

The manuscript by Bethe et. al., investigates the effect of soil temperature, soil moisture and exposed carbon on CO₂ emission from drained peatlands in proximity to ditches where topsoil removal has been implemented. They create 20 transects from ditch edges and into drained peatland fields and measure soil temperature, soil moisture and CO₂, 5 to 8 times during the period. To estimate the exposed carbon, they measure carbon content from transect cores above daily groundwater levels. Furthermore they calculate the time it will take to reach climate neutrality using modelled soil respiration and carbon density removed as topsoil. They find that implementing TSR in ditch proximity of drained peatlands reduce annual soil CO₂ emissions by 17%. Furthermore they estimate the payback time for peat removed as topsoil may exceed 100 years.

I think the manuscript is well written and follows a logic trajectory throughout. The manuscript is relevant to the peatland scientific community, as it thoroughly investigates CO₂ emissions in drained peatland and the specific method of including exposed carbon is, to my knowledge, still poorly investigated.

My only major concern regarding the manuscript is regarding the calculation of exposed carbon, as it is stated in the manuscript that only one core is sampled inside each transect which is used to estimate carbon content of complete soil profile inside the transect. While this method is valid, it is stated in the manuscript that the soil profiles, based on the cores collected, varied greatly and that the transects are in close proximity to one another. If possible, I would like an uncertainty added to carbon content estimated inside the transect and the matter mentioned in the discussion.

Besides this, I don't have any major concerns.

Abstract

L27 – 30: TSR is proposed to reduce CH₄ emission in rewetted peatlands more so than CO₂.

L30: How is it politically challenging? I suggest either explaining it or removing it.

L37 -38: As the exposed carbon is not a common known variable, I would like some more explanation to it.

Introduction

L58: Last decades – 20? 50? 80? Be more specific

L 81-83: appears somewhat redundant with line 65-68 as the role of oxygen in stimulating CO₂ emissions has already been explained. Consider combining these two statements.

L 103-105: Something appears to be missing from the sentence please check it.

L112: there is a discrepancy in the explanation of rewetting inside the parenthesis with the one in the abstract.

L126: Regenerative ditch border is first mentioned here. Please check abbreviation through the manuscript

Methods

307-336: The exposed carbon calculation relies on the assumption that the carbon densities measured at 360cm is representative of all other distances in each transect. As the exposed carbon variable is a major predictor for CO₂ emissions, I find this assumption “brash” as it is known that peat and soil layers can vary much spatially. Please acknowledge this limitation and discuss its implication.

Can the uncertainty be quantified?

404: missing word – years?

Results

509-512: How is the soil moisture only measured to 83% if groundwater levels are at or exceed surface level? Please check it.

519-524: please add trend lines and r^2 values to the relationships.

Discussion

705-707: This is important as it implies the importance of peat depth for CO₂ emissions

729-740: Here I miss a discussion on the exposed carbon assumption. As stated in L735-736: “the DB sites in this study were in close proximity to each other” and 513-516: “ There was also considerable variation in the relative distribution and thickness of the different soil layer types in particular DB 13 was rich in clay, which could suggest a previous riverine history, and DB 7 had quite a large, disturbed gravel layer in the top 1 m.”. This may indicate that the transect soil layer may vary to some extent. “