

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

Anonymous Referee #1

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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.

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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.

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). 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.

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.

13937/21: As far as the sedges are concerned “. . .plant roots and rhizomes. . .”

13942/8-11 and Fig. 7: The annual CH₄ 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.

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

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