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Biogeosciences Discussions

Interactive comment on "The role of endophytic methane oxidizing bacteria in submerged *Sphagnum* in determining methane emissions of Northeastern Siberian tundra" *by* F. J. W. Parmentier et al.

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The paper presents very interesting results on the influence of vegetation composition on methane fluxes from the Siberian polygonal tundra. Two vegetation types were studied, one dominated by vascular plants, the second dominated by Sphagnum. The significantly lower methane fluxes at the Sphagnum sites are explained with an efficient methane oxidation associated to Sphagnum mosses. Although there is no doubt that Sphagnum associated methane oxidation may reduce tundra methane fluxes, I think alternative explanations for the observed differences should be considered as well.

First, if only Sphagnum associated methane oxidation should be the reason for the different methane fluxes, the rates of methane production should be the same in all studied sites, irrespective the vegetation type. However, differences in the composition of tundra vegetation generally reflect differences in environmental conditions such as water table position, thawing depth, soil composition and available organic matter, pH, reox potential, etc.. Data given in Fig. 3 indicate higher water table and active layer thickness at the vascular plant sites, both parameters favouring methanogenesis. Hence, differences in soil properties, as indicated by the different vegetation composition, water table position and thawing depth, may result in different in situ methane production rates that might cause differences in methane emissions. It would be very interesting to see methane concentration profiles or methane production rates from the two site classes. Without this information, it is difficult to identify the cause for the observed methane flux differences.

Secondly, the high potential methane oxidation rates in Sphagnum samples are used as evidence for the observed differences in methane fluxes. However, only potential methane oxidation rates from the Sphagnum site are presented but not from the vascular plant site. As I understand, you conclude that elevated in situ methane oxidation at the Sphagnum site is responsible for the lower fluxes in comparison with the vascular plant sites. But for latter conclusion you should have methane oxidation rates from both sites. If the methane oxidation data from the vascular plant site are not available you cannot exclude that methane oxidation rates at latter sites are even higher than at the Sphagnum sites. We once measured depth profiles of methane oxidation rates in two water saturated tundra soils with similar environmental conditions and found tenfold higher rates at the bottom of a depression in comparison to a ploygon centre. The higher rates at the depression site in our study were most likely due to the higher methane production.

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