Geophysical Research Abstracts
Vol. 20, EGU2018-4633, 2018
EGU General Assembly 2018

Greenhouse gas fluxes on adjacent wetland, lake and forest ecosystems within a subarctic catchment

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Keywords: greenhouse gas, catchment, upscaling, eddy covariance

Introduction
The Finnish Meteorological Institute has been running a micrometeorological measurement station at Kaamanen in northern Finland since 1997. These measurements of the ecosystem-atmosphere exchange of energy and greenhouse gases (GHGs) have been conducted at a wetland site using the eddy covariance (EC) method. In 2017, EC flux measurements were also started at adjacent lake and forest sites. In addition, GHG fluxes were measured with the chamber technique.
The ecosystem-atmosphere exchange of CO_2 and CH4 were measured during the summer 2017 on adjacent wetland, lake and forest ecosystems as part of the CAPTURE -project (Carbon dynamics across Arctic landscape gradients: past, present and future) funded by the Academy of Finland. The objective of these particular measurements was to observe the growing season carbon fluxes on these ecosystems and habitat types, e.g. on different land cover classes (LCCs) of the wetland. Using these data, the annual ecosystem-level GHG balances will be determined and upscaled to a catchment scale and further to a regional scale. This will be achieved by combining the EC flux measurements with the LCC specific fluxes from the chamber measurements and a detailed vegetation mapping based on satellite data and field measurements.

Methods
The Kaamanen wetland is a mesotrophic flark fen (N69°8.435', E27°16.189', 155 m a.s.l.) comprising dry strings and wet flarks. The lake within the catchment is shallow (< 1 m) clear water lake and it is located 200 m southwest of the wetland site. The Scots pine forest, located 300 m west of the wetland site, has a mean tree height of 11 m. Vegetation and land cover classes were mapped in detail around the EC towers during the summer 2017. The mapping consisted of plant species coverage observations, soil sample collection and pH measurements along transects.

Results and conclusions
Six sets of manual chamber measurements were taken during the growing season (June – October) in 2017. At the fen, the ecosystem-atmosphere GHG exchange measured with the chambers was compared with the EC flux measurements. Both measurement methods utilized gave similar GHG fluxes at the fen. The CO_2 flux measured with the EC method indicated slight net ecosystem respiration at the start of the growing season, which changed to net ecosystem uptake at a level of -0.20 mg CO_2 m-2 s-1 during July 2017. The fen and forest sites show similar diurnal cycles of CO_2 flux, with the forest however showing larger net respiration and uptake.

Acknowledgements
This work was supported by the Finnish Meteorological Institute, the University of Helsinki, the Natural Resources Institute Finland and the Finnish Academy CAPTURE-project (Carbon dynamics across Arctic landscape gradients: past, present and future) Grant no. 296423.