EGU22-5235
https://doi.org/10.5194/egusphere-egu22-5235
EGU General Assembly 2022

Spatiotemporal variability of CO_2, CH_4 and N_2O fluxes over a soil hydrological gradient reveal soil water-temperature interactions on biogeochemical pathways

Jesper Christiansen and Klaus Steenberg Larsen
Department of Geoscience and Natural Resource Management, University of Copenhagen, Copenhagen, Denmark

Exchange of greenhouse gases (GHG) between soils and the atmosphere are highly dynamic in space and time challenging prediction of how the fluxes from soils respond to environmental change. The soil hydrological and thermal regime are major drivers of the rates of biogeochemical processes producing or consuming GHG's in the soil, but how these factors interact to regulate net GHG fluxes is unclear.

Part of the reason is the lack of high frequency *in situ* GHG flux measurements in environments with gradients of the hydrological and thermal regimes. Disentangling the interactive effects of soil hydrology and temperature on GHG fluxes based on *in situ* observations is key for building more accurate biogeochemical models.

Here we present the results from a unique GHG flux observation campaign using the SkyLine2D automated chamber measurement system. Contrary to other automated chamber systems, the SkyLine2D uses one chamber moved along two ropes and lowered on to predefined collars on the ground which is ideal for studying environmental gradients. With the SkyLine2D we can study the complexity of the interactions of GHG fluxes and edaphic and dynamic factors.

We deployed the SkyLine2D with a total of 30 individual flux collars covering a soil hydrological gradient in a reestablished beech forest swap in Denmark, from well-drained upland to waterlogged and occasionally flooded soils. Along the transect automated measurements of groundwater depth (GWD), soil moisture (SM) and temperature (ST) were measured continuously together with climatic parameters (rain, humidity, wind and air temperature). Bulk density, pH and carbon/nitrogen pools were measured as well along the transect. Plants were excluded by clipping above ground parts in the collars to measure net soil GHG fluxes.

The campaign covered a 2-year period (2019 – 2021) with simultaneous measurements of net CO_2, CH_4 and N_2O fluxes. With these data we will explore spatiotemporal patterns in GHG fluxes and relation of these to soil hydrology and temperature. We seek to present multi-factorial GWD/SM/ST - GHG flux response functions nested within a soil type gradient (carbon/nitrogen pools, pH).