Biogeosciences Discuss., 8, C622–C624, 2011
www.biogeosciences-discuss.net/8/C622/2011/

Biogeosciences Discussions

Interactive comment on "Stable carbon isotopes as indicators for micro-geomorphic changes in palsa peats" *by* C. Alewell et al.

C. Alewell et al.

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Received and published: 18 April 2011

We agree with referee 1 that the many different possibilities to explain the stable isotope data of the hummocks might be confusing to the reader. We did our best to delineate the most plausible explanations but we realize that we must still be clearer. We already phrased for 5.2.1. Preferential leachate of relatively young organic substances (see page 536, line 10-12) and for 5.2.4. Influence of methane and permafrost melting (page 538, line 13-15) how likely these scenarios are. We assume that we confused Referee 1 with the paragraphs 5.2.2 Change in vegetation and 5.2.3. Change in hydrology. Both, a change in vegetation as well as a change in hydrology can explain our stable isotope depth patterns in the hummocks. Since we can rule out vegetation changes due to climatic changes (see page 536, 25 to 537, 3), we would only expect a change in

vegetation parallel to a hydrological change. Thus, the turning points of the δ13C depth profiles in the hummocks are induced by an hydrological change due to permafrost uplifting, but are most likely amplified by a simultaneous change in vegetation due to the hydrological change. We will phrase this better in a revised version of the manuscript.

Response to specific comments of referee 1:

comment 2: We will include a short paragraph in the abstract about the typical carbon isotope depth patterns in soils (we assume that is meant by "scenarios"):

Stable carbon isotope depth profiles can be used to delineate preferential metabolism in soils. We expect an increase of δ13C with depth in soils dominated by aerobic degradation, due to preferential release of 12C during aerobic mineralization. In soils with suppressed degradation due to anoxic conditions, stable isotope depth profiles either are more or less uniform indicating no or very low degradation or depth profiles turn to lighter isotopic values due to an enrichment of recalcitrant organic substances during anaerobic mineralisation which are depleted in 13C.

comment 4: sorry, misunderstanding. "scrutinize" was the wrong word. "use" would be the better one.

comment 6: Referee 1 states correctly that we suddenly "discussed the depth profiles backwards". The correct sentence should be: Thus, the turning point may represent a situation where anaerobic decomposition with selective preservation of lignin or phenolic compounds is replaced by more aerobic decomposition with the corresponding shift in δ13C (change from type 2 to type 3 depth pattern).

comment 7: This would probably be the case if carbon dioxide is used as terminal electron acceptor : ($CO_2 + 4\ H_2 \rightarrow CH_4 + 2H_2O$). However, if we have acetic acid as electron acceptor (or other organic compounds; e.g. $CH_3COOH \rightarrow CH_4 + CO_2$) then we might indeed have an enrichment in the remaining organic substances.

comment 8: Conclusions will be revised according to the response to the general com-

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ment stating that the turning points in the hummocks are most likely induced by a change in hydrology but might be amplified by a parallel change in vegetation (see above).

Interactive comment on Biogeosciences Discuss., 8, 527, 2011.

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