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Allocation of atmospheric CO_2 into labile sub-surface carbon pools: a stable isotope labelling approach in a tundra wetland

Norman Rüggen, Christian Knoblauch, and Eva-Maria Pfeiffer
Institute of Soil Science, CEN, University of Hamburg, Germany (norman.rueggen@uni-hamburg.de)

Greenhouse gas emissions from permafrost-affected wetlands are intensively studied due to their important role in the global carbon cycle. There are concerns of increasing methane and carbon dioxide fluxes from tundra wetlands due to permafrost degradation and hydrology changes in a warming Arctic. Understanding the sub-surface carbon pool interactions will improve the prediction on how trace gas fluxes from these ecosystems will respond to changing environmental conditions.

Partitioning the sources of greenhouse gas fluxes will help to evaluate the quantitative role of recently produced plant photosynthates. Furthermore, partitioning allows separating respiration of long-term stored organic matter and freshly produced plant products. This knowledge is crucial for understanding the response of greenhouse gas fluxes in such wetlands to environmental changes.

An in situ $^{13}CO_2$ pulse-labelling experiment has been conducted in the northeast Siberian tundra (Samoylov island, Lena river delta) in August 2013 to quantify interactions among sub-surface carbon pools (DIC, DOC, CH_4) in three depths (6, 16 and 36 cm) of the active layer. The experimental site was a low-centred polygon centre in a polygonal tundra landscape, with a sedge-moss (*Carex-Scorpidium*) plant association. The water table was at the soils' surface and the permafrost table in a depth of 50 cm.

After the system has been $^{13}CO_2$ pulse labelled, all three studied subsurface carbon pools (CH_4, DIC and DOC) were clearly ^{13}C-enriched, which accounts for atmospheric C incorporated into these pools. One day after the labelling, in 6 cm depth 1.5 percent of DIC and 0.1 percent of CH_4were replaced by label C, which then steadily declined over a ten days period. The label C content of DOC increased gradually over the same period. In 16 cm depth, the label C increased gradually after labelling in both DIC and CH_4. Label C was found in DIC and CH_4 even in a depth of 36 cm, although in less pronounced concentrations. Carex material, exposed to the label, also substantially incorporated the label. Deduced from the results, we will present carbon exchange fluxes among sub-surface DIC, DOC and CH_4 in a sedge-moss covered polygon-centre.