Geophysical Research Abstracts
Vol. 20, EGU2018-8027, 2018
EGU General Assembly 2018

High resolution temporal variability of methane emissions induced by environmental drivers

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Freshwaters, including lakes have been considered as important methane (CH_4) sources for approximately two decades. Although numerous studies across various lake ecosystems have been conducted, it is still very challenging to make accurate assessments of CH_4 fluxes. The detailed CH_4 flux dynamics over short temporal scales can be very important, because CH_4 fluxes are highly variable and large part of this variability can be driven by environmental factors acting over short time scales. However, such short time dynamics are rarely evaluated due to labor-intensive traditional measurements.

The aim of this study was to determine CH_4 emissions and to decipher main drivers of CH_4 flux on various temporal scales. The measurements were performed with multiple automatic and manual flux chambers in boreal Sweden. We particularly focused on event-driven fluxes and diel variability.

Our findings revealed that CH_4 fluxes were significantly lower during night (p <0.05), and emissions during the day had higher variability than night-time fluxes. Preliminary findings also suggest that hydrological events such as precipitation and water level changes influenced methane emissions on a short-term, event scale. The impact of other potential controlling factors, including temperature and wind speed, on the response time of CH_4 fluxes were also investigated. Our results emphasize the importance of frequent and numerous flux measurements to accurately assess CH_4 flux variability.