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Biogeosciences Discussions

Interactive comment on "Carbon balance of a restored and cutover raised bog: Comparison to global trends" *by* Michael M. Swenson et al.

Anonymous Referee #2

Received and published: 8 October 2018

General comments: The manuscript reports the results from a two year study at two peatlands in Ireland: an abandoned (but not rewetted) and a rewetted peatland. In both sites, a full carbon balance (CO2, CH4, DOC and DIC) was measured and calculated. The authors indicate that the abandoned site was a strong annual carbon source and that the rewetted site was a small carbon sink. The authors also compare their results with literature values (a very nice literature review is included in the Supplementary material). The manuscript is well written (although it would benefit from a spell-check and does feel a little long), tightly focused (except Discussion) and the results are clear. However, the Discussion section is disjointed and requires some surgery, and I also have some concerns in regard to the models used but this may just need clarification by the authors rather than any major reconstruction.

Specific comments:

L2 Add C after carbon and use thereafter in abstract

L2 Add methane before (CH4)

L2 Not necessary to add "losses"

L4 Harvested suggests a renewable fuel source. Peat removal for fuel is anything but sustainable. Please replace harvesting here (and throughout the manuscript) with either "extraction" or "mining".

L5 Please define what you mean by "historically abandoned"

L6/7 What do you mean by "high quality"?

L7 Calluna vulgaris

L14 Why upper cases for Temperate and Boreal?

L15 ". . .in this study and was. . ."

L18 Add C after carbon and use thereafter in the manuscript

L26 95% is very high – 80 to 85% is generally cited

L31 Throughout the manuscript, you use intact, natural, near-natural and pristine interchangeably - please select one and keep to it.

L54 Consider Fritz et al. (2011) New Phytologist. 190, 398-408.

L75 Please use primary source as reference; Myhre et al (2013) Climate Change 2013: The Physical Science Basis Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change

L77 I would not be inclined to use specific data here; why Helfter et al. and not McVeigh et al. for instance?

L78 The CH4 values derived by Wilson et al (2016) include rewetted sites, so are not suitable here, however there are lots of CH4 studies you could cite instead, e.g. Laine et al. (2007) Plant and Soil. 299, 181-193; Green and Baird (2017) Mires and Peat. 19, Article 09.

L82 Change methane to CH4

L89 Bain et al (2011) is not in reference list

L90 Change methane to CH4

L101 Consider Barry et al. (2016) Aquatic Sciences. 78, 541-560

L109 “recovering” is a new term to me. Do you mean rehabilitated?

L129 What do you mean by “natural peatland area”? The site is obviously not natural and the surrounding landscape is mainly grassland and some forestry. Delete.

L130 See earlier comment regarding harvesting.

L132 Met station location? 1980-2010?

L134 1980s

L140 1970s and 1960s

Fig. 1 The quality of Fig. 1 is poor, although this might be due to the pdf. The legend on the elevation map is hard to determine.

Table 1. Check font sizes and spelling of Sphagnum and Eriophorum

L188 Where was the sensor located?

L196 Stainless steel collars – as written it appears as if you only had one

L197 Where was the water trough located?

L198 What does “constructed in house. . .” mean?

L207 and area, volume of collar/chamber?

L208 A constant temperature or a temperature similar to ambient temperature? The former could be 50C for example and fit your criteria but would be meaningless for gas flux calculations and subsequent modelling.

L213 State flux sign convention used in this study.

L214 describe criteria used for quality checking.

L212 How many samples?

L259-260 CH4 fluxes have a strong diurnal variability in some plant types.

L337 Unusual long-term dates; 1980-2010 more usual.

Fig. 2b Degree symbol missing on y axis.

Fig 5b The use of a 1:1 line would provide better information as to the performance of the model

Figs. 4,6, 9 and 10 Check spelling of plant names.

Section 3.4 Only use “significant” when related to statistical comparisons.

L407 GWP

L407 tonnes (and thereafter)

Fig. 10 Given that MAWT is used as a predictor variable in the models, these observations are not independent (especially as the collars were lumped together for modelling) and I am far from convinced as to their value in this manuscript.

L436 Consider Nugent et al (2018) Global Change Biology, https://doi.org/10.1111/gcb.14449

L477 1960s

L484/485 join the sentences

L490 five decades

Section 4.2 I am not sure of the value of this section. The manuscript is already quite long and this seems superfluous (especially given the extensive data set in the Supplementary). If it really must be kept, then it should be moved to the Results section and then discussed here.

L515 Natural or semi-natural = intact?

L539 What does “Restoration of high quality peatland ecology” mean?

L576 Not so: In Saarnio (2007) Boreal Environment Research. 12, 101-113, 15% of growing season flux is emitted in the non-growing season. This approach was also used by IPCC Wetlands Supplement (2014)

L577 What is “inter flux”?

L608/609 “The impact of these things..” is very vague.

L628 and also due the pulse effect.

L630 Why not quote Frolking directly?

Conclusion This reads as a summary not as a conclusion; what does your study mean for land managers, policy makers etc?

L668 “best models” = the ones you used?

Supplementary: Check spellings throughout

Tables S1 and S2 Please provide the standard error (SE) associated with each parameter estimate. Given the large number of parameters in the models, I would suspect that the SE will be very high and would invalidate your approach.

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