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Hydrology and Earth System Sciences
Discussions

Interactive comment on "A Fast-response automated gas equilibrator (FaRAGE) for continuous in situ measurement of methane dissolved in water" *by* Shangbin Xiao et al.

Anonymous Referee #1

Received and published: 15 May 2020

General:

This study present a new gas equilibrator setup that makes it possible to perform dissolved CH4 measurements with short response time and at relatively low cost. The paper is very well written, the set-up is overall well described, and all relevant tests of the set-up are presented in a convincing manner. I think that this set-up will become widely used by people working on greenhouse gas dynamics in surface waters. I have no major concerns with this paper, just one major comment, and in addition a few minor comments that might help to further improve the paper.

Major comment: Given that gas analyzers were used that simultaneously measure both

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CH4 and CO2, I really think that the authors should show the system's performance for CO2 as well. In L363, the authors write that have CO2 data but focus on CH4 for simplicity, but this choice makes life much less simple for all the researchers that want to measure both CH4 and CO2, and therefore need to do all the CO2 testing themselves. Showing the CO2 results would make this study much more useful and applicable for a much wider community, and certainly render more citations to this paper. At the very minimum, include the CO2 performance tests in the supplementary information, but I'd rather see that the CO2 data is fully integrated in the paper, including the title.

Minor comments:

Title: Include "carbon dioxide".

L13. Freshwater lakes and reservoirs are aquatic systems, so that's a repetitive formulation. Simplify.

L48-49. This sentence omits that dissolved CH4 concentration is very strongly a function of methanogenesis, this should be added.

L69. Not only phytoplankton, but also other microbial life forms. I suggest to reword to "biological".

Figure 1. The heart of the equilibrator is the gas-water mixing unit, and the gas-water separation unit. These should be illustrated much more clearly, as a technical drawing, such that people can build them themselves. The pictures in the SI don't really help very much.

L150-154. This text could go to the figure caption.

L155. Use full word "Laboratory"

L178. The 13 m tubing length is not mentioned in this list, but it's shown in the figures.

L193. Mention which these various methods were.

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L204. From what I read, the depth from which peristaltic pumps can pump up water is physically limited to about 14 m. So how come you could pump water from 30 m depth?

L210. Was the effect of boat speed on equilibration tested? Depending on the type and placement of water intake, bubbles might start to form when driving too fast.

L229. Please give this correction equation.

L255. No details on statistical methods or tests are given, yet it says “significantly” here. Which test were performed, and what test statistics did they return?

L260. Please rephrase, “while extended response times” is unclear. Fig.2, panel d. Change the right y-axis colour to red (such as in panel c). Also, why is the red point for 13 m tubing length not connected to the other red points, and how come that its response time is so much longer for high-to-low than for low-to-high, and also so much longer than for the 8 m tubing?

L373. I would be more careful with this statement. You can state that the equilibrator was not negatively affected by high phytoplankton density, but you haven’t tested suspended sediment, so it’s not sure it would work in e.g. in a turbid river. You can’t exclude that for sustained operation in a turbid system, a filter in the water intake might be required.

L383. Unclear what this sentence means, please rephrase.

L408. “potentially be” instead of “be potential”.

Supporting information:

L32. Coupling instead of couple.

Fig.S1. The pictures of the syringes don’t show much, and don’t help those who want to build their own. Use better pictures and include a technical drawing.

L120. This is not a complete sentence.

Fig.S3. Please also show the corresponding depth profiles of CH4 and CO2 at this sampling occasion, such that the reader can judge in how far phytoplankton density might have affected measurements.

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