

07 August 2016

Review of H. Mao et al., Current Understanding of the Driving Mechanisms for Spatiotemporal Variations of Atmospheric Speciated Mercury: A Critical Review, *Atmospheric Chemistry & Chemistry Discussions*

### Summary

Mao and colleagues present a review of published work on spatiotemporal patterns of atmospheric mercury. The authors have compiled an impressive volume of literature. I commend the authors on presenting an unbiased summary of published work. I recommend the review for publication after revision. Too much of the present manuscript feels like a reiteration of published work. The review could be greatly improved if it were more concise and provided a greater amount of critical insight.

### General Comments

- The Abstract could use a statement motivating why we care about mercury in order to help appeal to a broader readership. I also suggest tightening the conclusions and including at least one future research recommendation.
- The Introduction is unfocused and needs clearly stated objectives. Some of the content in the Introduction gets repeated in later sections. Delete redundancy wherever possible.
- The phrase “natural emissions” is used loosely and sometimes interchangeably with “re-emissions” or “legacy emissions”. In light of the Minamata Convention, it is important to maintain clear language here and distinguish between natural primary sources (volcanism, outgassing of enriched mercuriferous belts) and anthropogenic sources being remitted by land and ocean.
- Be concise. Delete unnecessary text. The current manuscript feels unnecessarily long.
- Old data (1960-80s) is included in comparisons alongside modern data -- is this really a valid comparison? At a minimum, it seems like it would be appropriate to comment on the major differences in analytical methods and the robustness of old data. I worry about the reliability of older data (Gustin et al., 2015).

### Specific Comments

Line 62: Please include a citation for biodegradation. Biodegradation isn't a process commonly associated with atmospheric mercury.

Lines 101-106: Mao & Talbot (2012) is cited exclusively. Are there other references that could be included too?

Lines 536-549: Rivers and wastewater cannot explain North Atlantic trends in Soerensen et al. (2012) (Amos et al., 2014).

Line 527: The Pinatubo hypothesis is not widely embraced. I do not recommend including it in the review.

Line 811: Why would ship emissions be important? My understanding is most ships burning crude oil, which is low in Hg (Pironne et al., 2010).

Line 1468: "Refuting... large oceanic emissions". Please include a rationale for this conclusion. This is not an obvious conclusion from the review. If it's true, it's significant, but the conclusion needs to be buttressed with supporting evidence here in the Summary & Recommendations section.

Lines 1484-85: "Global distributions... remain lacking..." Delete? This statement is not particularly helpful.

Line 1492: "...trends derived from such data suggested composite information instead..." Perhaps there is a typo in the sentence? I'm unsure what the intended meaning is.

Figure 1: Break the y-axes, so you better see the variability in the data and the plots aren't dominated by one extra-large error bar.