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Comparison of temperature and water table sensitivity of methane emission in temperate and arctic wetlands.

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Soil temperature, soil water table and below-ground organic matter production are generally considered as the main driving factors for methane production in wetland soils. We performed statistical analysis on a large database of closed-chamber CH_4 flux measurements in the Netherlands for dependence of fluxes on temperature and water table. Similar analysis was performed on CH_4 flux measurements from an arctic permafrost wetland in northeastern Siberia.

The analysis showed marked differences in the relation of CH_4 flux to water table and temperature. In temperate wetlands, temperature was the main driving variable, influence of the water table was comparatively minor. Significant positive fluxes even may occur at water tables below -30 cm. In the arctic wetland, water table was the mean driving factor. CH_4 fluxes rapidly diminish at minor water table decrease. The difference is confirmed by methane flux modelling using the Walter-Heimann (2000) model, and model optimization on site data. Correct modelling of the temperate wetland fluxes requires a much higher Q_{10} value for CH_4 production than the arctic wetland site.

We attribute these results to differences in microbial populations and differences in peat properties and soil structure.

Our results indicate, that methane fluxes from arctic and temperate wetland soils may react differently to climate change. The role of hydrological changes affecting water table will be comparatively large for arctic wetlands.