

Interactive comment on “Improvement from the satellite-derived NO_x emissions on air quality modeling and its effect on ozone and secondary inorganic aerosol formation in Yangtze River Delta, China” by Yang Yang et al.

Anonymous Referee #2

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This manuscript has presented a top-down estimate of NO_x emissions in the Yangtze River Delta (YRD) region and demonstrated that air quality modeling using the top-down NO_x emissions could improve the simulations of ozone and secondary inorganic aerosol (SIA) over this region. A set of sensitivity simulations are conducted to better understand the formation of ozone and SIA under perturbed precursor emission conditions.

This manuscript offers some new knowledge on the regional secondary pollution over YRD including an improved estimate of NO_x emissions and predicted effectiveness of

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various emission controls on secondary pollution formation.

This study is overall well conducted and analyzed. The manuscript is well written, and fits the scope of ACP. I think the following comments shall be addressed for merit publication.

Specific Comments:

(1) Sect. 2.1, top-down estimation method:

My main concern lies on the top-down method. The present description in this section is not clear. The section states “the a posteriori daily emissions were used as the a priori emissions of the next day, and the monthly top-down estimate of the NO_x emissions was scaled from the average of the a posteriori daily emissions of the last three days in the month”. Do you mean the NO_x emissions were calculated day by day for each month? In that case, there shall exist strong day-to-day variations in the top-down estimates, reflecting either true emission changes or uncertainties in satellite measurements and model results. It is then not proper to derive the monthly emission estimate based on only daily emissions in the last three days. This needs to be clarified in the manuscript and the daily emission variations if significant should be discussed.

(2) Page 4, Line 94 and Line 110:

“0.4 Tg N/yr” and “ 69.6×10^{13} molecules cm⁻²”. Please also provide relative percentage numbers from the two studies, so that the magnitudes can be better understood.

(3) Page 7, Sect. 2.2 Model configuration:

What is domain 3 (D3) labelled in Figure 3? Is it used in this study?

(4) Page 8, Line 204-210:

Which year of data is used for the MEIC emission estimates?

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(5) Page 9, Line 228-232:

Some previous studies (e.g., Lamsal et al., 2008; Liu et al. ACP 2018) suggested that the NO₂ measurements obtained from the molybdenum-catalyzed conversion technique might be overestimated due to interference from other nitrogen species. Would this affect your results?

Lamsal, L. N., et al.: Ground-level nitrogen dioxide concentrations inferred from the satellite-borne Ozone Monitoring Instrument, *J. Geophys. Res.- Atmos.*, 113, D16308, <https://doi.org/10.1029/2007JD009235>, 2008.

Liu, M., et al.: Spatiotemporal variability of NO₂ and PM_{2.5} over Eastern China: observational and model analyses with a novel statistical method, *Atmos. Chem. Phys.*, 18, 12933–12952, <https://doi.org/10.5194/acp-18-12933-2018>, 2018.

(6) Page 10, Line 258:

According to Figure 5 and 6, peaking ozone concentrations in YRD are also shown in the July month, and many previous studies have suggested more active ozone formation in summer. Some sentences are needed here to explain why this study focused on April and did not discuss July.

(7) Page 10, Sect. 3.1:

The spatial distribution of top-down vs. bottom-up NO_x emission changes in YRD as shown in Figure S2 is an important finding of this study for explaining and supporting improvements in the top-down estimates. I suggest move Figure S2 to the main manuscript, e.g., combine with the present Figure 2.

(8) Page 13, Line 363 and 364:

Here “Fig. 5” should be “Fig. 4”

(9) Page 17, Line 465-469:

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The decreases in the nitrate aerosol concentration in July with the top-down NO_x emissions are interesting and worth further discussion. Reductions in NO_x emissions would lead to increases in the nitrate aerosol concentration in other months (January, April, and July). Can you explain why the response in July is different from those in other months? Is it because the percentage reduction of top-down NO_x emissions in July is much larger?

(10) Page 19, Line 538:

Should “Fig. 9b” here be “Fig. 9c”?

Interactive comment on *Atmos. Chem. Phys. Discuss.*, <https://doi.org/10.5194/acp-2020-751>, 2020.