Biogeosciences Discuss., 10, C7962–C7966, 2014
www.biogeosciences-discuss.net/10/C7962/2014/

Biogeosciences Discussions
Open Access

Interactive comment on "Pumping methane out of aquatic sediments – forcing mechanisms that affect the temporal dynamics of ebullition" *by* A. Maeck et al.

Anonymous Referee #1

Received and published: 16 January 2014

General comments

This study investigates controls and mechanisms of CH4 ebullition from a heavily human-impacted river in Germany. The authors have made high-resolution measurements and use these to investigate the temporal variability of bubbling events and how these are linked to atmospheric and hydrostatic pressure changes. Overall, this is a good piece of science that is relevant to the scope of BG. The study does not present novel concepts, but its technical aspect and analysis of data make it an important contribution to the understanding of the complexities of ebullition.

The manuscript is well structured, the language is fluent, and the choices of refer-

Full Screen / Esc
Printer-friendly Version
Interactive Discussion
Discussion Paper

ences are appropriate. There are, however, studies published in 2013 that also use large datasets to investigate variability in CH4 ebullition from freshwaters. The scientific method and the aim of the study are outlined in the introduction and followed up throughout the paper. Calculations and mathematical formulas are properly described in the method section. The methods are to some extent outlined clearly, but they need revisions when it comes to the analysis of CH4 and to the approach when determining average CH4 concentrations in the bubbles (see specific comments).

The main concern regarding the content is the extrapolation of measured CH4 emission (in the very end of the manuscript) which should be removed entirely in a revision. The authors suggest that, based on their results, the global estimate of CH4 emissions from freshwaters could potentially be underestimated by 50%. This may very well be true, however, such a suggestion should not be made based on the results in this study. These measurements were made in a system that is heavily influenced by human activity and therefore not at all representative for freshwaters globally. The authors point this out in the same section, a statement that is contradictive and does not support the extrapolation of measured emissions.

Specific comments

Title: The title is too general. This study is looking at a river that is heavily influenced by human activity. It is not representative for any ("aquatic sediments") natural system.

Pg 18688, ln 9: Shouldn't "mechanisms" read "trigger"?

Pg 18688, Ln 15: Why only "underestimate"? Short sampling intervals are also likely to overestimate. Also, the extrapolation should be taken out of the abstract and out of the manuscript (see comment below).

Pg 18688, Ln 22: State a range in average bubble CH4 concentration. There are many papers that report different values and there are papers that report large spreads, e.g. Wik et al. 2013, JGR-Biogeosciences.

BGD
10, C7962–C7966, 2014

Pg 18689, Ln 21: The fate of rising bubbles is to some extent understood during the ice free period and in shallow regions, but certainly not in deep zones and during winter when lakes and even many rivers are ice-covered.

Pg 18690, Ln 1: There are additional papers that may be cited here that report large datasets on CH4 ebullition from freshwaters, e.g. Wik et al. 2013, JGR-Biogeosciences.

Pg 18691, Ln 24: Why were all measurements made in areas where you knew there would be high fluxes? It is as important to investigate variabilities and forcing mechanisms in zones where high fluxes are not expected, especially when aiming to extrapolate results. The river Saar is most likely not representative globally. Hence, results should not be extrapolated as if measurements were made in an undisturbed natural system (see comment below).

Pg 18693, Ln 6: Why do you base all your flux calculations on CH4 concentrations measured in bubbles that were deliberately stirred up from the sediment and not spontaneously released?

Pg 18694, Ln 3: This refers back to the previous comment. An average bubble CH4 concentration of 80% is a lot. Again, bubble CH4 concentrations often vary greatly in both time and space.

Pg 18694, Ln 21: Did you compare the concentrations in bubbles from disturbed sediment to the concentrations in spontaneously released ones? This is important when using stirred bubble concentrations in flux calculations and using an average value as high as 80%. Also, how often were the sediments disturbed for bubble CH4 concentrations?

Pg 18695, Ln 4: More information on the analysis of CH4 would be useful. GC method specifications (e.g. temperatures and flows) should be made explicit.

Pg 18697, Ln 5: The measurement period should also (or instead) be made explicit in

BGD
10, C7962–C7966, 2014

the methods.

Pg 18698, Ln 18: Are the fluxes normally distributed? If not, consider using percentile ranges as a measure of variability.

Pg 18698, Ln 26: Where was the mooring located in relation of the trap? State that in the methods.

Pg 18701, Ln 25: Production of CH4 is important. See comment below.

Pg 18702, Ln 23: This also implies that the recharge of gas in the sediment is an important control on temporal variability. Hence, sediment temperature and CH4 production rates do play large roles. Low production between large events affects both emission frequency and amplitude.

Pg 18704, Ln 13: What is the difference in flux magnitude between day and night (i.e. in this case human induced pressure changes vs. more natural)?

Pg 18704, Ln 25: The effect should vary whether it is a shallow or deep lake and with bottom topography.

Pg 18705, Ln 1: Shouldn't "control" read "trigger". The production rate in the sediment acts as the ultimate control of ebullition.

Pg 18707, Ln 7: The global extrapolation should be removed from the manuscript. The study is made in three locations only and in a system that is not representative for aquatic systems globally.

Table 1: Why is the average concentration (48.6%) in January at ABT-1 much lower than the rest?

Fig. 2.: Why not have volume on the x-axis if it is a "volume determination" error?

Technical corrections

Pg 18689, Ln 9: "methane" should read "CH4" for consistency

BGD

10, C7962–C7966, 2014

Pg 18689, Ln 12: “methane” should read “CH4”

Pg 18691, Ln 19: “methane” should read “CH4”

Pg 18695, Ln 8: Specify “five months”

Pg 18701, Ln 24: “mechanical forcing” should read “anthropogenic mechanical forcing”

Pg 18702, Ln 8: “methane” should read “CH4”

Interactive comment on Biogeosciences Discuss., 10, 18687, 2013.