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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Comparison and evaluation of anthropogenic emissions of SO_2 and NO_x over China" *by* Meng Li et al.

Anonymous Referee #2

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Review of paper by Meng Li et al. titled: Comparison and evaluation of anthropogenic emissions of SO2 and NOx over China

General comments

The work of Li et al. deals with the comparison of the ECLIPSE and MIX emission inventories over China focusing on SO2 and NOx sector- and region- specific emissions. Bottom up emissions are then compared with top down estimates from OMI. The paper is overall well written and I recommend it for publication after developing the following points:

The authors should clarify the aim of their work, since comparing two emission inventories (even at sector level) and top down vs. bottom up estimates comparison are not

new topics in literature. It is not completely clear the novelty of this work compared to literature studies dealing with top down and bottom up estimates such as Wang et al. 2011 and other works. The authors state that "To our knowledge, it's the first emission inventory assessment work where parameter-level comparison and remote sensing evaluations are combined", however, there are several literature works comparing top down and bottom up estimates, even over China (e.g. Wang et al., 2011; R. J. van der A, 2017 etc.). Therefore the authors should clarify the relevance of their study compared to former works.

Specific comments

- In the introduction the authors list several emission inventories covering China, however, several other emission inventories have been developed for that region (e.g. Liu et al., 2015; the EDGAR database, etc.). The authors should explain why they provide only that list of references.

- 2.1 The ECLIPSE and MIX emission inventory: This paragraph describes the two inventories later compared in the paper. To facilitate such comparison, it would be good to have a summary table listing for the two inventories the data sources for each sector (activity data and emission factors), the temporal and spatial resolution, the reference years, compounds, etc. The authors should highlight the independence of the two inventories in terms of statistics, EFs, proxies, etc. before doing the comparison.

- 2.3 Top-down emission inventory: The authors should explain why the methodology presented is applied only to NOx and not to SO2 columns. It would be interesting to see the same procedure applied also to SO2 since the paper focuses on both compounds.

- Page 6, line 4: please clarify how the sectors "power", "industry", "residential" and "transportation" are defined for each inventory. As described at lines 7-10, sectors are different for the two inventories. Please clarify how emissions from heating plants are re-distributed (line 9) in MIX to match the ECLIPSE sectors.

-page 10, line 8: “emission factors on mass base are converted to energy base with heating value of 43.1 MJ/kg”. Did the authors use the same heating value both for gasoline and diesel?

-page 10, line 10: although only 3% difference is found in total gasoline consumption, big differences in gasoline use by vehicle are observed for the two inventories.

-page 10, line 11: huge differences are observed not only for light duty vehicles but also for HDV-G and MC.

-3.1.3 Gridded emissions: Figure 3b shows the difference of the ECLIPSE-MIX gridded emissions. Did the authors compare the proxy data used by the two inventories to grid the emissions? A mismatch in the location of large point sources as well as the application of weighting factors to redistribute the emissions could strongly affect this type of calculation. Please develop this topic.

- page 15, lines 7-9: “The different trends of transportation emissions are attributed to the different assumptions on legislation effect on pollution control in two inventory systems”. The authors should demonstrate the aforementioned statement.

- page 18, line 17: “It can be concluded that ECLIPSE and MIX are consistent with the top-down estimates over China.” The authors should discuss why it is useful to compare bottom up and top down estimates. In their work they discuss the differences (sometimes not negligible) between two bottom up inventories over China and then through the comparison with top down estimates they find that the two inventories are consistent with these independent estimates. How is that possible? How can top down estimates help in constraining the bottom up emission inventories? How can this work reduce the uncertainty of emission inventories? Can the authors explain if the uncertainty of bottom up and top down estimates are larger, smaller or within the range of model uncertainties?

- page 19, lines 1-2: “Through sensitivity test analyses, treating sources as point

sources can significantly reduce the uncertainties in emission gridding process”. The authors should better explain how it is possible to reduce the uncertainties in emission gridding process through sensitivity tests. Sensitivity tests can help understanding the uncertainties due to the gridding procedure using e.g. different proxy data, but not necessarily to reduce the corresponding uncertainty.

- It would be interesting to see Figure S1 also in absolute terms. The authors should also better explain the different sectorial share for the various provinces. Why Tibet has only SO2 emissions from the transportation sector in the MIX inventory, while they are negligible for ECLIPSE? Large sector specific differences are also observed for NOx. Please discuss in a more comprehensive way the differences in sector specific emissions at province level.

Technical corrections

- Figure 5a shows empty maps for the SO2 trend from transportation sector of both inventories. Please check them.

-Figure S3: Please change the Figure caption with “NOx emission changes. . .” instead of “Emission changes. . .”.

References

Wang, S., Xing, J., Chatani, S., Hao, J., Klimont, Z., Cofala, J., and Amann, M.: Verification of anthropogenic emissions of China by satellite and ground observations, Atmospheric Envir.

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