Geoscientific Model Development Discussions

Geosci. Model Dev. Discuss., author comment AC1
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Response to the Comments of Referee 1

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-AC1, 2022

Major comments

(1) *The analysis presented and discussed is based on a modelling run for only two months – February and July – and the discussion and conclusions are drawn for Winter and Summer periods. An example is the sentence in line 327 "Total PM2.5 mass concentrations are underpredicted in the summer period". It is clear that those months were chosen due to the availability of measurements, particularly PM2.5 compounds. Notwithstanding, the study would be much more robust and conclusion better supported if the modelling period was at least one year. Results could be assessed with the observations from fixed monitoring sites for the whole year, with a focus on those two months for which more data is available.*

We do agree that longer evaluations are always better. However, significant resources are required to develop the emission inventory used for these PMCAM$_x$ simulations, so two months in two different seasons were chosen as a compromise. These simulations can provide sufficient information, so that the ability of the model to capture $PM_{2.5}$ differences due to the seasonal variability in major emissions sources and meteorology can be adequately assessed. The primary goal of this study is to evaluate the predictions of $PM_{2.5}$ concentrations at high spatial resolution (1 km x 1 km), produced using a corresponding high spatial resolution source-resolved emissions inventory. The high-resolution, source-resolved, and species resolved $PM_{2.5}$ predictions evaluated in this study are novel and require significant evaluation against available measurements which can be sparse (especially for $PM_{2.5}$ component analysis). Another factor in our decision has been the connection of the present work with the corresponding analysis and conclusions of Garcia Rivera et al. (2022) study who also studied the corresponding periods. A brief explanation and discussion of this point has been added in the revised paper.

(2) *The authors refer that "Garcia Rivera et al. (2022) investigated the effects of increasing grid resolution of model inputs and CTM output on source resolved predictions of PM2.5 concentration and population exposure at 36 km, 12 km, 4 km, and 1 km". Is the current work based on the simulations performed by Garcia Rivera et al. (2022) or are there additional runs in the present work? Are the runs referred in lines 309 – 310 examples of additional simulations? What exactly is the novelty of this study compared to (Garcia Rivera et al.,2022)? This should be made clear in the manuscript and perhaps the*

"Model Application" section could be shortened since it is already explained in the published paper.

This study uses the results of some of the simulations of Garcia Rivera et al. (2022) and adds several additional simulations. For example, additional simulations were performed to quantify the impact of the proposed emissions surrogates for traffic and cooking. The work of Garcia Rivera et al. (2022) is an analysis of the impact of increasing grid resolution on predicted human exposure to $PM_{2.5}$ and the corresponding links with the $PM_{2.5}$ sources. Garcia Rivera et al. (2022) did not address model performance and the corresponding challenges related to the different types of the available measurements. This evaluation is the primary purpose of the present study. The Model Application section now contains only the most essential information about the simulations so that the interested reader does not need to consult Garcia Rivera et al. (2022) to understand the major features of our simulations. These points have been clarified in the revised manuscript text.

Specific comments

(3) *The abstract is too long and has many details of the analysis of results that are unnecessary in an abstract. Conversely, the Conclusions lack a more comprehensive and focused text on the added value and limitations of this work and concrete ideas for future work.*

The content of the abstract and conclusion have been reassessed and changes have been made in the manuscript. Additional clarity on the scope of the work has also been highlighted in the revised manuscript.

(4) *Section 3 has a subsection 3.1, that would only make sense if a 3.2 exists. Please restructure this section or remove the subsection title. One idea is to join sections 2 and 3 into one section.*

This has been fixed in the manuscript.

(5) *Figure 1 – Please include the metric scale and draw the inner domain to allow to have an idea of where stations are located in relation to the modelling domains.*

Figure 1 (a) shows fully the entire inner domain. Figure 1 (b) shows the City of Pittsburgh limits, which are also shown in Figure 1 (a) to provide the reader with a scale reference. These notes have been included in the revised caption for clarity.

Technical Corrections

(6) *Line 323 - The reference (Kodros et al., 2021) is missing in the reference list.*

The missing reference has been added.

(7) *References Day et al., 2015, Skyllakou et al., 2021, included in the reference list are not cited in the text.*

These unused references have been removed.