

Atmos. Chem. Phys. Discuss., referee comment RC1
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Comment on acp-2021-121

Anonymous Referee #3

Referee comment on "Unraveling Pathways of Elevated Ozone Induced by the 2020 Lockdown in Europe by an Observationally Constrained Regional Model using TROPOMI" by Amir H. Souri et al., Atmos. Chem. Phys. Discuss.,
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This paper is an extensive and intensive study of the NO_x, VOC and O₃ changes over Europe due to the Lockdown using WRF-CMAQ and TROPOMI data. In a sense, it is 2 papers combined into 1. The first part is the assimilation of satellite data to adjust emission inventories of NO_x and VOC. The second part is a process analysis of ozone formation.

The paper seems rigorous and is well written, I am happy to recommend publication. Below are some minor comments that you may wish to consider.

Minor Comments:

Table 2 and 3: Do you mean that these are the differences between 2019 and 2020 after assimilation?

The inconvenience of having so much material in a single paper is that the paper brushes over a fair amount of the information on the assimilation.

I think it would be good to show the emissions in the prior as well as the emissions in the 2019 posterior and the 2020 posterior.

The caption should clarify that these are estimates based on inversions using TROPOMI (vs. estimates based on ratios of TROPOMI data, for example).

Fig. 10: There is a big difference in ozone production rates in Eastern Europe between rural and urban areas. This is discussed in Section 3.4. Given the importance of the

question of ozone sensitivity, would it be possible to provide average values of ozone changes for NW Europe, Rural East Europe and Urban East Europe? This could be integrated into a discussion of NOX/VOC sensitivity.

Fig. 10: It would be instructive to see the corresponding average MDA8 Ozone maps. We see many difference plots, but without seeing the actual average values that these are departures from, it is hard to get a sense of what is going on.

Technical Comments:

Fig. 3: "Estimate" not "Estmate"

Fig. 4: I think you mean $\Delta X = X_{2020} - X_{2019}$ - this is what you have in the text and elsewhere.

Fig. 5: Could zoom in on the area with data, which would make the figure more legible.

Fig. 10: There is room to spell out Delta in the title. I think this would make it easier for the casual reader to follow, eg. $\Delta O3P = O3P_{2020} - O3P_{2019}$