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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 #2

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This manuscript describes a one year mesocosm experiment with two types of vegetation communities, sphganum mosses and sphagnum + molinia grasses. CO2 and CH4 fluxes have been measured extensively over the one year period and this MS discusses the vegetation community caused differences in the annual GPP, ER and CH4 fluxes. The topic is important but I have two main concern: 1) the authors don't report if the molinia impacts the sphagnum mosses in any way during the experiment. If the impact of molinia is simply additive it may not describe the "field impact" of dense vascular cover on sphagnum dominated ecosystem and its functions. 2) only 1/3 of the data used here is "new" and this is not clearly told.

Detailed comments: l23: to have pg1 l27: maybe C storage would be better term than C sink pg2 l1: this sentence doesn't read well. consider changing into something like: Accumulating Sphagnum litter forms a major component of peat (Turetsky, 2003) and creates acidic... pg2 l9: reference needed for stimulation pg2 l10, change order of sentences: the increase in greenhouse gas emissions, mainly carbon dioxide (CO2) and methane (CH4) could shift the peatland from a sink to a source of carbon

pg3 l1: how was Molinia removed? with roots and stems? pg3 l3: how was the wtl controlled? pg 3 l3: what was the density of the sphagnum mosses in the treatments? did molinia impact sphagnum in any way? Considering the impact on invasion, it is a very different situation if molinia is just added on top of the sphagnum or if the invading molinia affects the sphagnum by decreasing its cover. the studies you refer in introduction imply that vascular plants replace sphganum mosses: A dense vascular plant cover should make the moss layer less dense and therein impact its functions. I am not sure how your treatment is in line with this as I expect that the pure-sphagnum mesocosms have grown under molinia during previous growing seasons. or did you choose such plots that had very little molinia originally? I think this is a really major issue and you should properly explain how this operates in your experiment. so does the moss layer in the two treatments differ in any means? pg3, l10: are you using here the same data that has been published already by Leroy et al 2017, with only GPP added? This feels strange to me. only 1:3 of the data is new. At least you should be clearly stating this. pg3 l15: Did you measure PAR during your NEE measurements and did the irradiation stay stable during the measurement? using the PAr measured every 15 min might be fine during clear days, but often it varies quite a lot. pg3 l20: Explain here that you are improving the data analysis from your previous paper so that you can evaluate the annual flux 2.3.2: Now this is very much unclear that you have actually not used the data collected as explained earlier to calibrate this model, but you use different data that is explained only later. I think you should move the GPP model calibration explanations here and explain the measurement methods much better pg4 l9: did you measure PPFD? pg4, l18: what is the measured T? soil? air inside cham-

ber? and how was it measured? pg4 l21: maybe you should refer here to your previous paper? pg4, l27: randomly selected pg5 l1: see previous comment on GPP model

pg5 l16: why did you decide to leave DOC out from this MS though you have measured it? 2.4: maybe open this a bit more. Effect of Molinia to what? pg6 l4: why does PAR differ between the treatments? did you have a sensor in each mesocosm and at which height? from methods I understood that you have a weather station measuring par, temp, wt variables, but these results make it look like they have been measured from each mesocosm pg6 l2: why are ghg fluxes mentioned here? replace more important with "higher" pg7 l2: you already showed this with your previous paper pg7 l3: delete table 1 pg7 l4: the fig 1b gives impression that sphagnum has not yet stabilized to conditions without molinia during the first summer, while during the start of next summer GPP is clearly higher. maybe the cover and density of sphagnum has increased as they have grown for a year without any shading molinia? Similarly, the difference in the rate of ER is much more pronounced during the second year, implying that molinia roots in pure-sphagnum plots have decomposed. pg7 l13: increased (not decreased) Figure 4 b) Do you think it reasonable to present daily GWP? how did you even obtain the values as in methods you say you calculated them based on annual, not daily flux estimates? pg11 l1: GGCB

pg11 l1: is it possible that there remained some root of clipped molinia in sphagnum columns that were decaying during the first half of the year? pg11 l8-10: maybe you want to give some reason, with references why molinia increased GPP. more photosynthesizing plant material, potentially higher photosynthetic capacity? molinia did not decrease sphagnum cover compared to pure sphagnum (true or not?). pg11 l14: lower GPP or actually lower photosynthetic capacity and lower leaf area? pg11 l22: Molinia is not a sedge pg11: 4.2. I am not convinced how interesting is the discussion about the parameter sensitivities, especially for empirical parameters that do not have a clear ecologically meaning full explanation (such as Pmax or half saturation constant), My advice is to shorten this section and leave only meaningful explanations pg11 l28: how

did you validate this? Pg 11 l30: throughout the MS you use terms irradiation, PPFD and PAR, please choose one of these and use only it pg12 l2-3: delete "as CO2 emissions", it is bit confusing there pg12 l4-5: this is one example of unvague text that I would delete: Parameter d connected to the WTL had an opposite sign in the two vegetation covers. This difference was difficult to interpret as the large variation of parameter e shifted the relationship between parameter 5 d and the WTL.

pg 12 l9-10: rephrase: Vascular plants, as Molinia caerulea, can influence the methane production through the introduction of root exudates into the deep peat layer by increasing substrate availability.

Also, add a reference for this pg12 l13-14: based on the above explanations I don't quite buy this. why would it switch to hydrogenotrophic as acetates are provided for acetoclastics? pg12 l20-21: you could add the references also to here pg 12 l26-27: but you do have last year's roots there? pg13 l31-pg14 l4: I don't think you need to repeat this information here but maybe you can give some implications that your study likely has.

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