

Interactive comment on “The unintended consequence of SO₂ and NO₂ regulations over China: increase of ammonia levels and impact on PM_{2.5} concentrations” by Mathieu Lachatre et al.

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We wish to thank the referee for his/her helpful comments. The comments of the referee are in bold and our answers in normal black.

The manuscript is in general well written, but there is a need for English language editing.

English language editing has been performed with help of a native English speaker.

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Specific comments:

P1L5: add the % sign to -37.5
Modified

P1L6: the (g) in NO₃ is redundant as gaseous is mentioned
In some part of the document species is only indicated with the indexes (p) or (g), I'll conserve them for all cases to preserve document homogeneity.

P2L3: This abbreviation has not been defined yet
Modified

P2L5: "Chinese emissions" can be removed since it is mentioned later in the sentence that you are talking about Chinese emissions P2L7: ...in 2005 and have been.
Removed

P2L13: Is likewise the proper word to use here? And P2L13-15: Maybe break the sentence in two. The way it is now it is not easy to understand. And P2L15: put NH₄NO₃ and HNO₃ in parentheses
Modified

P2L12:
“The rise of ammonia concentrations over China could be explained by increased NH₃(g) evaporated from inorganic PM due to a rise in temperature. As shown by Riddick et al. (2016), meteorological variations would change both the NH₃(g)

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volatilization and the equilibrium between ammonia, ammonium nitrate (NH₄NO₃) and nitric acid (HNO₃).”

P2L21: Use proper citation formatting for reference (Liu et al)
Modified

P3L6: change the quote style in "climate". Use the same quotation style throughout the document
Modified

P3L6: ECMWF abbreviation has not been defined yet
Added

P4L15: Since you are creating emissions for years 2013, 2015, why not create emissions for 2011 also? Isn't this adding to your uncertainty?
This could have been an option; we did not proceed to this modification as it appeared that 2010/ 2011 (+4.5). Also, please keep in mind that this procedure only affects the absolute values of emissions, and by much less than the currently accepted uncertainty for emissions of several tenths of percent. The relative changes between 2011, 2013 and 2015 are correctly taken into account (see our answer just below (P5L7)).

P5L3: is piloted the correct word to use here?
Modified by “controlled”

P5L7: This is confusing. Basically you apply a factor that is 2011 based, on an

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emission inventory of 2010. How does this affect your calculations? You should either make it all 2010 based, or all 2011 based
As said above (P4L15), our procedure slightly affects the absolute level of emissions (a few percents), but the relative changes between 2011 and 2015 are correctly taken into account. In addition, taking the year 2010 emissions which was the last year in the EDGAR inventory that we used, allowed us using uncorrected emissions. Indeed, correcting these emissions with our satellite columns based method also induces uncertainty. At the end, we use 2010 emissions to simulate 2011 and we then update emissions based on 2011-2015 satellite observation changes to evaluate change on ammonia between 2011 and 2015.

P7L24: correct typo on EDHAR to EDGAR
Modified

P8L3: Here you report more than 90
Modified

P10L2: A comma is needed after R4
Added

P10L12-14: either...or, not or....either
Modified

P16L22: correct the typo on times
Modified

P16L28: All your scenarios use the respective year's meteorology. How do you

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at-tribute differences caused by emissions changes to meteorology, since everything in the model changes, except for the NO_x and SO_x emissions?

In this part, we combine information and conclusion from sections 3.1 (Impact of meteorological conditions on the ammonia/ammonium/sulphate/nitrate system; Fig. 5) and 3.2 (Impact of SO₂ and NO_x emission reduction on NH₃ columns and inorganic aerosol; Fig 9) to better understand changes in section 3.3, which give the response both the whole of meteorology and emissions changes.

Section and figure have been added P17L5: "The impact of changing meteorology is to damp the negative changes of pSNA (Section 3.1, Figure 5 and Figure S11 in supplement file presents two-dimensionnal distribution of pSNA changes) and the positive changes in NH₃(g) due to emission reductions."

P18 table: remove the zeros from the beginning of non decimal numbers
I'd prefer not to change this because it keeps the table better structured and more easily readable.

P19L1: Change the citation style on Liu et al.
Modified

P20L4: Either report both reductions as negative numbers, or both as positive numbers
Modified

P20L20: updated, not up-dated

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Modified

References:

Chen, Q., Song, S., Stefan, H., Yuei-An, L., Zhu, W., and Jingyang, Z.: Assessment of ZTD derived from ECMWF/NCEP data with GPS ZTD over China, GPS Solut, <https://doi.org/10.1007/s10291-010-020>, 2010. Fu, X., Wang, S., Xing, J., Zhang, X., Wang, T., and Hao, J.: Increasing Ammonia Concentrations Reduce the Effectiveness of Particle Pollution Control Achieved via SO₂ and NO_x Emissions Reduction in East China, Environmental Science and Technology Letters, 4, 221–227, <https://doi.org/10.1021/acs.estlett.7b00143>, <https://doi.org/10.1021/acs.estlett.7b00143>, 2017. Jingjing, L., Jianping, H., Bin, C., Tian, Z., Hongru, Y., Hongchun, J., Zhongwei, H., and Beidou, Z.: Comparisons of PBL heights derived from CALIPSO and ECMWF reanalysis data over China, Journal of Quantitative Spectroscopy and Radiative Transfer, 153, 102 – 112, <https://doi.org/https://doi.org/10.1016/j.jqsrt.2014.10.011>, <http://www.sciencedirect.com/s> topical issue on optical particle characterization and remote sensing of the atmosphere: Part II, 2015. Liu, M., Huang, X., Song, Y., Xu, T., Wang, S., Wu, Z., Hu, M., Zhang, L., Zhang, Q., Pan, Y., and Zhu, T.: Rapid SO₂ emission reductions significantly increase tropospheric ammonia concentrations over the North China Plain, Atmospheric Chemistry and Physics Discussions, 2018, 1–19, <https://doi.org/10.5194/acp-2018-880>, <https://www.atmos-chem-phys-discuss.net/acp-2018-880/>, 2018. Owens, R. G. and Hewson, T.: ECMWF Forecast User Guide, Reading, <https://doi.org/10.21957/m1cs7h>, <https://software.ecmwf.int/wiki/display/FUG/Forecast+User+Guide>, <p> Replaces previous editions that were available as PDF documents.</p>, 2018.

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Van Damme, M., Whitburn, S., Clarisse, L., Clerbaux, C., Hurtmans, D., and Coheur, P.-F.: Version 2 of the IASI NH₃ neural network retrieval algorithm: near-real-time and reanalysed datasets, *Atmos. Meas. Tech.*, 10, 4905-4914, <https://doi.org/10.5194/amt-10-4905-2017>, 2017.

Zheng, B., Tong, D., Li, M., Liu, F., Hong, C., Geng, G., Li, H., Li, X., Peng, L., Qi, J., Yan, L., Zhang, Y., Zhao, H., Zheng, Y., He, K., and 35 Zhang, Q.: Trends in China's anthropogenic emissions since 2010 as the consequence of clean air actions, *Atmospheric Chemistry and Physics*, 18, 14 095–14 111, <https://doi.org/10.5194/acp-18-14095-2018>, <https://www.atmos-chem-phys.net/18/14095/2018/>, 2018.

Interactive comment on *Atmos. Chem. Phys. Discuss.*, <https://doi.org/10.5194/acp-2018-1092>, 2018.

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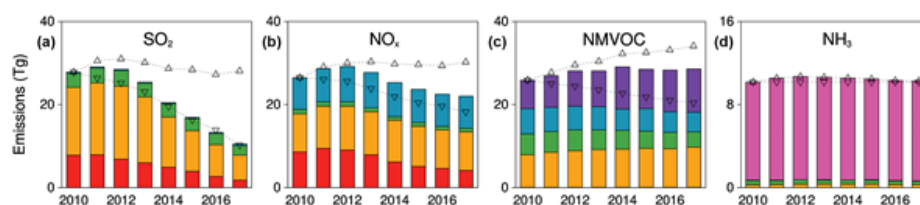


Fig. 1. Emissions evolution in China, from 2010 to 2017 (in Tg.yr⁻¹) from Zheng et al, 2018.

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