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Biogeosciences Discussions

Interactive comment on "Climate-related changes in peatland carbon accumulation during the last millennium" *by* D. J. Charman et al.

Anonymous Referee #1

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I found the paper very interesting, well-written and for the most part well justified. The main shortcomings arise from: the reconciliation between what is estimated by the analyses here and what has been reported in many "contemporary" studies on the effect of warming on the GHG emission in high latitudes ecosystems (most of them showed increase in C loss with warming and permafrost degradation, etc.); also the r2 reported here are generally fairly low so the authors should be careful in over interpreting their results.

Specific comments:

Line 28 Page 14331: is there a more recent estimate than Gorham, 1991? This reference is quite old, I would think there should be some more update studies reporting on C accumulation rates Line 3-5 Page 14332: what would drive the occurrence of the

ocean outgassing of the increase C uptake from peatlands? Is it temperature? It would be helpful if this is clarified here. Page 14332-14333: The numbering of the criteria used for the selections of the studies in the Methods section are at bit confusing, The paragraph is numbered as 2.1 then selection criteria are numbered as 1 and 2, then again 1 and 2 for a set of different criteria, I would suggest a clearer subdivision: 1.1 and 1.2 for the first two selections and then 2.1 and 2.2 for the last two? Or if the last two criteria are derived from a subsampled of the first two this should be clear from the numbering. Page 14334 Lines11-12 Why this difference in the dating methods? Specify Page 14335 Lines 22-23 It would be interesting mentioning and comparing decomposition rates in anaerobic vs aerobic peat Figure 4 I shard to read, please use larger font size Page 14335 Line 4: PAR is defined here no need to define it again in page 14338 Lines 3-4 Page 14338: This is not completely true, several studies indicated that warming increase C loss from high latitudes ecosystems (including some arctic and boreal forest studies). Please discuss and include references here. Page 14338 Define C (formula 3). It is carbon accumulation? What is the difference between C and M (formula 2)? Why using different terms for the same thing? If there is a difference between them explain also in the methods not inly in the results, otherwise be consistent in the use of symbols Page 14338 Sometime R2 and sometimes r2 is used, be consistent Page 14339 Lines 3-10 These are certainly important and interesting interpretation. But the authors should not forget that their model C/PAR0 only explained a minor % of the variability in C accumulation (about 30%), this means that almost 70% of the controls on C accumulation are unexplained. I realize the difficulties of modeling C accumulation, but it would be worth mentioning the limitation of the results and be cautious in drawing conclusions Page 14339 Line 10: which threshold? Specify Page 14339 Lines 20-22 This contradicts what stated in the previous paragraph: if the importance of the moisture cannot be quantified with more certainty, how can it be clear that it was not important? Be more careful in drawing conclusions. Also, there should be some explanation on how this is the case: similar decomposition under aerobic/anaerobic environment, etc... Line 5-6 Page 14340: Isn't PAR0 also

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linked to the growing season length? Also in Line 4 Page 14341, you said that growing season length is important? Be consistent and discuss this more clearly Lines 1-4 Page 14340, “subsidiary importance” might be a bit too much for an explanatory power lower than 1%...use more appropriate term Line 10 Page 1430: This is confusing: if there is a decrease in C accumulation in the LIA, how do you explain the decrease in [CO2]? Also you stated that there was a decrease in heterotrophic respiration, therefore also autotrophic respiration likely decreased, so the accumulation rates shouldn’t increase? This is a critical point and should be better explained, and these two observations should be reconciled. Line 3-4 Page 14345: How much are peatland and how much other ecosystems responsible for this change? What is the percent land cover of peatland? Lines 21-22Page 14345: does this mean that warming will increase C accumulation in peatlands? What are the results drown by contemporary studies? Worth mentioning that most of them actually conclude the opposite, and discuss the possible reasons behind this discrepancy.

Use larger fonts for the some of the figures, they are hard to read

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Interactive comment on Biogeosciences Discuss., 9, 14327, 2012.