

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

Anonymous Referee #2

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General comments

The manuscript entitled “A dual, single detector relaxed eddy accumulation system for long-term measurement of mercury flux” by Osterwalder et al. 2015 is a very well written easily-readable article. The authors describe a system that they adapted to attempt to measure gaseous elemental mercury surface-atmosphere fluxes via the micrometeorological relaxed eddy accumulation method. These additions include use of dual inlets to be able to collect updrafts and downdrafts during the same time periods and a single detector for analysis of GEM to eliminate potential differences between analyzers that could introduce systematic error. They have also added an automatic

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calibration source. In my initial quick review I felt that the authors deserved a chance to prove to me that they have made an entirely new breakthrough, pushing the science forward and convincing me to never again use other micrometeorological techniques for GEM. Unfortunately, they have fallen short of that. I fail to see the significance of this development that warrants publication of just the method alone. Although the paper is well-written, most of this information would typically go into supplementary info of a manuscript that reports the findings of flux studies that use this system. Simply “tweaking” an existing method does not warrant publication as an entirely new atmospheric measurement technique and appears a little like an attempt to just add to publication numbers. Also, the valid data collected by this system is very low (32 – 38%), thus I would argue it is not much of an improvement over existing systems/techniques.

Specific comments (based on print version)

Title: Should be “A dual inlet, single. . .”

- 1) Pg 8115 Line 9: should be “. . .difficult due to technical. . .”
- 2) Pg 8116 Line 10: Statement “ Over an annual cycle. . .” This is stated as a fact, but we actually do not know for sure, so citations are needed or it needs removed.
- 3) Pg 8116 Ln 16: should this be “. . .of GEM flux measurements.”?
- 4) Pg 8116 Ln 22: Cobos et al. 2002 did not use flux chamber so why is it cited here?
- 5) Pg 8116 Ln 27: “. . .for deducing regulating mechanisms. . .” I would argue that MM methods are applied over a large source area, making them difficult to use for mechanistic studies.
- 6) Pg 8121 Ln 6: Please indicate to the reader that (A1, A2) refer to Figure 1.
- 7) Pg 8121 Lines 12 – 21: What is the approximate “dead volume” of the system? What are the implications of the dead air volume in the system?
- 8) Pg 8122 Lines 2 – 9: What gold traps are used? How were they prepared? Or were

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they bought from a supplier? If so what supplier? What specifications were used to identify matched pairs of gold traps?

9) Pg 8122 Line 6: For a 1.2 ng m⁻³ calibration standard in a 5 min sample (0.003 m³ volume) then this is a loading of 6pg of mercury. This is a difficult thing to accurately load the incredibly small amount. If this paper were to be revised, considerably more information would be needed on how this is possible and the data provided on the reproducibility. If this has already been published then a citation is needed.

10) Pg 8122 Line 18. "The air samples were analyzed alternately every hour." To me this sounds like you're defeating your purpose of being able to continuously monitor updrafts and downdrafts for the same 30 min flux periods. If that is not the case then this needs rephrased. If it is the case, then this is an additional weakness of the system.

11) Pg 8123 Section 2.4: The actual criteria for rejecting data are not presented here or in Section 3.1.4. The only thing that is reported is the percentage of data that was rejected, but I think the reader should be allowed to make the decision whether the criteria used were valid. Sometimes data rejection thresholds can be too restrictive unnecessarily rejecting good data. The reader should be given this opportunity. For instance, exactly what percentage difference between the gold cartridges was used as a threshold to invalidate data.

12) Pg 8124 Section 2.4.3: How much bias between the lines was found? If the number is large then then this could indicate a contamination in the system, which may be causing some reactions within the system and impacting measurements. Did the bias change over time? This could indicate a systematic problem and needs to be reported.

13) Pg 8125 Line 22 – 26: Why were different footprint models used? I would think that to actually do a comparison between the two sites, then the same footprint model should be used. If there is a valid methodological reason then that should be stated. Or if it doesn't affect then that needs to be stated and discussed.

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14) Pg 8128 Line 5: should be "was determined to be 18 ms. . ."

15) Pg 8128 Line 20: Which sampled volumes? I take it this is combined updraft, downdraft, and deadband. I would not consider the dead band as sampled because in this sense it sounds like there is lots of loading of air onto the gold traps but later we find out that the percentage of time that there is actually loading is quite small.

16) Pg 8128 Line 27: "...high resolution voltage data were logged." So what was found in this data? Were there times when peaks were irregular? What could this indicate?

17) Pg 8130 Line 12: "...also in Basel. . ." Also what? I think there may be something missing.

18) Pg 8130 Line 15 – 21: So this paragraph means that the system actually did not work as advertised. To me, this means that the system does not actually continuously measure, since the purpose of a 4 cartridge system is continuous measurement. So instead of having updrafts and downdrafts separated in time, they are now only measured every other hour, missing important information. Gold cartridges should have been thoroughly tested before deployment and data on their performance presented as part of the QA/QC of the data. Also the performance of the gold traps should be monitored over time and reported. When using a commercially available analyzer such as a Tekran 2537A/B/X then there are precise protocols that the company follows before selling the analyzer. This is not necessarily reported all of the time, even though information on the performance of the gold traps is often reported in the supporting info. So this information really needs to be here if this is to be published.

19) Pg 8131 Line 15 – 17: I hate to say it, but I am not sure a new system that only accomplishes 32 – 38% data coverage may not be much of an improvement on current systems.

20) Pg 8134 Line 8: Need to have some citations for high Hg in vehicle exhaust. This is not exactly a straightforward, easy statement to make.

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