Comment on gmd-2021-380
Anonymous Referee #2

Referee comment on "Earth system modeling of mercury using CESM2: part 1. atmospheric model CAM6-Chem/Hg v1.0" by Peng Zhang and Yanxu Zhang, Geosci. Model Dev. Discuss., https://doi.org/10.5194/gmd-2021-380-RC2, 2022


In this study, the authors used the CAM6-Chem atmospheric component in the CESM model to implement the mercury chemistry that includes oxidation of \( \text{Hg}^0 \) by both \( \text{Br} \) and \( \text{O}_3/\text{OH} \) with reaction rates taken from Horowitz et al., (2017). They calculated the global atmospheric Hg budget. The model was evaluated against observations for total gaseous mercury (TGM) and deposition (dry and wet) of Hg. They further discuss the latitudinal and seasonal variations and the contribution of different processes to the variations in the two hemispheres. The paper can be accepted after addressing the following comments:

General comments:

- Shah et al., (2021) had a major revision to the GEOS-Chem mechanism described in Horowitz et al., (2017), how do the authors account for those changes? It is relevant to include a discussion on the mercury chemistry implemented in this study with Shah et al., 2021, which is the most updated mercury chemistry in a global model.
- Which version of the GEOS-Chem model output was used for the natural emissions? Add the details in the manuscript.
- Is there a specific reason for choosing the simulation period 2011-2013?