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How do CO_2 fluxes relate to groundwater table on a yearly and seasonal scale in Dutch drained peatlands used for dairy farming?

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Rewetting of drained peatlands is a proposed measure to reduce greenhouse gas (GHG) emissions. Worldwide, drained peatlands are responsible for 9–15 % of the total GHG emission and reducing these emissions therefore has a large potential to combat climate warming. In the Netherlands, almost all peatlands are drained and 85% are in agricultural use. The Dutch government has set the aim to reduce the yearly emission from peatlands with 1 Mton by 2030. Different measures are proposed to achieve this goal. There is, however, insufficient data to determine the magnitude of GHG emissions from Dutch peatlands and to validate the effects of mitigation measures. Therefore, in 2019, the National Research Program on Greenhouse Gas Emissions from Peatlands (NOBV) was initiated. In this program we use transparent automated flux chambers, eddy covariance and aircraft measurements, combined with a network of groundwater, soil and meteorological sensors, to perform long-term unattended measurements of soil-atmosphere GHG fluxes and relevant environmental variables on different dairy farms in the Netherlands. We aim to quantify emission magnitudes and monitor the effects of elevated summer water tables (using subsoil irrigation as mitigation measure) as well as develop models that predict GHG emissions and the effects of rewetting measures on a national scale.

In this presentation we will show the CO_2 flux results of the first two monitoring years of five drained peatlands. We will present the effects of elevating groundwater levels during the summer period with subsoil irrigation and discuss the differences between sites and years. In the wet year (2021) the mitigation effect was much less than in the dry year (2020), in some cases even negative, and mitigation effects strongly varied among locations. Aggregating data from all 5 sites shows that soil temperature and water table depth are important predictors for ecosystem respiration. However, overall, CO_2 fluxes did not show a clear relationship with water table depth

after controlling for temperature. Only a water table depth < -20 cm showed clear potential for emission reduction.

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