^{13}C signatures of methane emission from a northern wetland ecosystem at microtopographic and field scale

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Methane emission from wetland ecosystems exhibits considerable variation both seasonally and spatially. The spatial variation is typically connected to microtopographic variation over the distances of meters or even less. The temporal variation typically follows the seasonal cycle of peat temperatures, as these wetlands do rarely show diel cycle in their methane emission. These variations can be caused by several reasons including variation in methanogenesis due to substrate availability and temperature, methanotrophy due to oxygen availability, and transport pathways due to e.g. presence of plant aerenchyma.

Many of these processes alter the stable isotopic composition of the resulting methane emission. Thus, the isotopic signature of emitted methane can be used as an additional constrain to disentangle different processes leading to variation in emissions. This often requires well-constructed hypotheses and even numerical modeling of the fractionation effects of different processes on isotopic signatures.

We have measured the ^{13}C signature of methane from an ombrotrophic hemiboreal peatland in South-Western Sweden in microtopographic and field scales. The measurements in microtopographic scale were carried out by static chambers and those in field scale by nocturnal boundary-layer accumulation method. In both cases $\delta^{13}C\text{-}CH_4$ was measured by online CRDLAS analyzed and source $\delta^{13}C\text{-}CH_4$ obtained as the zero-intercept of a Keeling plot. In addition to isotopic signatures, we have also measured methane emission both at field scale with eddy covariance method, and at microtopographic scale with automated chambers.

We will present results on both spatial and temporal variation of $\delta^{13}C$ signature of methane emission in relation to the variations of magnitude of the emission. Implications on our understanding of the processes will be discussed.