

Reply to the editor:

We thank the editor again for his careful reading of the manuscript and the constructive comments he provided. We have adopted all the suggestions. The original comments by the editor are in black, and our replies are in blue.

Dear authors,

As both reviewers raised concerns about VOCs emissions, I would suggest adding some caveats in the conclusion section.

We added the following caveats in Section 5 as you suggested: “The updated anthropogenic VOC emissions with mass balance method are evaluated by comparing the GEOS-Chem HCHO and TROPOMI HCHO. However, the updated VOC emissions may still suffer from large uncertainties because of the low retrieval accuracy of TROPOMI HCHO (Vigouroux et al., 2020), large biogenic sources of VOC emissions and limited representativeness of HCHO for the whole VOC species.” Thanks for the suggestion.

Also, a similar conclusion has been drawn in "Wang et al. (2022) Seasonality and reduced nitric oxide titration dominated ozone increase during COVID-19 lockdown in eastern China." *Npj Climate and Atmospheric Science*". If the authors feel the same, feel free to give credit to it and other relevant studies.

Sincerely,

Hang Su

Wang et al. (2022) showed ~80% of the O₃ MDA8 increase during the COVID lockdown period is caused by the meteorological factors, and ~20% is caused by the emission decline in East China. As you suggested, we added the discussion on the similar conclusion from Wang et al. (2022) to Section 4.1 in the updated manuscript. In addition, conclusions from Liu et al. (2020) and Zhao et al. (2020) are also relevant to this study, and we have discussed their work in Section 4.1 in the original manuscript.

References

- Liu, T., Wang, X., Hu, J., Wang, Q., An, J., Gong, K., et al. (2020). Driving Forces of Changes in Air Quality during the COVID-19 Lockdown Period in the Yangtze River Delta Region, China. *Environmental Science & Technology Letters*, 7(11), 779-786. 10.1021/acs.estlett.0c00511
- Vigouroux, C., Langerock, B., Aquino, C. A. B., Blumenstock, T., Cheng, Z. B., De Mazière, M., et al. (2020). TROPOMI-Sentinel-5 Precursor formaldehyde validation using an extensive network of ground-based Fourier-transform infrared stations. *Atmospheric Measurement Techniques*, 13(7), 3751-3767. 10.5194/amt-13-3751-2020
- Wang, H. L., Huang, C., Tao, W., Gao, Y. Q., Wang, S. W., Jing, S. A., et al. (2022). Seasonality and reduced nitric oxide titration dominated ozone increase during COVID-19 lockdown in eastern China. *Npj Climate and Atmospheric Science*, 5(1). 10.1038/s41612-022-00249-3
- Zhao, Y., Zhang, K., Xu, X., Shen, H., Zhu, X., Zhang, Y., et al. (2020). Substantial Changes in Nitrogen Dioxide and Ozone after Excluding Meteorological Impacts during the COVID-19 Outbreak in Mainland China. *Environmental Science & Technology Letters*, 7(6), 402-408. 10.1021/acs.estlett.0c00304