

## ***Interactive comment on “Partitioning of soil CO<sub>2</sub> efflux in un-manipulated and experimentally flooded plots of a temperate fen” by S. Wunderlich and W. Borken***

**Anonymous Referee #2**

Received and published: 27 June 2012

This paper presents data on an interesting topic of how peatland C dynamics respond to flooding events, particularly looking at the wsoil CO<sub>2</sub> efflux. It does so in a balanced experimental design and applies appropriate statistics to analyse the data.

I overall agree with the first reviewer that there are no major flaws in either of these two aspects and also agree with the major issues raised which are: 1) it is a complex site which is in transition after previous drainage and as such the responses might not easily translate to 'natural sites'; 2) the water applications seem excessively large (100mm/day) which seems out of proportion and it would either need to be corrected if it is a mistake or justified/explained why such high input was considered. Particularly

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as the latter might change nutrient and C inputs and also create a flush of the system rather than flooding? Moreover, I felt the <sup>14</sup>C data are a sort of mixed bag and the root C inputs could be considered a bit more - how deep are roots penetrating and thus the C signal could be affected. Still, the data seem robust although no translation into 'age' has been done but this might reflect the limitations of doing so with such young carbon?

Abstract: There could be some +/- indication given for the rhizosphere contributions %ages L15. Trenching (with permanent collars) could be added L16.

Introduction: The range in peat accumulation can be much wider - look for a new reference L6. decline [exponentially?] L10. labile C pool - protected by water table? explain a bit more maybe L 15. Explain if the lowering of water table by 1 cm was over a depth range of just 1 cm L21. not all peatlands seem to respond to L25.

5290 L11 add something on plant mediated transport. L 24 UK site - if so add this info?

M&M 2.3. collar issues are important for capturing R<sub>r</sub> or R<sub>a</sub> – see Heinemeyer et al., 2010 – particularly in such environments where the root mat is near the surface. Also permanent collars affect lateral water flow, causing all sorts of issues (maybe repeated cutting would have been better) and the permanent membrane might have still changed O<sub>2</sub> exchange and changed soil moisture and temperature – any comments? The CO<sub>2</sub> monitoring over 10 min might have increased CO<sub>2</sub> headsapce by too much to measure accurate fluxes (see heinemeyer & McNamara 2011?), it seems that the 'true' flux for cover boxing should be captured over the first 5 min or less...crucially, even a high r<sub>2</sub> does not help to detect this.

2.4 water level was adjusted to a few centimetres ... L18 5294

2.5 why did you not use exetainers (evacuated) but argon dilutions?

2.6 could you consider a co-variate analysis of your flux data stats (water table/moisture) as the C1 is so close to the D1 treatment and seems to have been

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affected by the flooding?!

5298 L1-2 the 1 week dry period is tricky to interpret as the CO<sub>2</sub> efflux will respond largely to easily decomposable and quickly available C.

Results 3.1 why the temp difference, was the flood water cooler?! L10-15 could be shortened. L23 maybe better use recovery instead of increase in the water table?

3.2 add not significantly different - first sentence. L17 I don't think that the flooding was less effective – the difference is basically the same just the stats do not show this (please check P values as the SD was not overlapping ...). L21 was slightly greater in 2010 ...

3.3 rhizosphere respiration rates over time – you might want to discuss PAR/light issues in relation to GPP and subsequent C allocation to the rhizosphere?! There is literature there...

5301 last sentence is discussion – take out here.

3.4 5302 L17-20 again this is discussion.

Discussion Why 1 degree difference? Could there be a CO<sub>2</sub> outgassing from the flood water?! 5304 L13-15 take out pers comm. Sentence. L21 till end of page – I don't quite follow this, sorry. Maybe rephrase?

4.2 do you have any +- for the % values? 5305 L25 but see collar insertion issues and Ra/Rr...

Conclusion Provided reasonable ... in this peatland. Shpaghnum in ital please.

Table 1 add Precip column for the flooded site? Check p-values... Maybe covariance for CO<sub>2</sub> data?

Fig5 any +- indication?

Fig. 6 and 7 maybe indicate the flood period for all panels by some shading or dotted ?

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Interactive comment on Biogeosciences Discuss., 9, 5287, 2012.

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