Biogeosciences Discuss., 12, C223–C225, 2015
www.biogeosciences-discuss.net/12/C223/2015/

Biogeosciences
Discussions
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Interactive comment on "Technical Note: Cost-efficient approaches to measure carbon dioxide (CO_2) fluxes and concentrations in terrestrial and aquatic environments using mini loggers" *by* D. Bastviken et al.

Anonymous Referee #3

Received and published: 16 February 2015

I have no expertise in soil CO2 exchange, and so I will limit my remarks to the aquatic environment. As with most gas measurement systems for aquatic environments, there are two major problems to solve – delivery of a sample to the analyzer and reliable and accurate performance of the analyzer. The application in this paper is for flux chambers placed on the water's surface, and so the sample delivery is straight forward – measure the gas in the chamber. Whether these types of flux chambers are the best way to measure CO2 air-water exchange is a debate happening within the community now. For example, there is considerable debate over how to quantify the gas piston

velocity needed to interpret in situ pCO2 measurements (Read et al. 2012), there is high uncertainty in interpreting eddy covariance over aquatic systems, as well as interpretation of flux chambers (Podgrajsek et al. 2014). For now, it seems reasonable to have alternative approaches to estimating CO2 exchange.

With the scope of application limited to aquatic gas exchange chambers, how accurate and reliable are the sensors? The field testing is an important component of this research. Although the authors did not test a wide range of conditions, they did demonstrate suitability under reasonable field conditions in temperate climates. This is not trivial, given exposure to the environment can quickly ruin expensive analyzers that are not field robust. Furthermore, low cost, coupled with operational reliability, including minimal drift, low power consumption, compatibility with other components of sensor networks, freely available software make this an analyzer worth considering. Finally, over a broad range of concentrations, output from the sensor closely matches that of much more expensive and standard analyzers.

While I would have liked to have seen more testing under a greater variety of conditions to determine its reliability in the field, I think this paper is a useful account of a reasonably priced CO2 sensor that would work under typical conditions in the field.

Detailed comments:

There are many fluxes that account for CO2 mass balance, including biological, physical, and chemical. The focus of this paper is the flux due to atmospheric exchange. I would recommend being explicit about that in eq. 1.

p. 2359, paragraph beginning line 3: The flux chamber protocol should be supported by one or two references.

p. 2366, line 21: "priciple" should be "principle"

p. 2368, line 27: Change "also" to "nearly".

Figure 3: According to the caption, panel A shows "soil respiration", which would be a

flux. However, the units on the Y axis are not a rate (or flux), but rather a concentration. The caption should read something like, ". . .shows changes in CO2 concentration due to soil CO2 efflux in three repeated experiments." Similar changes should be made for panels B and C.

References:

Podgrajsek, E., Sahlée, E., Bastviken, D., Holst, J., Lindroth, A., Tranvik, L., and Rutgersson, A.: Comparison of floating chamber and eddy covariance measurements of lake greenhouse gas fluxes, Biogeosciences, 11, 4225-4233, doi:10.5194/bg-11-4225-2014, 2014.

Read, J.S., D.P. Hamilton, A.R. Desai, K.C. Rose, S. MacIntyre, J.D. Lenters, R.L. Smyth, P.C. Hanson, J.J. Cole, P.A. Staehr, J.A. Rusak, D.C. Pierson, J.D. Brookes, A. Laas, and C. Wu. 2012. Lake-size dependency of wind shear and convection as controls on gas exchange. Geophysical Research Letters, 39, doi:10.1029/2012GL051886.

Interactive comment on Biogeosciences Discuss., 12, 2357, 2015.