Dear Editor,

Thank you very much for guiding the review of our manuscript. The new suggestion is appreciated! We have accordingly revised the manuscript. Please find our response below.

Thank you again for your guidance and support for the publication of our manuscript in GMD.

Best regards,

Ashu Dastoor and coauthors

Referee's comment:

The manuscript provides a comprehensive state-of-art review of multi-compartment mercury (Hg) models and their key inputs and constraints, and proposes the ambitious MCHgMAP multi-model research initiative for the effectiveness evaluations of the Minamata Convention (MC) and the Convention on Long-Range Transboundary Air Pollution (LRTAP). The manuscript is well organized and provides useful information to broad audience in the global Hg community. The authors have also done a great job revising the manuscript according to the referees' comments. Overall in my opinion, the manuscript is acceptable for publication on Geoscientific Model Development after minor revision. I have one more comment for the authors to consider:

Section 4.1: Although reactive Hg monitoring is not prioritized for the effectiveness evaluation, concentrations of reactive Hg are crucial constraints for the atmospheric models. Recent advances in reactive Hg measurements should be briefly summarized in this section. The following literatures could be utilized.

Response: We thank the reviewer for appreciating the paper and for providing an excellent suggestion (and relevant papers) to include reactive Hg advances in section 4.1. We have accordingly added the following text and references in this section on the topic of reactive Hg (i.e., oxidized Hg or Hg(II) = Hg(II)g + Hg(II)p, these are the terms used in the paper).

"For constraining atmospheric chemistry in models, robust and high temporal-resolution measurements of oxidized Hg (gaseous and particulate) concentrations and characterization of its chemical compounds under all environmental conditions are needed. However, currently deployed instruments for Hg(II) observations have significant artifacts (Gustin et al., 2021; Dunham-Cheatham et al. 2023). KCl-coated denuders, the predominant method to measure Hg(II)g, has been shown to be biased low by up to 50%; its collection efficiencies for various Hg(II) compounds depend on environmental conditions and local chemistry. Hg(II)p is typically collected on filters, such as quartz fiber and polytetrafluoroethylene (PTFE), which are found to also collect Hg(II)g.

Recent advances in oxidized Hg measurement methods such as Dual-channel system (DCS) and The Reactive Mercury Active System (RMAS) (e.g., Lyman et al. 2020; Elgiar et al. 2024) allow for the development and deployment of new Hg(II) measurement systems in the field, which can improve the measurement accuracy and elucidate Hg(II) compounds involved in atmospheric chemistry across space and time. Gustin et al. (2024) recently reviewed the advances and limitations of current ambient Hg *measurements and suggested that future work should focus on the development of following: better surfaces for collecting oxidized Hg compounds, analytical methods to characterize Hg chemistry, methods for differentiating between Hg(II)g and Hg(II)p, and high time-resolution calibrated measurement systems."*

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Elgiar, T. R., Lyman, S. N., Andron, T. D., Gratz, L., Hallar, A. G., Horvat, M., Vijayakumaran Nair, S., O'Neil, T., Volkamer, R., and Zivkovic, I.: Traceable calibration of atmospheric oxidized mercury measurements, Environ. Sci. Technol., 58(24), 10706–10716, 2024.

Dunham-Cheatham, S. M.; Lyman, S.; Gustin, M. S. Comparison and calibration of methods for ambient reactive mercury quantification. *Sci. Total Environ. 856*, 159219, 2023.

Gustin, M. S., Dunham-Cheatham, S. M., Huang, J., Lindberg, S., and Lyman, S. N.: Development of an understanding of reactive mercury in ambient air: a review, Atmosphere, 12(1), 73, 2021.

Lyman, S. N., Gratz, L. E., Dunham-Cheatham, S. M., Gustin, M. S., and Luippold, A.: Improvements to the accuracy of atmospheric oxidized mercury measurements, Environ. Sci. Technol., 54(21), 13379–13388, 2020.