

Responses to comments raised by reviewer 1.

We are grateful for the constructive comments and suggestions for improving the manuscript. We try our best to address the issues raised and to revise the manuscript. In the following we go through the comments by the reviewer point by point.

General comments

This study reports the seasonality of methane emission from two boreal peatlands with different vegetation, and concludes that the methane flux vary across vegetation type in boreal peatlands. This finding partially supports authors' previous study on natural wetland in another site in northeast China (Song et al., 2009, GCB), while for different wetland types; this study focuses on a boreal peatland in northern permafrost region. To this point, this study is critically important to fill the research gap in China on the current international hot-topic of carbon-rich permafrost in releasing carbon. Meanwhile, the reported methane flux would serve as data basis for methane emission from wetlands in permafrost region. Basically, the experimental design and data analysis are sound; the manuscript is well-written except some writing errors.

Responses: Thanks for reviewer's comments.

Comments: Study site and setup

This should be revised to "Study site" or "study site and experiment installation" In this section, the authors describe the two sites with different vegetation types; some information is missing. How far of two sites? How measurements were taken for two sites.

Responses: Thanks for reviewer's comments. According to the suggestion, we will change "Study site and setup" to "Study site and experiment installation" in the coming revised manuscript. In the present study, we measured gas fluxes from two types of vegetation communities in the peatland site. As described in the manuscript,

the surface of the study site is a mosaic of microforms which are hummock, hollow and tussock. These microforms are randomly distributed in the peatland. The dominant vegetation varied in microforms. To capture CH₄ flux from different vegetation communities, we chose 8 plots (4 replicates each dominant vegetation community) which can be representative of the dominant vegetation in the three microforms after field survey. According to the reviewer's suggestion, we will add more detail information about experiment design and plot setups. In addition, the details of gases measurement were described in the section of "2.2 Gas flux determination".

Comments: Results and discussion

The author reported that "The active layer depth continuously increased with air and soil temperatures at initial stage. In the late sampling period, the active layer depth still increased with decreasing air and 10 soil temperatures." While the discussion of effects of active layer on methane fluxes is not quite rich, little inconsistent with the title in which the active layer is emphasized. The authors might want to include more information on potential control of active layer on observed methane fluxes. Meanwhile, the current efforts focus on methane emission in growing season; while the seasonality usually includes winter season as well. So the authors should have some words on this aspect, at least should point out the potential uncertainties derived from this issue.

Responses: Thanks for reviewer's comments. According to the reviewer's suggestion, we will add the explanations that we observed decreasing methane fluxes with continuous increasing active layer depth during the late sampling period. We agreed on the reviewer's viewpoint that we miss winter observations of methane emissions and "seasonal" in the title was not appropriate. Therefore, we will change the title "Seasonal methane emission from a boreal peatland in continuous permafrost zone of Northeast China: effects of active layer and vegetation" to "Growing season methane emission from a boreal peatland in continuous permafrost zone of Northeast China:

effects of active layer and vegetation” in the coming revised manuscript.

Specific comments

I saw several occurrences of “both in shrub-sphagnum- and sedge-dominated plant communities” throughout the ms. It should be “in both shrub-sphagnum- and sedge-dominated plant communities”

Responses: Thanks for reviewer’s comments. According to the suggestion, mistakes will be corrected.

Comments: *At the end of abstract, I would like to see one sentence to summarize the implication of the findings of this study.*

Responses: Thanks for reviewer’s comments. We will add “With increasing temperature in future climate patterns, increasing active layer depth and shifting plant functional groups in this region may have a significant effect on CH₄ emission.” in the coming revised manuscript.

Comments: *Some words are not accurate and need to be corrected. “Distinct” in line 24 on page 6753; “about” in line 18 on page 6754.*

Responses: Thanks for reviewer’s comments. We will change “distinct” to “significant” and “about” to “on” in the coming revised manuscript.

Comments: *Line 2-4 on page 6754. Confusing. Did you mean “transition from anaerobic to aerobic condition”?*

Responses: Thanks for reviewer’s comments. We did not clearly describe this sentence in the previous manuscript. We mean that water table fluctuations in wetlands take an effect on CH₄ production and emission through determine soil

oxygen availability. We will change the sentence “In addition, peatland soil aerobic or anaerobic condition resulting from a drop or increase of water table can influence on CH₄ oxidation or production and then affect CH₄ fluxes (Whalen, 2005).” to “In addition, peatland soil aerobic (anaerobic) conditions resulting from a drop (increase) of water table can influence on CH₄ oxidation (production) and then affect CH₄ fluxes (Whalen, 2005).” in the coming revised manuscript.

Comments: Line 4 on page 6756, “by using the static chamber method”. Check the previous publication (such as Song et al., 2009 or Wang and Wang, 2003) for professional description of the method.

Responses: Thanks for reviewer’s comments. We will improve this part in the coming revised manuscript.

Comments: Page 6758, 2.5 Data analysis. “Statistic analysis”; the description in this section needs to be re-casted.

Responses: Thanks for reviewer’s comments. We will improve this part in the coming revise manuscript.