

Interactive comment on “Changes in black carbon emissions over Europe due to COVID-19 lockdowns” by Nikolaos Evangeliou et al.

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Anonymous Referee #1 Received and published: 2 November 2020 The manuscript submitted by Evangeliou et al. investigates how COVID-19 related lockdowns impacted the levels of BC in Europe. They found a decline in BC emissions with a regionality showing strong links between the magnitude of emission decline and the severity of restrictions. The paper is well written and based on sound analyses. Authors include an account of sources of uncertainty in the presented results, and further support their findings by data from other sources. Papers investigating the effects on the current pandemic on climate and emissions are important contributions to the field, and I recommend the paper to be published after relatively minor revisions. General comment: Authors use a well-developed scientific language. However, a reader not familiar with

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these method may at times be confused. Some very small adjustments may improve this. My comments exclusively pertain to the first part of the manuscript.

Response: We appreciate reviewer's willingness to help us improve this manuscript. We have tried to follow all of his comments.

Specific comments:

L 48: "Despite the socioeconomic impacts". The sentence is entirely correct, but it too easily reads as if the air quality has improved despite the societal impacts (which have lead to reduced emissions, which is the cause of the air quality improvement). I had to read it a couple of times to get its correct meaning. Since everything else is so fluent and well written here, I suggest to improve this sentence. A suggestion could be to start it as "In contrast to the detrimental societal impacts" or something similar.

Response: We have corrected the sentence as reviewer pointed (L48-50): "In contrast to . . . pollutant emissions".

L 55: "in at the beginning of" → delete either "in" or "at" I enjoyed reading this introduction, it really sets the research into context and is a great motivation for the importance of the results to come. Well done.

Response: We removed "at" (L 56). We kindly thank the reviewer for reading and altering on our manuscript.

L 245: Maybe this is just me, but "the aforementioned numbers" makes me look further up than to the last sentence. If you refer to the numbers 191/239 kt in this study/Eclipsev6, could you simply say "these numbers"?

Response: We replaced "aforementioned" with "these" (circa L 303, p 11) as suggested by the reviewer.

L 274: I am very tempted to think that the fact that the posterior emissions are lower than the prior ECLIPSEv6 emissions is solely due to COVID-19, which shows that I

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have not entirely understood your methods. You have a nice sentence on line 284 explaining that this is not so, but if you could move/repeat this, in more words, to somewhere around line 274, this would help prevent misunderstandings. Could you write out clearly, here or in the methods section, what a smaller posterior emission number that the prior emission input could potentially mean and why?

Response: The inversion algorithm itself tries to better match modelled concentrations with observation by correcting emissions (of course taking into account some uncertainties). Since we calculated decreased posterior emissions throughout the whole inversion period (before and during the lockdowns), we cannot conclude that this is due to COVID-19 restrictions. To confirm COVID-19 impact on the emissions, we first need to compare with what was happening with emissions in previous years, as well as with emissions before and during the lockdown measures. We have now tried to clarify this in the text (circa L 350-357, p 11).

L 278: Again, it is not entirely clear to me what “posterior decreases” mean here – do you simply point to the fact that posterior emissions are lower than the prior emissions, or is there some time aspect that I am missing here, so that the decrease refers to something else? Please clarify in the text. Perhaps consider sticking to the word “difference” instead of “decrease” here?

Response: Yes, the expression refers to prior – posterior differences. We have now corrected it as suggested (circa L 304, p11).

L 281: While you state further up that the largest posterior decrease is in Eastern Europe, with a drop from 35 to 29 kt, Southern Europe had a decrease from 61 to 48 kt, which is higher? It would be good to look over this section and clarify this – perhaps also a more consistent way of reporting differences in percentual and/or absolute numbers would help?

Response: The answer here already exists in the text (L 334: “these numbers refer to the whole inversion domain (not only Europe) and . . .”), but we agree with the reviewer

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that can be clarified further. We have now included the exact definitions of the areas mentioned in the text (circa L 336-346, p11).

L 283: Please fix sentence (the last “were slightly enhanced” can be deleted).

Response: We have corrected this in p 11 (circa L 295). “were slightly enhanced” was deleted.

L 285: consider “the decrease” → “the general decrease in emissions” to make clearer that this last sentence is about the overall decrease found (as it contrasts the previous sentence on Poland and Spain).

Response: The whole explanation there has been changed in a way to tackle reviewer’s previous comment and explain in a more comprehensive way why a change in posterior emissions does not necessarily imply a COVID-19 impact.

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