

Interactive comment on “COVID-19 lockdowns highlight a risk of increasing ozone pollution in European urban areas” by Stuart K. Grange et al.

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Grange et al. utilized time-series random forest models to analyze the changes of NO₂ and O₂ concentrations caused by the COVID-19 lockdowns across European countries. This work has important findings from the natural experiment of atmospheric pollution that most urban areas in Europe is in the VOC-limited scheme of O₃ formation (e.g., at least in Spring). Therefore, only mitigating traffic NO_x emissions might bring in unwanted increase of urban O₃. Overall, the manuscript is well organized, and the data analysis is solid and consistent.

Line 29: I suggest add the explanation of the evaluation metric of Google mobility; e.g., the search frequency of points of interest, or the visit frequency (or duration spent) at

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points of interest?

Line 36: Please reconsider the wording “near-minimum”. I suppose commercial, transportation and recreation activities would be drastically declined, and the impact on essential industrial sectors would be less substantial.

Line 57: Please describe the distance between traffic sites and urban-BG sites in the selected urban areas. I wonder whether these traffic sites in various European countries would be deployed based on a unified, clear principle (e.g., distance to road curb, daily traffic volume)? Or, consider to enhance the statement around Line 70.

Line 65: Please briefly describe how to match air quality and weather sites in this study. Line 104: It is not clear, in Figure A1, whether the distribution of R₂ represents the interval of R₂ (minimum to maximum) for each site-specific RF model? In addition to R₂, other validation metrics like normalized mean error can be used to evaluate the average discrepancy between modelled and observed results. And, I am surprised that both NO₂ and O₃ share good model validation results but O_x has lower R₂. What are the possible reasons and implications?

Line 109: what is the percentage of underestimation.

Line 147: What is the possible cause (from the perspective of atmospheric chemistry or model validation performance) of comparable O₃ concentrations in the late period of this analysis to the business-as-usual levels, while NO₂ concentrations still indicated some degree of NO_x emission reduction?

Line 170: I consider the less correlated relationship between lockdown date and O₃ surge possible is because O₃ is a more regional pollutant than NO₂ (high contribution from regional transport). I wonder how about analyzing the maximum daily average 8-hr instead of all O₃ observations?

Line 185: Is there any supporting mobility data to verify the actual change of mobility activities in Germany and Switzerland vs. in France and Italy?

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Line 205: Please consider to add the increase of maximum daily average 8-hr ozone concentrations.

Line 210: The authors has strong assumptions that the future reduction pace of NO₂ would follow that in the past decade, and the O₃ increase would greatly relate to the change of traffic emissions. I am not very confident with these assumptions. In particular, O₃ pollution is a regional issue, and is relevant to emission controls not only for NO_x but also for VOCs (e.g., deeper mitigation of NO_x might lead to O₃ reduction). Similar concern for the statement in the abstract (e.g., the predicted situation in 2028)

Line 265: and biogenic VOCs emissions.

Figure A3. What are the measurement methods and data reliability of VOC concentrations?

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