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High-resolution ecosystem-level CO_2 and CH_4 fluxes with novel automatic chamber techniques

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We combined a state-of-the-art field applicable CH_4 sensor (Los Gatos LGR-DLT100) with a novel, custom-built ecosystem-level automatic chamber controlled by a LI-COR 8100/8150 system. The chamber covers an area of 2827 cm2 (60 cm diameter), is 90 cm tall (volume: 254L), and is capable of switching automatically between transparent and darkened mode enabling separation of light-sensitive and light-indifferent processes in chambers. For CO_2 fluxes, net exchange (NEE) was estimated in transparent mode, ecosystem respiration (RE) in darkened mode and Gross Ecosystem Photosynthesis rate (GEP) was calculated as NEE – RE.

We measured hourly fluxes of CO_2 and CH_4 continuously for 2 years in Danish *Calluna vulgaris* (common heather) heathland (Larsen et al. 2011) thus generating more than 30,000 individual chamber measurements.

We will present an analysis of the novel, high-frequency data set including novel insights into the diel fluctuation in ecosystem respiration rates in response to diel, weekly and seasonal changes in gross photosynthesis, temperature, soil water availability and rain events.

Novel findings include the observation of increased respiration at similar temperatures during daytime compared to nighttime as well as increased ecosystem respiration in the days following rewetting events during dry periods. Over the study period the ecosystem was a sink for CO_2. CH_4 fluxes revealed a very stable uptake of CH_4 at the site, which has a very sandy soil and therefore is naturally dry for Danish ecosystems. In summary, the novel high-resolution data revealed new insights to the short- and long-term patterns in gaseous carbon uptake and release in this heathland ecosystem.

Reference:

Larsen, K.S., Andresen, L.C., et al. 2011. Reduced N cycling in response to elevated CO_2, warming, and drought in a Danish heathland: Synthesizing results of the CLIMAITE project after two years of treatments. *Global Change Biology* 17, 1884–1899.