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Cutting peatland CO2 emissions with rewetting measures

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Peat decomposition in managed peatlands is responsible for a decrease of 0.52 GtC yr^{-1} in global carbon stock and is strongly linked to drainage, which increases the oxygen availability in the soil. Microbial aerobic decomposition is responsible for the bulk of the net CO_2 emission from the soil. This decomposition could be reduced by rewetting efforts or minimizing drainage, but the effects of rewetting on microbial respiration rate are largely unknown. Our research aims to assess the effects of rewetting measures on soil wetness, soil temperatures and CO_2 emissions by field data collection and simulations of peatland parcels under dairy farming. Here we present the results for two dairy farming peatlands where subsoil irrigation and drainage (SSI), which aims to increase summer groundwater tables. At both dairy farms parcels with rewetting measures were tested against a control situation for the year 2020. Furthermore, we introduce a process-based methodology to estimate potential aerobic microbial respiration rate as measure for peat decomposition in managed peatlands, based on potential respiration rate curves for soil temperature and water filled pore space (WFPS). This methodology enables us to quantify effects of rewetting under different weather conditions, water management strategies (raising ditch water levels and SSI) and hydrological settings (i.e. seepage). We present the effects of the water management strategies on CO_2 emissions, groundwater table height and soil moisture and discuss to what extent we can rely on commonly used groundwater table-based proxies to estimate peat decomposition. Towards improved understanding of biophysical soil processes and peatland management!