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Biogeosciences
Discussions

Interactive comment on "CO_2 and CH_4 budgets and global warming potential modifications in *Sphagnum*-dominated peat mesocosms invaded by *Molinia caerulea*" *by* Fabien Leroy et al.

Anonymous Referee #1

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Overall the manuscript describes a nicely conducted mesocosm experiment that enables comparison of pure moss vs. vascular plant dominated peat cores. My main concern is that the modeling procedure needs some more explanations, especially concerning the extrapolation to artificial environmental conditions, or whether that modeling excercise is even necessary for this paper.

Detailed comments: The introduction is well composed. my only comment is that molinia and its role in peatlands could be better introduced. Methods: pg3: did you control the water table level somehow and what was the range during the period? was there some seasonality? pg 3: modelling, did you parameterize your models separately

for each mesocosm or did you pool them to the two vegetation types? I would like to see some model statistics as supplementary material. Such as parameter values and SEs and p-values. pg 4 line 10: is the RVI in GPP model different from Mcleaves in ER model? pg4 line 20: molinia leaves did not impact ch4 or was not tested? it might be good to list all the parameters that you tried to include in the models. Pg 5: not sure what are your calibrated models and maybe you could explain how you retained your 15min timestep environmental data that you use to run your models to achieve the annual fluxes. The use or word modelize is not familiar to me. I would rather say: to calculate annual emissions, we run our xxx models with 15 minutes timestep using continuous weather and vegetation data... Pg5: this needs a more thorough explanation: The GGCB was also modeled for a variation in annual temperature from 9.8 to 13.8°C and in WTL from 2.5 to -9 cm, to stimulate increases or decreases in average temperature or WTL by about 2°C and 3 cm, respectively. A simulation of the NEE for Sphagnum+ Molinia plots was also carried out for an elongation or shrinkage of the growing season up to 60 days. Onset 5and offset occurred during the period of maximum number of Molinia caerulea leaves and were combined with a modification in the annual temperature between –and + 2°C, for a mean air temperature between 9.8 and 13.8°C

PG5: I suggest to move the section "model validation" to follow the modelling sections, so as new 2.3.4. it would make more sense there, as you use and mention the calibrated models in the current 2.3.4

Results: 3.1. lines 4-5: I don't quite understand this: "The annual air mean temperature was 11.8°C and was lower than the average air temperature during the measurements (13.1 °C, Table 1)." from where do these two different estimates come from? -could you give some range for the WTL values?

3.3. why is calibration of GPP models explained in here, and why you decided to use different method as for ER and CH4? More so, I am sorry but I am not able to follow the model validation procedure explained here. Did you somehow compare these light

response curves with your other GPP models and how did you do that? Were the linear relationships shown in figure 3 used for something?

Section 3.4: What do you mean by calibration and validation? how do they differ from each other? is calibration a comparison between modelled and measured values and validation a comparison between modelled and extra data (validation data)? table2: what were the standard errors and p-values of the parameters a to f? pg 13 line 3: "hypothetical strong increase of 2 months in the length of the growing season": based on current state of methods I am not sure how this was done at all and therefore I am not able to validate your results. how did you create the conditions e.g. leaf area during this longer growing season?

Discussion pg 14 lines 8-9: maybe also differences in leaf area? pg 14 line 10 "that are not taken into account in the simulation": what simulation? lines 17-18: I would like to see a bit longer discussion about CH4. are the rates high or low? does molinia functions similarly to sedges? does it have aerenchyma? 4.2. is this evaluation now same as calibration or validation, or a combination of those two? I am not sure if it is necessary in the discussion lines 22-24: do you think that in your mesocosms the sphagnum cover and moisture remained rather stable and that this could be the reason for rather stable flux rate? if so, you could say it here. pg 15 lines 1-2: change into present tense: dominates... requires.. pg 16 line 1-8: I find this discussion here rather hard to follow. could you try to rephrase this? You concentrate on impacts of vascular plants on methane production, but what about the impact of sphagnum mosses on methane oxidation, or vascular plants on methane transport? line 6: what do you mean by Graminoids soils? do you consider La Guette at its current form, and minerotrophic peatlands in general, not a graminoid soil? pg 15 line 12: GPP that led to... pg 15 line 16-20: I don't catch the idea in here, consider rephrasing this pg 15 line 21: you say that litter inputs are not considered in your gas measurements, but how about root and leaf litter from previous years? you have not removed those, so it is there decomposing in the mesocosms, similarly as the litter produced during the study

year will decompose during following years. pg 15 line 21-24: could you put the GWP in context with peatlands in general? have you estimate from La Guette, is it similar? pg15 lines 25-30: I am not sure why you have this modelling exercise in you paper at all. It is not well described in methods and the discussion and conclusions are quite short and surficial. Based on this discussion the moth vegetation types reacted similarly to changing conditions? what are the other factors mentioned in line 30? would it be more interesting to test how the differences in the cover of these two vegetation types would impact carbon sequestration and how that would change under changing environmental conditions?

Supplementary material table s1: what is the point to retrieve linear correlation co-effients to clearly non-linear correlations with very different formats? There is no way you can compare any of these against each other.

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