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Carbon balance of a fertile forestry-drained peatland in southern Finland

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Forestry on peatlands is a significant land use form and has been economically important during the last decades particularly in the Nordic countries. While nutrient-poor forests are generally able to maintain their carbon sink status even after drainage, the peat soil at the fertile sites is typically considered as a large carbon dioxide (CO_2) source. This means that despite of high timber production capacity, the fertile peatland forests gradually lose their peat carbon store. In addition, many of the nutrient-rich sites emit considerable amount of nitrous oxide (N_2O) into the atmosphere. While the current estimates of the greenhouse gas (GHG) balance of forestry-drained peatlands are largely based on soil inventories or on data combining soil GHG fluxes and tree growth litter input measurements and modelling, only few studies have utilized the high-resolution, continuous eddy covariance (EC) data to address the short-term dynamics of the net CO_2 fluxes covering both the soil, forest floor vegetation and the trees. Hence, little is known about the factors which control the year-to-year variation in fluxes. Here we present a 5-year dataset of CO_2 fluxes measured with the EC method above a nutrient-rich forestry-drained peatland in southern Finland. The site, drained in the beginning of 1970's, is a well growing pine forest with some spruces and birches, the tree volume and carbon fixation rate equaling 8.0 kg C m^{-2} and 0.273 kg C m^{-2} yr^{-1}, respectively. The average summer-time water level depth is -50 cm.

By combining the gap-filled half-hourly net ecosystem exchange (NEE) data, the tree growth measurements, and the measurements on dissolved organic carbon (DOC) losses and soil methane (CH_4) exchange, we will in this presentation estimate the total annual loss of peat carbon of this fertile peatland forest. In addition, using the N_2O flux data we will estimate the contribution of different gases to the total GHG balance. Factors controlling the carbon balance and its seasonal and inter-annual variation are discussed.