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Carbon balance and greenhouse gas emissions of subarctic lowland palsa mires related to permafrost degradation.

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The Torneträsk area in northern subarctic Sweden is particularly vulnerable to any further climate change since it is located on the 0-degree isotherm. Within the next decades a projected ongoing climate warming and increase in snow cover will most likely lead to the disappearance of lowland permafrost in this region, affecting greenhouse gas emissions, surface energy fluxes and vegetation cover.

A previous study from the Torneträsk area has resulted in extensive data on the effects of permafrost degradation on surface energy balance. In this study we focus on the effects of different stages of permafrost degradation on carbon balance and emission of greenhouse gases.

The study area covers several mires with similar local topographic conditions along an east-west oriented transect. Due to a strong climatic gradient, with maritime climate in the west and a more continental climate in the east, active layer thickness and permafrost temperatures generally increase from east to west while permafrost thickness decreases. In recent years permafrost has completely disappeared at the westernmost study site while at the other investigated locations the peat plateaus show varying stages of degradation.

For our measurements we use both mobile and stationary energy balance and eddy covariance towers. Data has been collected during the growing season in 2013 by measuring flux densities of carbon dioxide and water vapour and all components of the surface energy budget, i.e. net radiation, turbulent fluxes of sensible and latent heat as well as ground heat fluxes. In addition, we measure active layer thickness and both soil moisture and soil temperature at various depths.

In this study we aim to (A) investigate and better understand the effects of permafrost degradation on the CO_2 dynamics in subarctic palsa mires, (B) assess variation in terrestrial CO_2 and water vapour flux with changes in vegetation cover and soil moisture, (C) determine possible meteorological and phenological controls on net CO_2 exchange.