independent from the bottom-up emission inventory that might be limited by the accuracy and timeliness of data, this work applied OMI $NO_2$ data and estimated the trends of $NO_x$ emissions for selected cities and power plants across the country, following previous studies from the same research group. In general the paper was well organized, clearly written, and easy to follow. I recommend its publication with some more discussions or corrections as suggested below:*

**Response:** We thank Referee #2 for the encouraging comments. We addressed the comments carefully as below.

*Specific comments:*

*1. Is there any big difference or correction in the method of "top-down" emission calculation between this work and the authors' previous studies (i.e., Liu et al., 2016a; b)? I understand the inter-annual trend is included in this work, but other improvement in method (if any) needs to be clarified so that the audience could easily compare different papers.*

**Response:** In general, there is no fundamental change in methodology between this study and our previous one (Liu et al., 2016a). In order to perform the inter-annual analysis, we made the adjustment as follows: we based the estimation on $NO_2$ columns around the source of interest averaged over three years, similar as in previous studies (e.g., Fioletov et al., 2011; Lu et al., 2015); afterwards, the total $NO_x$ mass was integrated over the mean TVCDs at weak wind speeds (below 3 m/s) instead of calm winds (below 2 m/s) used in our previous work for better statistics. We have clarified this in Sect.2.1.

Another previous study (Liu et al., 2016b) calculated changes in OMI $NO_2$ column densities for each province over China from 2005 to 2015 and compared them with the bottom-up inventory to examine $NO_x$ emission trends and their driving forces. It is not directly associated with the methodology in this study.

*2. Pages 4-5, the authors said they presented cities/plants with satisfactory fitting results. Here needs some explanations: what's the criterion of examining the fitting results, and why were there any "unsatisfactory results"? Does that imply that there are some problems or limitations in the calculation method and it cannot be applied for all the selected cities/plants?*

**Response:** We followed the criteria defined in Liu et al. (2016a) to assure a good fit performance. We add the description for the criteria in Section 2.1, as follows:

"The fitting results with poor performance (i.e., $R<0.9$, lower bound of confidence interval CI <0, CI width for lifetime >10 h, CI width for the $NO_2$ mass >0.8×mass) were discarded, in accordance with the criteria in Sect. 2.2 of Liu et al. (2016a)."

Satisfactory results stand for fitting results meeting the criteria above. The fit method

can be applied for all cities/plants in principle, but the fit may fail because of the low R or unreasonable CI resulting from the low signal/background ratio. We rephrase the sentences in Section 2.3, as follows:
"Among over 200 pre-selected cities, 48 cities (including 14 mountainous sites) were fitted with good performance (see the definition in Sect.2.1). While among over 100 pre-selected power plants, over half were excluded from the fit procedure, because they are located in a radius of 100 km around prefecture-level city centers, on the basis of a visual inspection of satellite imagery from Google Earth. Only 7 power plants (including 3 mountainous sites) were fitted with good performance."

*3. Although the emission trends between top-down and bottom-up methods were generally consistent with each other, it seems that larger emission growth was estimated based on the OMI data than MEIC for both cities and power plants before 2012 (e.g., Figure 3 and 7). Uncertainties in bottom-up emissions (i.e., MEIC) might be part of the reasons, and I suggest a paragraph of discussion including comparisons with other available bottom-up estimates.*
**Response:** We agree that uncertainties in bottom-up emissions contribute to the differences, which has been detailed in Section 3.2. The spatial allocation approach adopted in bottom-up inventories tends to diminish regional diversity and may consequently result in smaller emission growth compared to top-down estimates. This is a general limitation of applying regional inventories to calculating urban emissions.
We thank for the suggestion of including more bottom-up inventories into the comparison. We added the comparison with other widely used bottom-up emission inventories in the community. In order to keep consistent with the top-down estimates derived from 3-year average $NO_2$ concentrations, only inventories with more than three years data available from 2005 to 2015 are included. We finally added Emission Database for Global Atmospheric Research version 4.3 (EDGAR v4.3, Crippa et al. 2016), Regional Emission inventory in Asia version 2.1 (REAS v2.1, Kurokawa et al., 2013). All bottom-up inventories show similar growth rates, suggesting that the differences to our estimates indeed arise from the methodology of deriving urban emissions from regional inventories, rather than depend on the chosen inventory. We added a brief introduction of the available bottom-up inventories in Section 2.2 and further discussed the comparison with the fitting results in Section 3.1.

*4. Figure 4. Did that imply the poorer estimation in emissions from small industrial plants than those from power plants in MEIC? Needs clarification.*
**Response:** We agree that it implies the poorer estimation in emissions from small industrial plants that those from power plants in the MEIC inventory. We have clarified it in Section 3.2, as follows:
"For industrial emissions, MEIC first downscaled provincial totals to counties using industrial GDP, and then allocate county emissions to grids with population density. Thus uncertainty of emissions from the industrial sector is larger than that from power plants."

*5. Small issues: Line 40, Page 4: "section 2.2" ? please check. Line 28, Page 5: "new dry-process" or "precalciner"?*

**Response:** Thanks for pointing out them. We have replaced “section 2.2” with “section 2.1” and replaced “new dry-process” with “precalciner” in the revised manuscript.

## References


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