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Methane Oxidation of Arctic Wetland Soil of a Taiga-Tundra Ecotone in Northeastern Siberia

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Arctic wetlands are significant sources of atmospheric methane and the observed accelerated warming of the arctic causes increased methane formation in water-saturated tundra soil with deepened permafrost thawing. Methane oxidation is the key process to regulate methane emission from wetlands. In this study we measured the activity of methane oxidation rate of the wetland soils of a Taiga-Tundra transition zone in Northeastern Siberia by an incubation experiment and flux measurement combined with the inhibitor of methane oxidation. Surface peat soil samples (0-10 cm) collected from the wetland covered with tussocks of sedges and Sphagnum spp. demonstrated a high methane oxidation rate (70 and 190 nmol h^{-1} g^{-1} dw at 15 oC) when incubated in the bottle with methane at the initial concentration of 0.5-0.8 %v/v showing no time lag. Active methane oxidation was observed over the depths including the water-saturated layers. On the other hand, difluoromethane, the inhibitor of methane oxidation, did not alter the methane flux from the sedge and moss vegetation, indicating the undetectable levels of methane oxidation associated with the peat plants. The difference in methane oxidation activity between in the incubation experiment and the flux measurement may suggest 1) methananotrophs in the peat soils keep the potential activity in situ even under the unfavourable conditions including anoxia, or 2) there might be other sources of oxygen than diffusion from the atmosphere and plants that sustain the activity of methanotrophs in the waterlogged peat soil.

Keywords: methane oxidation, incubation experiment, flux measurement, CH2F2, tundra