Biogeosciences Discuss.,
https://doi.org/10.5194/bg-2018-61-RC1, 2018

Biogeosciences Discussions
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Interactive comment on "A simple and cost-efficient automated floating chamber for continuous measurements of carbon dioxide gas flux on lakes" *by* Kenneth Thorø Martinsen et al.

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Received and published: 23 February 2018

This manuscript describes an approach to automatically ventilate a floating flux chamber to measure CO2 fluxes across water-air interfaces, building on a previously presented chamber with a CO2 sensor. The timer regulated ventilation of the chamber described here represents a development to restart the measurement time periods for automated repeated flux measurements over long periods. The proposed solution for chamber venting appears straightforward and has a low cost which would be adventageous if working properly. in general this type of development towards simpler and more cost-effective measurements of greenhouse gas fluxes are important for improved flux assessments around the world, and also small improvements in design can lead to profound progress. I think this manuscript has potential to contribute significant such improvements if the below comments can be appripriately addressed. Hence, I would first like to thank the authors for their work and interst in improving greenhouse gas measurement methods. I think this as a very important and timely field of reserach.

General comments:

1. Please describe previous work to develop chamber wenting approaches and differences relative to the suggested approach already in the introduction. One such approach is cited later in the text (Duc et al. 2012 in EST; please note that publication on the web was 2012 but the real publication was 2013 so it should be Duc et al 2013), but there are other approaches for e.g soil/plant/wetland chamber types that could be of interest to give an overview.

2. A key is the time-frame and power consumption of the chamber venting. We tried a similar approach when working with the automatic chamber development presented in Duc et al 2013 EST. At that time we found that it took rather long time to vent the chamber completely, which in turn made the pumping consume a lot of power and also resulted in a loss of measurement time (this was a main reason why we moved on with an approach that opens the chamber to reduce venting time). It would be nice to learn more about how these problems were tested and handled in this study. Seemingly in accordance to our findings, Figure 3 indicates that background CO_2 levels were not reached in the 7 minutes pumping time used - the minimum chamber headspace after pumping was always between 700 and 800 ppm also during periods when the background was 500 ppm. This may have been a small problem in the test case where pCO_2 was very high, but could lead to biased fluxes under some conditions. How long pumping time would be needed to ensure that the background levels were rached inside the chamber? What implications would this have on the power consumption of the system?

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Discussion paper

3. With respect to the above, what was the power consumption and power limitations? How long time did the solution presented here work (please give detailed specs on what batteries were used)? Would this be a suitable technique for long-term use in the field with respect to power consumption and if so, how would this be done?

4. In the proposed design the pump and battery is placed on top of the chamber. How much does this increase the chamber mass and does this influence flux rates? The desire to minimize chamber mass is mentioned in the discussion, suggesting to put larger batteries elsewhere. Could also the pump together with the battery be placed in a separate floating box next to the chamber to remove the chamber mass issue?

5. Data from the real in-situ test is given for one day only. This data is too limited for readers to evaluate the potential of the approach. Ideally data from longer time periods covering variable weather conditions should be presented. Can such data be presented? If not, how can the system performance under variable weather conditions and system characteristics be analyzed/assessed and shown convincingly in other ways? In addition, please give real measurement data from the CO2 sensor to illustrate variability in raw data (not smoothed curves as in Fig 3c).

6. Is the test of gas transport through the long open pressure equilibration tube valid for all weather conditions? Could e.g. wind-induced pumping effects or convection cause more rapid gas transfer than in the laboratory environment? How to not risk any substantial gas transfer under any weather conditions?

7. Please expand the technical description and give full details, perhaps as supplementary information. For example, please provide a detailed step-by-step guide on how to build the system with instructive pictures and component lists. A key for widespread use is easy access to such details and good instructions for persons with no background knowledge in e.g. electronics.

Specific comments:

8. Equation 2 made me a bit confused: If the term dC/dt is the change in partial pressure (atm) over time - is it then really correct to multiply with the ambient pressure (Pamb)? This would lead to atm*atm in the unit later on. If I understand this correctly, the multiplication with Pamb makes sense to me only if dC is change in molar fraction, i.e. (ppm/10ˆ6) over time.

9. Page 6, line 13-15: I am not sure I understand this sentence. Schilder et al. 2013 (Spatial heterogeneity and lake morphology affect diffusive greenhouse gas emission estimates of lakes, Geophysical Research Letters) showed that it is important to consider local k variability on lakes. It seems like the sentence is saying the opposite?

If these points can be addressed convincingly, I think this manuscript makes a good and important contribution towards one way of improving aoutomatic flux chamber design.

Best regards, David Bastviken

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