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Modelling CO_2 emissions from drained and rewetted peat meadows with PEATLAND

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Peatlands that are drained for agricultural purposes emit large amounts of CO_2, which contribute worldwide to 9-15 % of the total greenhouse gas emission. With the aim to mitigate emissions, (partly) rewetting of drained peatlands is often proposed as a useful contribution. Monitoring the effectiveness of rewetting by measuring CO_2 fluxes is time intensive. Thereby, to extract peat oxidation from the bulk CO_2 flux, long term measurements are needed so that fluctuation in respiration from the short term carbon cycle (driven by biomass production) is not of influence.

To overcome long term intensive measurements, a model could help out to evaluate CO_2 emissions and the effect of water table increase on peat oxidation. PEATLAND is a 1D process based model, consisting of four submodels for 1) soil physics (water table, soil temperature and soil moisture), 2) biomass production, 3) CH_4 production, oxidation and transport, and 4) CO_2 production. CO_2 production is the sum of decomposition from different soil organic matter (SOM) pools, like litter, root exudates, microbial biomass and peat.

We calibrated the PEATLAND model for three intensively used drained peat meadows in the Netherlands, that are equipped with sensors for measuring continuously CO_2 fluxes and all environmental variables related to that. These sites have a reference field and a field with elevated groundwater level. In this presentation, we discuss the model performance on these sites. We will show how this model can be used to evaluate rewetting measures on CO_2 emissions from peatlands, and what the limitations are.