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Biogeosciences Discussions

Interactive comment on "Wetland succession in a permafrost collapse: interactions between fire and thermokarst" *by* I. H. Myers-Smith et al.

Anonymous Referee #1

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The paper is well written, logically structured and overall a pleasure to read. The interactions of fire and permafrost, and impact of climate change on permafrost and carbon dynamics are important topics and insufficiently understood. This paper combines multiproxy evidence of change following fire and permafrost collapse, with short-term monitoring. The use of diatoms provides a fresh point of view in this kind of study. The material is original and relevant to the topic. The conclusions are realistically speculative since much more research is needed in this subject to draw more definite conclusions.

I recommend the paper for publication with minor changes. Some points might benefit of revisiting. All these are detailed below.

Abstract, p. 4508

lines 14, 16. The term bog is used in non-traditional way later on; in what sense is it used here? Expansion of ombrotrophic mire community or expansion of wetland/ wet surface?

line 16. How does it follow from the observations that carbon storage will increase in the collapse (scars)?

Introduction

p. 4509, line 21. Interior Alaska

p. 4510, line 3. projected, or perhaps change wording: “projected” is repeated several times

line 27. testate amoebae

Methods

Study area

p. 4511, line 28. Is the adjacent Picea forest a peat plateau?

p. 4512, line 1. These are not bog species. The site is poor fen. The selected site description terms are somewhat confusing; may be old collapse, recent collapse and the burn, instead?

line 3. What does the Sphagnum growth mean? 2.5 cm above the moat level? It is not the Sphagnum layer, because that is ca. 25 cm.

line 10. grasses or Poaceae (not Grass spp.)

line 14. ca. 0.5 m (the example site is thicker than 0.5)

line 16. How much peat there is in the P. mariana forest? – Could be used to estimate how much was lost in the fire.

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Soil coring, p. 4513 and physico-chemical analyses

Bulk density was also measured?

Core dating

Are the dates for the bog from the same core as C/N analysis?

line 18. radiocarbon

line. 20. Why bulk dates, when AMS dating and well preserved peat were available?

Diatoms, p. 2514

line 5. macrofossils, instead of macrofossil analysis (because indicators)

line 7. Are these the same cores mentioned earlier? If so, please say in the coring chapter that the cores were subsampled for various analyses.

Statistical analysis, p. 4515

line 24. The link does not work

Results

Age estimates, p. 4516

line 5. How are these different age models combined? Do 210Pb and 137Cs agree? Do you assume the bulk 14C ages too old? If so, why? Do you consider Pb210 ages reliable? - There are problems using them for peat dating.

How are the rest of the C14 dates used?

line 16. yr BP is in common use (not ybp)

Core stratigraphy

Bog core zone 2

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p. 4517, line 26. Eunotia (not E.)

p. 4518, lines 4 and 16. These accumulation values are uniquely high.

line 7. 0.02-0.06 g

line 10. macrofossil analysis is not mentioned in the methods. Are these gross-stratigraphic descriptions?

Conclusions, p. 4519. better Discussion and conclusions

line 1. plant macrofossils?

line 2. dry peat forest better than “terrestrial”

line 8. Is “terrestrial portion” peat plateau?

line 12. The results do not sound like the peat soil under stunted P. mariana wood. You do not know what tree species it is in the sylvic peat layer? If you are not sure this layer corresponds to dry permafrost plateau, your interpretation of collapse becomes ambivalent too.

line 15. omit terrestrial. Where do you get the figure “over 200 yrs” from?

line 20. This is described as less nutrient rich as the previous zone, not more

line 22. Should be “zone 3”

p. 4520, line 5. plant macrofossils (not peat)

line 4. Could the Sphagnum growth be result of peat increment?

line 6. The modern plant assemblage does not support the ombrotrophic bog interpretation

line 8. spp.

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line 11. You are not sure the substrates are younger. Could you not have dated this core too? Is the moat same thing as post 2001 collapse? But it was a collapse scar even earlier?

line 12. What do you mean by terrestrialisation of a peatland? Lakes terrestrialise to become peatlands.

line 14. Have you considered the possibility of missing layers here?

line 19. What is terrestrial influence in a bog?

line 23. The 12 cm level is dated to 1995 in Fig. 3.

line 28. Why at 46 cm a local fire; what is the difference to the two other charcoal layers?

line 29. spruce stand

p. 4521, line 2. I see little change in the diatom diagrams following the charcoal peaks; the most significant changes occurred at other times. E. nymanniana slightly increases in the bog core after 2. and 3. peak, but the initial increase predates the 1. charcoal peak, and in the moat core there it does not react.

Mechanisms of collapse, p. 4521

line 16. 1900 – it is said earlier that the collapse occurred at least 200 yrs ago

line 21. Why fire leads to lateral expansion? Due to decreased evapotranspiration? How do you know the collapse scar was not expanding already prior to the fire?

Future trajectories

p. 4522, line 1. You do not discuss possible initial lose of peat in the collapse stage.

line 8. Very high accumulation rates are reported from incipient permafrost conditions in northern Europe: 40-100 gC/m2/yr (Malmer & Wallen 1996, Oksanen et al. 2001, 2003, Oksanen 2005, 2006). Compared to common rates from mature peat plateaus

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(2-8 gC/m2/yr) these are extremely high. Your figures are even higher. Are you quite sure the 210Pb-137Cs model is not too young? There seems to be a gap in accumulation or missing layers if the 14C date from the sylvic peat layer is correct.

References

p. 4524, line 8. Anisimov is not referred to in the text

p. 4527, line 21. Smithwick. Check, 2005 or 2006?

Table 1. Sphagnum fruiting bodies (not peat)

What of these dates come from same cores?

Fig. 2

How do bog and moat relate to Fig. 2A? There are more colours in the figure than in the legend.

2B. Thaw depth 2001 and 2004 are indicated by lines, not colours.

Fig. 3

Stratigraphy (omit t). Is the 1418 age calibrated C14 date – the calibration method is not mentioned in the methods.

Fig. 4

Stratigraphy (omit t).

Figs. 5 and 6

N. tripunota var. H. amphioxys var. major (not maior)

Fig. 7

extra space before oC

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