

Soils in seasonally flooded forests as methane sources: A case study of West Siberian South taiga

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Field measurements of methane and carbon dioxide flux were carried out using portable static chambers in south (ST) and middle taiga subzones (MT) of Western Siberia (WS) in summer seasons of 2015-2017 years. Two sites were investigated: Bakchar bog in Tomsk region (in typical ecosystems for this area: oligotrophic bog/forest border and waterlogged forest) and Shapsha in Khanty-Mansiysk region (in waterlogged forest). Highest values of methane fluxes ($\text{mgC}\cdot\text{m}^{-2}\cdot\text{h}^{-1}$) were obtained in burnt wet birch forest (median 6.96; first quartile 3.12; third quartile 8.95). Lowest values of methane fluxes (among sites mentioned above) were obtained in seasonally waterlogged forests (median -0.08; first and third quartiles are -0.14 and -0.03 $\text{mgC}\cdot\text{m}^{-2}\cdot\text{h}^{-1}$ in 2015; the fluxes of methane from soil were from -0.08 ± 0.07 to 9.3 ± 0.8 $\text{mgC}\cdot\text{m}^{-2}\cdot\text{h}^{-1}$ depending on various water table levels (WTL) in different seasonally flooded forests in 2017). The study shows that seasonally flooded forests may become a methane source when the WTL increases up to 15-45 cm below the surface. But what part of periodically flooded forests area may become a methane source even under optimal conditions? Apparently, this question can not be solved by one-time measurements of the methane fluxes. Indeed the forest may be not under optimal (for emission) hydrothermal conditions at the time of a site visit and instead of the emission, it may appear to be the methane sink. To understand long term site conditions we measure profile of the methane concentration in soil. It is obvious that at the same surface methane flux the concentration profile is to have a qualitative difference when: (i) there are only methanotrophs in the soil and (ii) when there are methanogens, under the methanotrophs layer, that may provide sufficient methane emission in the optimal conditions. These data will help to estimate regional methane flux from waterlogged and periodically flooded forests and to improve its prediction.

Keywords: waterlogged forest, methane emissions, Siberia, observations