EGU22-5257
https://doi.org/10.5194/egusphere-egu22-5257
EGU General Assembly 2022

The long-term biogeochemical fate of C in Subarctic thawing peat plateaus

Sigrid Trier Kjær[1,2,3], Nora Nedkvitne[2], Sebastian Westermann[3], and Peter Dörsch[2]
[1]ETH Zürich, Department of Environmental Systems Science, Zürich, Switzerland (sigridtrierkjaer@hotmail.com)
[2]Faculty of Environmental Sciences and Natural Resource Management, Norwegian University of Life Sciences, Ås, Norway
[3]Department of Geosciences, University of Oslo, Oslo, Norway

Global warming causes permafrost to thaw at an unprecedented rate. In Northern Scandinavia, permafrost peat plateaus have been found to decline rapidly during the last decades, releasing old organic carbon to decomposition and runoff. Thawing peat plateaus can partly turn into thermokarst ponds, with consequences for the biogeochemical fate of the released carbon. We investigated carbon degradation of thawing permafrost peat by incubating permafrost peat and thermokarst sediments from three peat plateaus in Northern Norway. The samples were incubated field moist at 10°C for almost one year. Initial decomposition was dominated by CO_2 production which strongly responded to oxygen availability, while methane (CH_4) production was small. Methane production increased drastically after more than ten months, indicating that thawed permafrost peat has a considerable potential to produce CH_4 after a time lag. The cumulative CH_4 production of thawed permafrost peat after one year of incubation exceeded that of overlaying active layer peat by up to 641 times, illustrating the potential of thawing subarctic permafrost to act as an additional CH_4 source. Comparing laboratory thawed permafrost peat to thermokarst peat revealed remarkable differences in CH_4 production, with much higher CH_4 production potentials in thermokarst sediments during the first months of incubation and in some samples exceeding CH_4 production measured in permafrost peat after one year. This suggests that the potential to produce CH_4 increases dramatically with thermokarst formation. Interestingly, thawed permafrost peat produced more DOC over the period of one year than gaseous C (CO_2 and CH_4), which suggests that hydrological conditions are key to the understanding of the fate of C released from thawing peat plateaus.