

Interactive comment on “Air-surface exchange measurements of gaseous elemental mercury over naturally enriched and background terrestrial landscapes in Australia” by G. C. Edwards and D. A. Howard

Anonymous Referee #4

Received and published: 20 March 2013

This paper describes the first measurements of gaseous elemental mercury air-surface exchange from Australia. The data presented here will make a significant contribution to the scientific community, for both measurement comparisons and for input and analysis of modelling studies. The following comments are provided for the authors to improve the paper.

1. Page 27934: Was the soil pH measured? There is no mention of it in the text but if it was, it could be useful to include.

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2. Page 27936, line 5 and Table 1: Should the ratio values be “depth to surface”?

3. Page 27936, line 13: What does “interestingly compare with Oe horizon litter” mean? Are they similar?

4. Page 27936 (Section 3.2): any possibility of generating dry deposition velocity values and their dependence on related parameters for the periods that had downward fluxes since such data is very limited (e.g., Zhang et al., 2009, *Atmos. Environ.* 43, 5853-5964) and GEM dry position may be more important than previously assumed (e.g., Zhang et al., *ACP* 12, 4327-4340)?

5. Page 27937, lines 21-22: This paragraph relates the diurnal variations in the fluxes to the shading by the tree canopy. Are there trees? In the section above, the sites are described as bare soil and soil with sparse vegetation. Is the canopy thick enough to provide shade from solar radiation?

6. Page 27937, lines 21-23: This sentence is a bit awkward. “The locations of the background and mercuriferous sites were different with respect to canopy architecture, thus the modality differences seen in the respective diel flux graphs”

7. Page 27938, the first three paragraphs: The first sentence seems to be an important new finding compared to existing studies (flux controlled by total solar radiation rather than by UV-B). However, the conclusion on line 6 seems to be not consistent with the discussion in the third paragraph. If flux is temperature driven, then correlation between flux and soil surface temperature should be better than that between flux and air temperature (since GEM was emitted from soil).

8. Page 27939, line 5: The compensation point value given here is for both the day and night data combined for the background data for June (I assume since it's not stated otherwise). Differences in the compensation point with light have been observed in previous studies. Is it possible to calculate the compensation point separately for the daytime and the nighttime to determine if there is a diurnal dependence on your value?

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9. Page 27939, line 20: "Fig. 4d vs. Fig 4d"?
10. Pages 27938-27939: Is it possible to calculate the compensation point for the mercuriferous soil and the April studies as well? These additional data would be useful for modelling studies that are looking to reproduce these values for different land use types and seasons. Additional figures aren't necessary, just the values, if possible.
11. Pages 27938-27939: Perhaps a more in depth comparison between your measured compensation point and that of Xin and Gustin (2007) would be beneficial. Are you comparing to their daytime or nighttime value or both? Are the two measurements both for the same conditions (i.e. background soils, temperatures, etc)?
12. Page 27940, line 10: "to illustrating" should be changed to "to illustrate".
13. Page 27940, line 16: It is suggested that the higher trendline for the Australian data is related to the higher temperature (+1.2°C). You mention a difference in environmental factors. What are these differences (e.g. soil types, soil Hg concentration, etc). Have they been ruled out as possibilities for the shift? Perhaps mention why, as well a few more details on the North American site(s).
14. Page 27940, line 27: "however pointed to...: should be changed to "however it pointed to..."
15. There are some small grammatical errors throughout the text, such as missing commas, which could be addressed. For example, p. 27928, line 21 "(ICMPG), several..."; p. 27929, line 23 "seasonal variation, the...".

Interactive comment on *Atmos. Chem. Phys. Discuss.*, 12, 27927, 2012.

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