Biogeosciences Discuss., 12, C8293–C8295, 2015
www.biogeosciences-discuss.net/12/C8293/2015/

Biogeosciences Discussions
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Interactive Comment

Interactive comment on "Methane dynamics in warming tundra of Northeast European Russia" *by* M. E. Marushchak et al.

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Received and published: 7 December 2015

The paper aims to contribute on knowledge of CH4 emissions in a mosaic of vegetation forming subarctic Russian tundra. Flux estimates by chamber and EC are compared regionally and temporally. Isotopic signatures are used to characterize the relative differences of vascular transport in different vegetation types. QuickBird high-resolution land cover classifications are employed in order to resolve the distribution of vegetation types and the landscape methane emissions, assuming similar characteristics of CH4 emissions in similar vegetation. Furthermore, a scenario analysis is attempted as part of the Discussion. What if climatic warming, thawing of the permafrost, would affect the relative abundance of wet versus dry habitats? HIRHAM-4 RCM climate output is used to predict a scenario of landscape CH4 release at the end of 21st century when a 10% increase in coverage of wet habitats may have occurred.

The field work is well done, the setup earlier published along with CO2 and N2O results. Results of CH4 are enough for the present paper especially when the 13-C isotope ratios are measured. Comparisons between EC tower and chamber-derived flux estimated have been published earlier, but given that such data is sparse in the vast European Russian tundra, the different views to the data are welcome.

Author response: We thank the reviewer for an accurate synthesis of our work and for the kind words on the overall quality of our paper.

Methodology involved in the scenario analysis is not fully described, and leaves the reader a bit confused on how the climatic data is conveyed to the CH4 flux model (Equation 1).

Author response: Based on this and other reviewer feedback, we have reconsidered the presentation of the scenarios for future CH4 emissions, and decided to exclude the projections based on temperature response of CH4 emission. The use of temperature response function based on data from a single season in order to predict long-term ecosystem response has indeed many uncertainties. Detailed biogeochemical modeling of future CH4 of the study site is underway, and will be presented in a later publication.

The authors do not provide sensitivity analyses to support the temporal and regional extrapolations. The nonlinear regression applied has temperature and water table level in its exponential terms. After playing with the model with a range of temperatures and water table levels, it was clear that the model is highly sensitive to temperatures approaching and exceeding 10 degrees Celsius. I recommend that the authors add a statement how much the CH4 prediction they give is impacted by the sensitivity of the model.

Author response: The point is well taken. Please refer to our response above.

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Minor comments:

Page 13936/lines 17-: Plants are referred to by their genus only. The authors should consider if more accurate taxonomy or adding a table with dominant species composition in each vegetation type would be beneficial also in this paper.

Author response: Dominant plant species of the high CH_4 emitting sites (willow stands and fens) have now been added in the paragraph on site description.

13937/21: As far as the sedges are concerned "plant roots and rhizomes"

Author response: The page and line numbers indicated by the reviewer do not correspond to the issue raised. Therefore, we are not sure how we should respond to it.

13942/8-11 and Fig. 7: The annual CH_4 emissions from the different vegetation types (willow habitats show highest emissions) are slightly controversial compared to what is said in 13947/19 ("fen sites are strongest emitters"). Please clarify.

Author response: As willow stands are dominant on fen like wet environments at the site, willow habitats are also grouped under fens. This point is now made clear in the manuscript.

13944/6: Reference to Table 2 should be to Table 3?

Author response: Thanks. This is now corrected as suggested.

Interactive comment on Biogeosciences Discuss., 12, 13931, 2015.