Biogeosciences Discuss.,
doi:10.5194/bg-2016-105-RC1, 2016

Biogeosciences Discussions
Open Access
EGU

Interactive comment on "Ecosystem feedbacks from subarctic wetlands: vegetative and atmospheric CO_2 controls on greenhouse gas emissions" *by* Matthew J. Bridgman et al.

Anonymous Referee #1

Received and published: 11 May 2016

The authors of the manuscript attempted to model how increasing carbon dioxide concentration in the atmosphere influence on methane emission using species-specific approach. The paper definitely falls within the scope of the journal. Coupling field measurements and laboratory experiments is a strong advantage of the paper extending our understanding of processes at different scales. While I find the MS very interesting, I feel that its quality could be improved. In particular, more consistency and clarity is needed. In addition, the gas measurement description and the discussion should be improved and extended.

General comments 1. Introduction is well structured and consistent. However, we recommend explaining importance of your exact study, not only of the general subject.

Printer-friendly version

Discussion paper

For example, is this the first study describing experiments with species from these latitudes and wetland types? Have any experiments been made earlier with species if studied families and genera? Why experiments with these species and from these wetlands are of special importance? In addition, we suggest explaining background of CO2 and methane fluxes field measurements. Did you have any preliminary hypothesis how to connect field and laboratory experiments? Please, also mention it in Discussion.

2. We recommend adding schemes or photos concerning your experiments to make them clearer for readers. For example, you may add photo of chamber during measurement process. Now it is not clear if they were floating or standing on any collar. You should mention how you prevented disturbance of wetland soil during measurements (e.g. using bridges or a boat). Please, add scheme or photo of grown room experiment. Now it is not clear what the volume of samples was, how they were set into pots, what depth the water level has inside of the pots, what exposition conditions were, etc. Without detailed description, your experiment would be obvious only for small group of scientists closely related to this subject. Scientific community would benefit if your study were described more clearly.

3. Since methane cycle in wetlands is complicated, it includes different biological and physic-chemical interactions. Could you add a paragraph about your experiment limitations? For example, bubble transport in situ differs from the one in the laboratory experiments because in the last case the wind is absent. Changing in bubble transport influences other gas transport pathways. It is important because bubble transport is high in ecosystems with water level higher than the soil/peat surface. Volume of pores filled by air is of special importance too, as it was shown by many mathematical models. Probably, this volume had been changed during the experiment with further impact on other processes. If the air volume in pores was small, methane was not oxidized and rapidly emitted into the atmosphere. Is it possible to estimate bulk density changes of peat? In addition, such peat water properties as pH and ion concentrations could be changed during the experiment (see specific comments).

Printer-friendly version

Discussion paper

Specific comments

Site description

l. 105. Probably it would be more informative if mean July temperature would be reported instead of mean summer temperature.

l. 107. Can you explain what does “mesic” mean? It would be very useful for readers if more information about study site will be reported in Site Description. What are the typical values of pH and electrical conductivity for this mire? What is the trophic state of this mire, source of water supply (ombrotrophic or minerotrophic)? Does this object representative as subarctic wetland for both regional and global scale?

Experimental design and analysis. Field campaign

l. 126. It is not clear, what was the time of the whole time of flux measurement in the field? It is also important to say in this section, what was the typical level of uncertainty for individual flux measurements (both in the Lab and in the field). Please, provide this information.

l. 129-130. What was the precision of gas chromatography? It would be better to provide more details about gas chromatography (see for example (Repo et al., 2007)).

Repo, M. E., Huttunen, J. T., Naumov, A. V., Chichulin, A. V., Lapshina, E. D., Bleuten, W., & Martikainen, P. J. (2007). Release of CO2 and CH4 from small wetland lakes in western Siberia. Tellus B, 59(5), 788-796.

l. 132. What were the results of this examination? Do you use any criteria to check linearity?

Growth room experiments

l. 141. Can you say, what was the typical volume (or sizes) of peat samples, taken from mire. And please, clarify, whether these samples were taken with or without plant.

l. 143. Please, clarify, when WTL > 0, whether it means that water table is above or below mean peat/moss surface? Root-to-shoot ratio is very complexed parameter. It reflects a lot of influences and especially the influence of plant competition between each other. Can you say and proof somehow that plant density (on m2) was the same in your experimental pots and in the field? How many (typically) individual plants were grown in one pot?

l. 145. In the MS it is not reported that peat samples in the pot were submerged. I guess they were. Please provide information what was the height of water column (above peat sample) in pot and what was the typical volume of peat in the pot. I think, it would be very helpful for reader if you give photo of pot with a submerged peat sample, and also photo with a native sample, taken from the mire. Please, add it. It can be suggested that peat properties (e. g., pH and ion concentration) can strongly drift from natural values during long laboratory experiments. Of course it can influence on methane production and oxidation. Do you control them? Can you discuss it somehow in paper?

Discussion

In general discussion seems a little fragmentary and inconsistent. Probably it would be helpful to present a scheme showing all kinds of interactions and their results.

l. 246. Please provide an explanation, why methane fluxes on your site are so high. Does your mire also minerotrophic? If it is not probably it is better to compare with similar mires.

l. 252. Can you say what is “open water”? Does it have moss or peat bottom? Do open area and vegetated area have the same bottom properties. Does vegetation create a small submerged tussock? All these factors are important for methane emission.

l. 252-258. Even if sites are close to each other production is not the only thing that influence on plants. Plants are responsible not for 100% of organic matter supply for

Printer-friendly version

Discussion paper

methanogens. You are right that surface ch4 oxidation can unlikely be a reason of different emission. But deep ch4 oxidation (using oxygen transported by plants) can, and it should lead to difference in emission between vegetated and open areas. Then, as you mentioned, CH4 can be transported to plant tissues. And it also should lead to difference in emission between vegetated and open areas. Probably in this situation all these influences seems to be confounded. Thus we suggest 1) to list all possible plant effects on net methane emission; 2) to show that they have both positive and negative influence on net methane emission; 3) State that all these influences can compensate each other.

l. 262. Please, change “temperature” on “temperate”.

l. 259-274. In this paragraph you list a number of studies reported different responses. It is useful. But all these responses are given for plant species which are different from species in your experiments. Can you compare your results for the same species? For the species from the same family or with the same characteristics? In the last sentences you state that there are fundamental properties, governing response of species to increased co2 concentrations. Does your study in agreement with these findings?

Interactive comment on Biogeosciences Discuss., doi:10.5194/bg-2016-105, 2016.

Printer-friendly version

Discussion paper