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Reduced methane recycling efficiency at higher temperatures in peat bogs

Julia van Winden (1), Gert-Jan Reichart (1,2), Niall P. McNamara (3), Albert Benthien (2), and Jaap S. Sinninghe Damsté (4)

(1) Utrecht University, Earth Sciences, Organic Geochemistry, Netherlands (j.vanwinden@geo.uu.nl), (2) Alfred-Wegener-Institut für Polar- und Meeresforschung, Bremerhaven, Germany, (3) Centre for Ecology and Hydrology, Lancaster Environment Centre, Library Avenue, Bailrigg, Lancaster, United Kingdom, (4) Department of Marine Organic Biogeochemistry, The Royal Netherlands Institute for Sea Research (NIOZ), 't Horntje, The Netherlands

Peat bogs are the largest terrestrial carbon sink and an important source for atmospheric methane. Methane emissions are, however, reduced by symbiotic methane oxidizing bacteria (methanotrophs) living in peat bogs dominated by peat moss (Sphagnum). Future climate change projections indicate that mid to high latitudes, especially Western Siberia with the largest peat bog occurrence globally may become increasingly wetter and warmer. According to kinetic theory, increasing higher temperatures will enhance biological methane production and oxidation rates. To unravel the temperature effect on methane and methane cycling, intact peat cores containing actively growing Sphagnum were incubated at 5, 10, 15, 20 and 25 ºC. Net methane fluxes showed a strong temperature-dependence, with higher methane fluxes at higher temperatures. This suggests that methanotrophs are not able to compensate for the increasing methane production by methanogens. After removal of Sphagnum, methane fluxes were even higher, indicating that methanotrophs play an important role in regulating the net methane flux from peat. The efficiency of the Sphagnum-methanotroph consortium as a filter for methane escape decreases with increasing temperature. Our mesocosm study indicates that, whereas 98% of the produced methane is retained at 5 ºC, methane retention drops to approximately 50% at 25 ºC. This implies that warming at the mid to high latitudes will be enhanced by a powerful feedback through increased methane release from peat bogs.