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Pulse labelling for carbon turnover measurements with a CRDS for wetlands – challenges and solutions

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Carbon turnover in peatlands has commonly been studied by estimating carbon allocation and decomposition rates by litterbags, assessing changes in carbon stocks and by measuring the biosphere-atmosphere exchange of carbon gases with various chamber methods or by eddy covariance. In addition, C turnover rates have been measured with pulse labelling methods using ^{13}C and ^{14}C (e.g. Bahn et al. 2009). Pulse labeling (PL) studies in wetlands are, however, sparse (e.g. Gao et al. 2015), presumably as descriptive high water table levels and relatively low productivity render successful tracing difficult. Quite low cost fast-gas-analyzers (Cavity Ring Down Spectrometry, CRDS) make PL experiments more cost-worthy, but their applicability at wetland field and further for measuring elevated ^{13}C – levels is challenging. We carried out a PL as a pre-experiment for a larger labelling campaign of the Wetman-project at Rzecin wetland in Poland. We aimed at defining 1) The optimum labeling for the peatland site, 2) The importance of dissolved $^{13}CO_2$ both for the loss of the pulse label and for the potential bias to respiratory flux, 3) The reliability of the $^{13}CO_2$ and $^{13}CH_4$ measurements when using dynamic closed chambers with a factory calibrated CRDS.

We labelled the study area by a transparent chamber combined to Picarro CRDS G2201-i (C input during labelling 4.9 μg ^{13}C). After labelling, we monitored the respiratory $^{13}CO_2$ flux and the $^{13}CO_2$ content in the peat water over a 10d- period. In addition, we measured the vegetation^{13}C before labelling and 10 days after. Plants assimilated 2.1 μg C of the added ^{13}C. Half of the recovered $^{13}CO_2$ (3.6 μg C) originated from respiration. Nearly one third of added $^{13}CO_2$ immediately dissolved in the water, which at the end of the experiment retained 0.5 μg ^{13}C. Finally, 127 % of the added label was recovered. The high recovery was mainly caused by overestimation in the δ^{13}C. The results of our pre-experiment indicate that 1) Measuring dissolved gases is required for correcting the biases to the respiratory flux 2) the Picarro CRDS has to be thoroughly calibrated for linearity and for δ^{13}C at different signatures. As a result, we developed calibration methods suitable for field conditions and for higher labels.

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Bahn, M. et al., 2009. The New phytologist,

Gao, J. et al., 2015. Scientific Reports,