

“Chemical cycling and deposition of atmospheric mercury in Polar Regions: review of recent measurements and comparison with models” by H. Angot et al.

Response to referee comments by Referee #2.

We provide below a point-by-point reply to the comments (points raised by the referee in bold, changes made in the manuscript in red).

A few minor suggestions:

-line 568: interesting that the models underestimate RGM since the KCl denuder collection method is thought to collect RGM with < 100 % efficiency. I did not immediately see that a reason for the discrepancy was given. Similar to the results shown in Weiss-Penzias et al ACP 2015, Figure 5, where the GEOS-Chem model underpredicted high RGM event at Desert Research Institute site in Nevada USA.

Indeed, several studies highlighted the inefficient collection of Hg(II) with a KCl-coated denuder leading to an underestimation of RM concentrations by a factor of 1.3-3.7 (Huang et al., 2013). This suggests that the underestimation of RM concentrations by current models might be even greater.

-line 938: passive samplers are mentioned in too casual a way as a possible solution to obtaining year round RGM data. Have they been adequately tested to know their collection efficiencies and potential biases? This is mentioned in point number 2. Maybe combine points 1 and 2?

We agree that passive samplers have to be adequately tested first. This has been corrected in the revised manuscript:

“Passive samplers, such as Polyethersulfone cation exchange membranes, could provide an alternative (Huang et al., 2014) **but further tests are needed to assess their collection efficiency and potential biases**”.

Point number 1 deals with RM measurements while point number 2 deals with Hg(II) speciation. We would rather not combine them. Point number 2 has been slightly modified in the revised manuscript to avoid redundancy:

“Recent advancement on analytical techniques may offer new insights into Hg(II) speciation (Huang et al., 2013; Jones et al., 2016) **but However,** further research is still needed **and application of passive samplers for collection and identification of Hg(II) compounds should be tested in various environments and at different times of the year.**”

-line 949: from how many sites in Polar Regions would snow samples need to be taken in order to have a better understanding of Hg wet and dry deposition?

We believe that collecting surface snow samples at all sites carrying out long-term atmospheric Hg monitoring would be a good start.

References:

Huang, J., Miller, M. B., Weiss-Penzias, P., and Gustin, M. S.: Comparison of gaseous oxidized mercury measured by KCl-coated denuders, and nylon and cation exchange membranes, *Environmental Science and Technology*, 47, 7307-7316, 2013.

Huang, J., Lyman, S. N., Hartman, J. S., and Gustin, M. S.: A review of passive sampling systems for ambient air mercury measurements, *Environmental Science: Processes & Impacts*, 16, 374-392, 10.1039/C3EM00501A, 2014.

Jones, C. P., Lyman, S. N., Jaffe, D. A., Allen, T., and O'Neil, T. L.: Detection and quantification of gas-phase oxidized mercury compounds by GC/MS, *Atmos. Meas. Tech.*, 9, 2195-2205, 10.5194/amt-9-2195-2016, 2016.