Goldschmidt 2023 Abstract
https://doi.org/10.7185/gold2023.18171

Effect of water table depth on greenhouse gas production and consumption in fenland peat

THOMAS IDRIS MARQUAND[1], KATY FAULKNER[2] AND ALEXANDRA (SASHA) V. TURCHYN[2]

[1]Department of Earth Sciences, University of Cambridge
[2]University of Cambridge
Presenting Author: tim24@cam.ac.uk

The East Anglian Fens host some of the UK's richest agricultural peatlands. Since drainage of the land began in the 17th century, most of the peat has been exposed to oxygen facilitating microbial oxidation of the soil organic matter which now represents a source of carbon dioxide to the atmosphere. One way suggested to reduce the carbon dioxide production rate is to raise the water table. Oxygen is rapidly depleted in the waterlogged soil preventing respiration of the underlying organic matter by aerobic microbes. The anoxic soil, however, can host methanogenic archaea such that raising the water table causes increased production of methane. Given an overlying oxic soil layer, most of the methane produced at depth is oxidised to carbon dioxide by methane oxidising microorganisms. In order to make land management decisions which minimise emissions of carbon dioxide and methane, it is important that we understand the effect of water table depth on the rates of production and consumption of methane and the rate of carbon dioxide respiration. Here we present a range of in situ discrete measurements and incubation experiments in which the water table level was artificially varied to explore how waterlogged peatland soils produce methane. We use the carbon isotopic composition ($\delta^{13}C$) of the methane to determine how the pathway of methane production may change under induced flooding. Using a reactive transport model, rates of greenhouse gas production and consumption can be reconstructed from the concentration and isotopic composition data. These results will allow land managers to make better informed decisions about the drainage of their land.