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Biogeosciences Discussions

Interactive comment on "Annual carbon balance of a peatland 10 yr following restoration" *by* M. Strack and Y. C. A. Zuback

Anonymous Referee #1

Received and published: 29 January 2013

General comments

Follow-up studies of restored peatlands are needed in order to control if the rewetting efforts have been sound. There are results showing persistently lowered CH4 emissions after rewetting, immense CH4 emissions either immediately after rewetting, or later, following high carbon sequestration during the first few decades. This paper presents a careful and comparison of annual C balance in terms of CO2 and CH4 exchange by chamber between a natural open peatland, a "restored" (or just rewetted?) and an "unrestored", abandoned peat extraction plot. The measurements included water borne C export in DOC, which is seen as an increasingly important component of C balance. The paper addresses relevant scientific questions with clarity and presents timely and novel data. Relevant published work is credited. The title is well suited with

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the contents.

Chambers were located in various microsites found in the sites with aim to get the within-site variability covered in the uncertainty of the overall mean estimate. Although the chamber methods may have their constraints in pursuing a credible extrapolation of C balance for the whole site, they still persist well in describing the roles of vegetation patterns or microtopography in the developing mosaic of C balances.

Ideally, both eddy covariance and chamber studies could be employed. When that has been possible, the results from both approaches have proved well comparable. I thus a bit disagree with Referee #2 in that the chambers would not represent the state of the art technology. Here the methodology has been used in a manner well comparable to other literature. The strength of the chamber approach is that they give useful information on the relationships between e.g. GEP vs. vascular plant cover and NEE vs. water table depth (Fig 3). Is it possible to utilize more of the strengths and show more data on the microsite level and analyze the key components of the vegetation/microsite pattern with respect to the restoration phase, i.e. the role of high diversity?

Uncertainty management is not simple. Since the gross photosynthesis and ecosystem respiration seasonal estimates are derived using the transfer function approach commonly applied in chamber studies, the within-site variance estimate should in a strict sense combine the model error and inter-plot variances. Now the variability is characterized by standard deviation derived from plot-wise seasonal integrals only.

The main finding of this study is that under a dry spell, the C balance in the rewetted site is no worse in net C release that what was measured in the undrained natural site. At the same time the abandoned site released more C than either the natural or the restored one. The results are well presented, but could reveal even more of the microsite variability.

Caution should be added to the ultimate interpretation of the results. The authors

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deduce from those results that the restoration methods taken here would result in near natural C balance functions within ten years. I agree with Referee #2 in that such conclusion may be premature. Given that the water table stays lower than in the natural site, and that the low net release may be due to differences in the palatability of the decomposing peat between the natural conditions with plenty of fresh organic matter in the acrotelm layer exposed by the drought, the rewetted system may still be well in the middle in restoring the C balance functionality. Modification of the final statement in the Conclusions might be needed. Otherwise the reasoning is sound.

Specific comments

Page 17219, line23. Language: . . . remain lower than *in* undisturbed peatlands . . . ?

Page 17219, line 24. Language: . . . compared *to*the natural site.

Table 2. Show also n for each average and S.D. estimate.

Interactive comment on Biogeosciences Discuss., 9, 17203, 2012.