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Atmospheric Chemistry and Physics Discussions

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

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Response to Anonymous Referee #4

We are pleased by the positive review of our paper. We thank the anonymous referee for the insightful and constructive suggestions for improving the paper. We have revised the manuscript accordingly. We will briefly summarize those revisions below in the same numbered order as the reviewer.

1) Soil pH was measured and we have revised Table 1 to include these data and added

some discussion relating to the role of pH in the mercury flux from mercurifereus and background soils. 2) Yes, thank you. Revised to read “depth to surface” 3) We have added text here to be more quantitative with our comparison. Specifically, Obrist (2012) found an average leaf litter THG concentration over 12 sites of 0.038 μg g-1 compared to our 0.041 μg g-1 and Graydon et al. (2008) found an average leaf litter THg over 5 sites in Canada of 0.041 μg g-1. 4) We have calculated deposition velocities for the periods we saw deposition during the studies. We revised the paper to report these as ranging from 0.00025 cm/s to 0.0083 cm/s with an average value of 0.0041 $\pm$ 0.00018 cm/s, representing bare soil, nighttime conditions. 5) We have revised the site description to add more information on the sparsely treed site. We don’t have an LAI measurement however the sparse tree cover was sufficient to partially shade the flux measurement sites depending on time of day. 6) We have reworded this awkward sentence to be clearer on what we mean by “modality differences”. 7) We have revised the description here to better explain our results. We have also revised Figure 4 to better illustrate the findings. Certainly, soil temperature is a key correlate with respect to mercury evasion as the soil temperature plays a role in the in-soil processes that supply the GEM for evasion. The other processes that control the evasion are the diffusion through the quasi-laminar layer near the soil surface and the turbulent diffusion above that. These processes also are central to the sensible heating of the air. It is the latter we believe is responsible for the better correlation of the flux with air temperature. 8) Again we have provided a more in-depth discussion in the revised paper. For these studies we only observed emission and deposition in the June background data and thus are unable to duplicate Xin and Gustin’s (2007) laboratory studies for day and night exactly. To our knowledge this is the first full scale field study over bare soil reporting a mercury flux compensation point. Furthermore, our data taken in both light and dark conditions with variable climatic conditions showed a remarkable linear relationship and clear compensation point. Nonetheless our data do lie in between Xin and Gustin’s light and dark data and within the range of compensation points they reported. 9) Corrected to Fig 4c 10) Answer to 8) above addresses this comment. 11)

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Answer to 8) above addresses this comment as well. 12) Changed to “to illustrate” 13) Here we have revised the text to provide more information on the differences as suggested, as well as more details on the North American sites to highlight those differences. For naturally enriched substrates mercury, evasion has been shown to be strongly correlated with substrate Hg concentration and essentially temperature driven (Edwards 2001; Gustin et al., 2000) . The shift presented in Figure 6 of Australian and North American naturally enriched substrates is thus likely to be due to temperature. We have expanded the discussion on the implications of this shift. 14) Changed to “however it pointed to” 15) Undertook a more thorough proof read for grammatical errors, as suggested.

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