

Response to reviewers – second review

Comments by reviewer Lena Wohlgemuth

The authors put careful work into the revision of the manuscript, which improves the scope of the paper. I therefore support the publication of the manuscript as it is. Two final remarks for clarification:

- Line 385 – 386, first submission: I agree, that we have to be mindful about foliage age when we evaluate e.g. foliar Hg concentrations. Just for the net Hg(0) flux (e.g. to one forest site over one growing season) foliage age might not be as relevant because the foliage Hg uptake rates normalized over time are not so different between old and young foliage (Fig. 4b first submission) and the mass of younger foliage is often much higher than the mass of older foliage at the same tree (compare e.g. masses of spruce needles current season to six year old needles). I just think we have to carefully differentiate in wording between concentrations and fluxes so they do not get confused.

Response: *We agree that one has to differentiate between concentrations and fluxes, but concentrations are relevant to fluxes.*

- Even though SLA values of coniferous needles and broad leaves are usually quite distinct, I agree that there is a large SLA variation within these categories and sometimes we observe inbetween SLA values (e.g. by Larix). My suggestion to separate needles and leaves is more born out of their different metabolic strategies and structure, which might impact Hg uptake. I am excited for further insights into the similarities between uptake mechanisms of needles and leaves. Whatever the direction, SLA seems to be a functional trait of interest in this context.

Response: *We completely agree on this.*

Comments from the anonymous reviewer

Comments on “Mercury accumulation in leaves of different plant types – the significance of tissue age and specific leaf area” (BG-2021-117).

Pleijel et al. studied the Hg concentrations in the leaves of deciduous, conifer and evergreen trees and wheat and found that the accumulation rates of Hg in the diverse set of tree species were related to the specific leaf area. I think this is interesting. Additionally, leaf area based [Hg]A is relevant to assess the tree canopy accumulation capacity of Hg, typically being substantially higher in conifers than in deciduous trees. I recommend minor revise before acceptance.

Line 35. I donot think the background concentrations of GEM in Northern hemisphere is approximately 1.5 - 1.7 ng m⁻³. I think the concentrations are much lower. Please double –check and the Sprovieri et al. (2016) seems did not show the background concentrations of GEM in Northern and southern hemisphere.

Response: *We have revisited the paper by Sprovieri et al (2016), who state that “The GEM concentrations highlight that the mean GEM values of most of the GMOS sites were between 1.3 and 1.6 ng m⁻³, with a typical interquartile range of about 0.25 ng m⁻³.” We have accordingly adjusted the concentration range to 1.3 and 1.6 ng m⁻³. We do not believe that it is correct to say that the GEM background concentrations in the Northern Hemisphere is “much lower” than 1.5 - 1.7 ng m⁻³.*

Line 55. New article by Zhou et al (2021) (Vegetation uptake of mercury and impacts on global cycling) has reviewed the Hg source in vegetation, including leaf and needle, which would help you to know the leaf Hg uptake and emission.

Response: *We agree that this reference is relevant. Unfortunately, we did not observe this article since it was published just before we submitted our manuscript. Thank you for drawing our attention to this valuable article.*

We have now referred to this paper in an already existing sentence in the Introduction. In addition, the second sentence of Discussion now reads “This was further substantiated by the review of Zhou et al. (2021)”, and in the support to our observation of higher [Hg]_M in the tropical trees compared to the Swedish deciduous trees we added: “... and the findings by Zhou et al. (2021) that evergreen broadleaf trees have significantly higher [Hg]_M compared to deciduous trees.” (see line 399-400 in revised version).

Line 105-110. Based on my knowledge, all the four hypotheses have been confirmed by previous studies. What’s the new perspectives of current study?

Response: *We believe that the relationship between Hg accumulation and SLA has been investigated only to a very limited extent earlier (Hypothesis 2). To do this it was necessary to obtain data on Hg accumulation over time (related to Hypothesis 1) for a wide range of species with different SLA. The amount of data on leaf concentrations of Hg on tropical evergreen species (especially from Africa) is small and the comparison with temperate species is relevant to the field (Hypothesis 3). In relation to Hypothesis 4, we believe that the observation of the pronounced effect of charcoal filtration of air lead to a strongly reduced leaf Hg concentration of field-grown wheat. Also, the effect of ozone on leaf Hg concentration by reducing the leaf life span is new and relevant to the field.*

Line 380. I donot think the higher Hg in litterfall is due to organic matter loss. As the author observed higher Hg concentrations in older foliage. Litterfall lives longer time than foliage, which is the main reason for the high Hg concentration.

Response: *This is not the topic on line 380, neither in the clean manuscript, nor in the annotated version. We assume that the comment refers to the text on lines 383-384 in the annotated version. In response to the comment we have added the following sentence: “Also, it cannot be excluded that Hg accumulation in litter continues after shedding of leaves/needles.”*

Line 515. Besides life span, what the other reasons for the foliage Hg differences?

Response: *“Life span” is not mentioned on Line 515, neither in the clean version of the manuscript, nor in the annotated. We assume that the comment refers to the text on line 525 in the annotated version of the manuscript. In response to the comment by the reviewer we have added this piece of text here: “, but differences in rate of gas exchange may also be of importance.”*