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Response to the Comments of Referee 2

Brian T. Dinkelacker et al.

Author comment on "Evaluation of high-resolution predictions of fine particulate matter and its composition in an urban area using PMCAMx-v2.0" by Brian T. Dinkelacker et al., Geosci. Model Dev. Discuss., <https://doi.org/10.5194/gmd-2022-145-AC2>, 2022

Comments

(1) *While it is clear that the different spatial distribution has an impact on the distribution of emissions for commercial cooking and on-road traffic, how are these two sectors typically distributed in the default surrogates? Please consider elaborating in Section 3 to provide some context to the reader.*

The spatial distributions of cooking and traffic emissions using both the new and old surrogates are illustrated in the Figures S5, S6, S7 and S8 located within the supplementary material. This was not made clear in the main text and some text has been added to both explain the approach used and to also point the reader to these additional figures.

(2) *In the PMCAMx model simulations, are there removal processes such as dry deposition and wet scavenging? If so, how were these handled between the different grid resolutions? Are these something that must be interpolated from WRF or is it something that PMCAMx explicitly captures?*

These processes are included in PMCAMx, and this has been clarified in the included model description. Wet deposition is dependent on precipitation, which indeed relies upon the meteorological input data. The need to interpolate meteorology is a limitation of the study, however the evaluation process described in the supplementary material (Figures S1 and S2 with corresponding discussion) provides confidence in this specific application.

(3) *The WRF simulations were conducted at 12 km resolution with the information interpolated to higher resolutions of 1 km and 4 km. First, what was the procedure to create 36 km inputs for PMCAMx? Second, why was this design choice made rather than simulating WRF at 36 km and interpolating for all higher resolution grids? Or perhaps simulate meteorology at 4 km with interpolating to 1 km grid and extrapolating to 12 and 36 km grids?*

The WRF simulations and PMCAMx simulations use the same domain, meaning we can

directly aggregate the nine 12 km x 12 km cells that make up a single 36 km x 36 km cell to create input data for the coarse grid. For the higher resolution grids, we use the interpolation process used in previous work (Fountoukis et al., 2013) that has been evaluated extensively for use in higher resolution air quality studies. An evaluation for the specific meteorological data used in this study is provided for the reader in the supplementary material (Figures S1 and S2 with corresponding discussion).

(4) *For those unfamiliar with emissions processing and emission surrogates, it may prove useful to further emphasize how using different surrogates merely change the spatial distribution of the total amount. The authors perhaps made this clear in Section 6 and the Supplementary material, but the reader could benefit from this stated more clearly and earlier.*

A short description of this is now provided in Section 3 (Model Application). A clarifying discussion about how these surrogates might change the emissions provided to the model has been added.

(5) *Related to the previous point, at times in the paper it reads like the novel surrogates for commercial cooking and on-road emissions were applied to all grid resolution configurations and other times it reads like they were only applied to 1 and 4 km simulations (see Line 183-184).*

They were used for the 1 km simulations. Conflicting statements have been removed and a clarifying note has been added to the caption of Table 4 highlighting that these results are for the high-resolution simulations only.

(6) *There is no mention of the novel emission surrogates for commercial cooking and on-road emissions in the abstract. I feel like this point could use some emphasis in terms of mentioning that these were used and developed and briefly mention the evaluation of these novel surrogates.*

A sentence has been added to the abstract, noting the use and evaluation of new surrogates for these sources at high spatial resolution.

(7) *The paper could in general benefit from making it more clear how this study is both related and also different from Rivera et al 2022.*

These studies are of course related. This work is meant to be a detailed quantitative evaluation of the simulation results used to investigate the changes in predicted concentration and exposure with increasing resolution in Garcia Rivera et al. (2022). None of this evaluation is included in the previous work. A clarifying statement has also been added, noting the additional simulations performed to quantify any differences in the use of the novel spatial surrogates for commercial cooking and on-road traffic.

Minor comments

(8) *Table 4 could benefit from explicitly mentioning in the caption that it is for the 1 x1 km resolution.*

The recommended change has been made in Table 4.

(9) *In supplementary material, the captions for Figure S7 and S8 should be checked and corrected to avoid any confusion. Figures S7 and S8 captions incorrectly start off with mentioned commercial cooking and also both for February 2017. Presumably, S7 and S8 are for on-road traffic for February and July respectively as they mention using simulated traffic approach.*

These are correctly identified typos. They have been corrected in the manuscript.