EGU22-9445
https://doi.org/10.5194/egusphere-egu22-9445
EGU General Assembly 2022

Investigating hydrology and carbon cycling connections in peatland permafrost, northern Norway.

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Permafrost in northern Norway is characterized by peat plateaus and palsas and is among the fastest degrading permafrost areas in the world. Changes in these ecosystems with sporadic permafrost can be viewed as possible future states for currently stable permafrost regions. The thawing of permafrost at large scale has the potential to release stored carbon into atmospheric cycling and becomes a source of greenhouse gases. Lateral export of dissolved organic matter (DOM) from thawing permafrost could be an important pathway for loss of formerly stable organic matter (OM), and is controlled by temperature, soil moisture and local hydrology. We aim to study thermokarst ponds and the lateral flux of water, heat, organic carbon and greenhouse gases from a rapidly thawing permafrost peat plateau using high-frequency sensors, floating chambers, measurements of dissolved gases and water chemistry, and assessment of DOM. We analyzed water chemistry and extracted gas samples on 5 sampling campaigns of the Iškoras peat plateau located in the Finnmarksvidda in northern Norway between Sept 2020 and Oct 2021. We investigated production and consumption rates of gases at 3 campaigns by dark incubations between 36-50 hours. We present early data of the peat plateau and the hydrologically connected adjacent wetland.

We explore three hypotheses to better understand the role of hydrology and biogeochemistry in lateral transport of organic matter from the active peat plateau area to the larger catchment. First, there is seasonal changes in the lability of DOM in thermokarst ponds. Second, there is seasonal connection and transport of OM from the peat plateau to the wetland stream that connects to the catchment. Finally, we focus on identifying the areas in the landscape that are hotspots for greenhouse gas production and transport.

The thermokarst ponds were very acidic and high in dissolved gases and TOC compared with the wetland stream system. High emissions from the thermokarst ponds are a key source of CO_2 and CH_4. Aquatic processing of DOM and turbulence in streams both affect level of GHG emissions. There are also differences in parameters such as CO_2 evasion and DIC concentration when there is connection of the wetland stream to the peat plateau. The early data indicate high rates of DOM

processing and GHG production in the thermokarst ponds and high variability in DOM export from the peat plateau.