

Interactive comment on “A dual, single detector relaxed eddy accumulation system for long-term measurement of mercury flux” by S. Osterwalder et al.

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General comments:

1) use consistently “unstable” instead of “instable” in the whole manuscript, including the supplement.

Response: We now use “unstable” instead of “instable” consistently throughout the manuscript.

2) replace Rannik et al. (2003) with Rannik et al. (2000), “Footprint analysis for measurements over a heterogeneous forest”; that fits better as reference for the basic footprint model.

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print model.

Response: Indeed the stochastic footprint model is described in more detail in Rannik et al. (2000). We have changed the reference accordingly.

3) why are you using different β approaches for the two sites? Maybe it would be good to explain this a bit more.

Response: The reason for the two different β approaches has to do with the difference in eddy size and subsequently the switching frequency of the fast-response valves at the two sites. In Basel, eddies were generally larger and higher GEM concentrations could be expected due to additional emissions from civil heating and motor vehicle exhaust. A stable deadband is very suitable at a site like Basel with comparably low switching frequency and high concentration gradients between up- and downdraft. With the application of the dynamic deadband at Degerö we aim to reduce the switching frequency of fast-response valves since eddies were expected to be much smaller than in Basel. Using a dynamic deadband we made sure that we measured a big enough air volume for the GEM analysis that had not been guaranteed if we had measured with a fixed deadband.

Suggested changes in the manuscript (from Page 8119, line 25): “During the campaign in Basel larger eddies resulted in lower valve switching frequencies relative to the situation at Degerö. The GEM concentration differences between updraft and downdraft were also larger in Basel. This made a fixed deadband appropriate for Basel, while a dynamic deadband was more appropriate to Degerö since the fixed deadband makes β dependent on atmospheric conditions (Milne et al. 1999, 2001), with increased deadband widths leading to lower β -values (Ammann, 1999). The application of a dynamic deadband at Degerö, with its smaller eddies, aimed to reduce the switching frequency of the fast-response valves. Using a dynamic deadband also ensured that large enough air volumes for the GEM analysis were measured as that would not have been guaranteed by measuring with a fixed deadband. A dynamic deadband is applied more often

(cf. Gaman et al., 2004; Olofsson et al., 2005b; Haapanala et al., 2006; Ren et al., 2011) and enables the use of a constant β (Grönholm et al., 2008)."

Specific comments:

4) Page 8118, line 13: replace "challange" with "challenge"

Suggested changes in the manuscript: "Even though there has been steady improvement in REA systems for measuring Hg fluxes, the financial and technical challenges to accurately ..."

5) Page 8120, line 7: replace "sampled" with "determined" or similar. Air temperature is nothing what is sampled. And it has to be calculated from sonic temperature.

Response: We followed the suggestion. Suggested changes in the manuscript: "To compute β in Eq. (2), air temperature was calculated from the sonic temperature at the same intervals ..."

6) Page 8126, line 23: replace "mire surface" with "surface" or "snow surface". During winter you are not measuring above mire surface.

Response: That's a good point. We have changed that according to your suggestions. Suggested changes in the manuscript: "A measurement height of 1.8 m above the surface was maintained by gradually ..." and p.8133, l. 12 "For all contour lines calculated, the surface was ..."

7) Page 8127, line 14: not the "sonic anemometer temperature" is measured, but the "sonic temperature".

Response: Yes, we changed that. Suggested changes in the manuscript: "One of these is the determination of the β -value, which includes sonic temperature and ..."

8) Page 8129, line 16: rewrite; e.g. "...data were omitted for kinematic heat flux in the range +/- 0.01"; I think you are talking about the range which is omitted, not the exact values.

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Response: Absolutely, we changed the sentence according to your suggestion.

9) Page 8131, line 16: remove comma after "was"

Response: We deleted the comma.

10) Page 8134, line 2: use consistent space between numbers and symbols. That should be done for the whole manuscript also including the supplement.

Response: Yes, I will do the final check on that during the proof reading.

11) Page 8136, line 15: exchange of what? Name it.

Response: GEM land-atmosphere exchange. We changed that in the MS.

12) Acknowledgements: "Stormyr" wasn't named before, introduce it maybe earlier.

Response: The site is named Degerö. We deleted "Stormyr".

13) Page 8146, table 2: replace "averaged" with "average" in figure caption

Response: We changed that.

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