Biogeosciences Discuss., 11, C120–C123, 2014
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Biogeosciences Discussions
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Interactive comment on "Degradation changes stable carbon isotope depth profiles in palsa peatlands" *by* J. P. Krüger et al.

Anonymous Referee #2

Received and published: 25 February 2014

general comments:

According to introduction MS by Kruger et al. "Degradation changes stable carbon isotope depth profiles in palsa peatlands" deals with arctic climate change, on geographical area being threatened by climate change bringing changes to basics factors of palsa existence and also making changes to storage pattern of 270 Pg of carbon sequestered in northern permafrost zone. δ13C values of peat are used to evaluate degradation in hummocs and hollows of palsa peatlands in Abisko in discontinuous permafrost area, in Northern Sweden. The difference there being preferential release of 12C during aerobic mineralization leading to enrichment of 13C values and anaerobic mineralization keeping 13C intact or decreasing it. And thus accelerated permafrost thawing (degradation of peatland surfaces) can be identified by δ13C values of peat

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depth profiles.

Introduction gives impression that we are dealing with current climate change, but what I rather see is normal palsa processes, since changes in bulk C isotopes collected in 40 mm resolution can not follow current processes. So, this is showing the situation just now, which might be changing in future due to warming climate also in regard of peat stable isotopic composition. Change is already seen from annual increasing depth of active layer depth measured by steel rod (price ∼100 €, but not with IRMS (price 200 k€.

This MS is interesting visualization of palsa and its surrounding lawn. However, results and discussion show that current climate change is not seen from stable isotopes of peat, since the change, indicated as turning point, was happening 100 or 800 years before present. And it is unclear was it then due to natural ageing of palsas or some other phenomen.

This MS is a sister article to "Stable carbon isotopes as indicators for environmental change in palsa peats by Alewell et al. 2011, (Biogeosciences, 8, 1769-1778). In this MS sampling was done in Sept. 2012 from same area, but from three location. Also there theoretical depth profiles of δ C values and turning point was discussed, so I can't find much new in this MS in its current form.

Specific comments

I think that palsa peatlands are connected here too tightly to permafrost areas: (Row 7 p.1385). Luoto and Seppälä (2003) is dealing with Finnish Lapland, which is - to my knowledge - not permafrost region, permafrost is found only inside palsas in there. Furthermore: "Palsas are mounds with a permafrost core covered by peat located at the outer margin of the permafrost zone in Fronzek, 2014: (Climate change and the future distribution of palsa mires: ensemble modelling, probabilities and uncertainties (Monographs of the Boreal Environmental Research No. 44). Repo et al. 2009 may be replaced (or added) by Marushchak (2011), since there peats that are uplifted by frost

BGD
11, C120–C123, 2014

(palsas and peat plateaus) are measured and described instead of peatlands only in permafrost area and besides northern Russia also from northern-Finland in quite similar climate as that in Abisko: Marushchak M.E., Pitkämäki A., Koponen H., Biasi C., Seppälä M. and Martikainen PJ. (2011) Hot spots for nitrous oxide emissions found in different types of permafrost peatlands. Global Change Biology 17: 2601-2614.

Methods seem to be OK for isotope analyzes, but since C/N ratio is expressed, it will be nice to know how C% and N % were measured and standardized to get C/N ratio. Results: I am not sure about this, but if precision is expressed to be better than $\pm 0.5‰$ is it then better to express results rounded to only one digit?

Turning point timing ranges from 120 yr to 800 yr. in same area, according to authors indicating that degradation started then since peat got then to dryer conditions when it was lifted from anaerobic conditions to aerobic ones. This might rise question of Suess effect, since peat is this old.

The C/N ratios is often used in soil literature and peat and sediment profile studies, but would it be better to have (also) values for both C% and N% separately mentioned (at least for some points) to get impression of real amounts especially in articles dealing with biogeochemical processes? Knowing N% and C% gives more information about what might be happening in future with these C and N stores.

p. 1393, r. 25. This gets rather speculative: when no change in stable isotope values is detected even there is visible changes in peat, then this shows that there is not yet any changes in stable isotopic composition of peat?

Table 1. Age of turning point seems to be calculated straight from depth divided by accumulation rate, except in Stordalen, where deeper point is younger with same accumulation rate, or then rows have been mixed here. In table 3, same method to calculate age is used, even they are then degraded hummocs, which may not be accumulating carbon any more? Could these data be combined to one table?

BGD
11, C120–C123, 2014

Fig. 2. Transect schematics figure is vital, before it I did not understand the site selection. However, naming rim of palsa as degraded hollow is misleading to me. Would pair for this be rather a hollow near not degraded palsa? This part is in any case (degraded or not) the point, where snow accumulates keeping rim warmer, also nutrients and water from palsa drain there. And it is differed from hollow further from palsas, where palsa is not giving its shelter and nutrients.

Fig 3.4, 5 and 6. Figure sets of all measured data (36 times d13C and C/N ratio from profiles) is heavy. I don't know is there any other solution to this. Alewell et al. 2011 combined three measurement to one figure, would it help? In figures δ13C is only in two cases of 36 heavier than -24 ‰ but still all figure scales are same and starting from -20‰.However scale is changing in C/N ratios, so why not here? Furthermore figures could be combined and made bigger to panels by not repeating titles.

technical corrections p. 1388, row 5. cycle -> circle

Interactive comment on Biogeosciences Discuss., 11, 1383, 2014.