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Modelling carbon, water and energy fluxes of drained nutrient rich and poor peatland forests

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Flux measurements on Carbon (C) cycling have revealed contrasting results on two nearby forestry-drained peatlands in Southern Finland. The nutrient-rich site, Lettosuo, lost soil C to the atmosphere whereas the soil at the nutrient-poor site, Kalevansuo was a strong C sink. The reasons for why these two sites behaved so differently are however still unclear. We therefore applied the CoupModel to these sites to investigate: 1) to test if the model could reproduce the measured C cycling data; 2) to evaluate the possible reasons for the contrasting soil C balance for two sites and 3) to investigate the management practices i.e. influence of drainage depth. The model was calibrated against a very detailed dataset, consisting of: total net radiation, latent heat flux, sensible flux, soil temperatures, groundwater level, manual chamber measured soil respiration, net ecosystem exchange and annual forest growth. The calibrated model was further validated by 30 min interval soil respiration data measured by automatic chambers. Sensitivity analysis was then conducted to evaluate the impact of drainage level, soil surface temperature, forest growth, litter quality or soil fertility on the soil C balance. Preliminary results show that the CoupModel reproduced calibration and validation data reasonably well. Model sensitivity analysis shows that soil C balance is highly connected to the quantity and quality of plant litter, due to plant C composition and/or N status. For the nutrient poor site, Kalevansuo, soil C sequestration continued until the groundwater level was 0.5-0.6 meter below the surface. While for nutrient rich site Lettosuo, the groundwater level needs to be rather shallow for soil C sequestration to occur.