Response to Reviewer 1:

We would like to thank reviewer 1 for the valuable comments and suggestions. A revised version of the manuscript that addresses the review comments is provided along with point-by-point responses below.

> RC1: Anonymous Referee #1, 21 Apr 2024 The manuscript introduces the adaptation and optimization of the CMAQ 5.3.3 for high-performance cloud computing environments. This paper fits the scope of GMD and can serve as a detailed reference to showcase how the CMAQ model can enhance computational efficiency and accessibility for diverse modeling tasks. Here are some minor suggestions that could be addressed to further improve the paper.

Response: *We thank the reviewer for the positive and encouraging comments on our manuscript. Please see detailed responses below.*

Line 115-125: How about illustrating the CMAQ workflow using a figure? It would help readers better understand how CMAQ works.

Response: *We have incorporated the reviewer's suggestion in new* ***Figure 3.***

Line 130-150: This is lengthy and somewhat difficult to follow. Please break it into multiple paragraphs to enhance readability.

Response: *We have restructured th***e** *paragraph as suggested to enhance readability****.*** *The new content is in lines 130-165.*

Line 160: Figure 1 only shows the rectangle of CONUS but lacks grid representation. I suggest exemplifying the grids over an area of interest with a zoom-in minimap.

Response: *We have added a new figure depicting a subdomain of CONUS over NY with grid lines* ***(Figure 2).***

Line 165-290: Section 3 offers valuable insights into CMAQ deployment from an engineering perspective. However, to align more closely with the scientific paper, consider pivoting towards system or experiment design to elucidate the methodology behind this work, while relocating detailed technical tutorials to an appendix.

Response: *The additional figures 2, 3, 13 help better elucidate the methodology and code surrounding the experimental design, by illustrating examples of existing functionality (DESID module) for the example of the CONUS cloud benchmark suite. The links to the tutorials are provided to allow the users to not only reproduce the results of the suite, but also define the experimental design for their individual needs, that can often expose unique limitations and require additional benchmarking and optimization pathways (i.e.,*

cpu/memory/storage/networking). Given this, the links could be more useful to end-users if made directly available.

Line 335-410: How about combining Figure 6/7, 8/9/10, 11/12/13/14/15/16? It is a little bit hard for readers to compare the results across multiple figures.

Response: *We have combined these individual figures as suggested in new Figures 8 - 12.*

Line 495-560: The current discussion could be streamlined and organized into subtopics, such as the strengths of the proposed cloud-based implementation, scalability/reusability, limitations, and future research recommendations. Meanwhile, a conclusion section is recommended to summarize the research findings from this work.

Response: *We have restructured and rewritten the discussion section into 5 subsections to consider the reviewer's suggestion. In addition, we also incorporated a conclusion section at the end of the manuscript to summarize the research findings.*