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

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Received and published: 11 January 2008

The authors present an extensive description of the historical development of a permafrost collapse feature. The research is sound and the use of different techniques in dating and environmental description (vegetation, diatoms, chemical description) make this a model approach for its field. The topic (the development and vegetation succession after permafrost collapse) increases our understanding of the processes involved after permafrost thawing, one of the major changes expected for the arctic. In addition, the research has been conducted in cooperation with leading scientists in the field. However, the paper could be written a bit more focussed. Now I found myself repeatedly going back to methods (for some results) and found other results in the discussion, when I wondered about them in the results themselves (see technical

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comments for suggestions).

My main problem with the paper is the firmness in which conclusions are drawn in relation to the mechanism responsible for the observed, and well documented, changes. To my mind the presented data does not allow the authors to draw such firm conclusions about the interactions between fire and thermocast. Although the authors accentuate the role of fire as a trigger to thermokarst collapse in their discussion, their data at most indicates an accelerating role, although I must admit it is not my core area of expertise. My reasons are the following: 1) Remains of charcoal can be found at different points throughout the soil profile, especially the Sphagnum core (Fig. 3). The authors attribute these remains mainly to fall-out of surrounding fire events and one local event. The charcoal remains thus explained away are much more pronounced than the one found at the boundary between sylvic and sedge remains. It is strange to me why one stand replacing fire, leaving so little charcoal evidence would be the trigger for permafrost collapse, whereas other charcoal peaks (extending over several cm of depth) would be nothing more than regional fires and do not result in major changes in the profile. 2) The fast lateral expansion of the collapse feature after the 2001 fire are given as additional evidence of the role of fire. But there is no documentation of the lateral expansion before the fire. 3) And there are no charcoal remains of the 2001 fire in figure 3 (unless it is the peak dated at 1995?). If fire is an important driver, and the amount of charcoal remains indicate the severeness of the fire, then why would there be increased lateral expansion as a result of fire in 2001 and no response after the earlier fire events indicated as left-overs of regional fall-out. Could a big regional fire not have more consequences for rewetting etc. than a localised fire? 4) Most of the trees sampled surrounding the collapse feature showed compression wood in their growing rings, indicating continued slow permafrost degradation since initiation, nor one sudden response after fire. Was there any evidence of fire scars?

Specific comments

1) P4515, line 22: which ANOVA, what model? I cannot find anything back in the paper.

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Can you be a bit more specific about what you tested and how; on which data did you use regression (or correlation analyses?), what ANOVA model type and which data tested? 2) You present data of many diatom species/ genera. Maybe it is an idea to group/lump the diatom species into three categories according to their indication value (as you have done with the shading) and present those in a figure with the information of the three cores in one figure. 3) P4516, paragraph 3.1 age estimates under results. I would suggest moving remarks concerning models used for dating to the methods, and focus on the agreement/ disagreement between several methods. Now it is unclear which methods you finally used and why. 4) P4517, line 17. Species were similar to terrestrial soil core. I could only find two species that were restricted to the silvicultural region and the terrestrial soil core. But maybe I misinterpreted the figure. Maybe you can elaborate/ substantiate this a bit more, instead of stating they are similar? 5) P4520 lines 23-24: Maybe you can explain this a bit more. I did not understand why, if the moat peat is younger, you would find a charcoal peak at 12 cm in the bog core and at 20 cm in the moat core. Or is this because the C accumulation rate was higher in the moat core? 6) Table 1: you hardly refer to the majority of this data. I suggest removing them or using them. Same amounts for table 2. Why mention supported Pb values, when you end up using unsupported values. I would suggest using the unsupported values and indicate that the Ra correction did not change much as Ra concentration/activity was mostly below the detection limit? 7) Fig. 7: do you have data until 2003? If so, please add this, makes your conclusions drawn about the expansion of the collapse as a result of the 2001 fire more credible. 8) I miss in your discussion a bit the ways in which fire may interact with thermokarst, and what likely happened in your study (pros & cons). You have indicated four other authors in your introduction that have reported similar findings. I feel your discussion would improve with a short comparison of results before you make conclusions about mechanisms. 9) I miss in your discussion in what ways your study has added to the existing knowledge. I feel it is always good to stress this.

Technical comments

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1) I would reduce the number of references cited in your introduction if possible. 2) Page 4509- line5. Maybe you could explain this a bit more. Permafrost thaw can also result in water body drainage as the thawing soil loses its water impermeability. 3) P 4509 line 26 to P4510 line 3: I would suggest deleting 4) P4510 lines 19-26 move upwards after line 10 5) Page 4510 lines 26-30: I would suggest deleting 6) You mention several personal communications: the information you refer to is not written somewhere? 7) I would suggest focussing your methods a bit more around captions as study area, Experimental set up/Sampling procedure and Measurements. 8) Why did you not include some extra information on the lateral expansion in the results. Now a reader has to check the methods to find these results. 9) Results: Please put sections 3.3-3.5 under one section and stress the environmental indication of the diatom species found. I assume there are not many people around who directly know those species. 10) In your discussion/conclusions you enter new data on for example the nature of the charcoal layers found (P4520, lines >22). I suggest you move these to the results, where you first mention the charcoal remains. 11) Future trajectories: this section can be shortened; remove overlap with introduction. Leave out P4523:lines 20-25 12) Figures 3 and 5: Which age estimates did you use? Which age model?

Interactive comment on Biogeosciences Discuss., 4, 4507, 2007.

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