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Integrative comparison of CO$_{2}$ flux measurements at a boreal peatland by chamber and eddy covariance methods with LPJ-GUESS model output

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Many studies have been conducted to quantify the exchange of CO_2 between the atmosphere and the biosphere and to analyse the underlying processes at different spatial and temporal scales. The chamber method and the eddy covariance (EC) technique are the two measurement techniques which are mainly used to determine the CO_2 fluxes. The chamber measurements provide discontinuous flux data on the plot scale (10^{-2}-10^{0} m^2) while the EC measurements provide under ideal conditions continuous flux data on the ecosystem scale (10^{4}-10^{6} m^2). In general, measured CO_2 flux estimates of the plot- and ecosystem-scale over homogenous areas are comparable. Over heterogeneous areas, however, large differences between EC and chamber measurements can occur. This study focuses first on the comparability of CO_2 flux measurements conducted with those two techniques at a heterogeneous patterned boreal peatland (seven microform types) in Northwest Russia from April to October 2008 and then compares measured fluxes with CO_2 flux estimates of the LPJ-GUESS. Both measurement methods were carried out simultaneously to allow for comparison by empirical modelling of the flux time series. Three different approaches were used to integrate the plot-scale chamber measurements with the larger-scale EC measurements: 1. upscaling based on average microform distribution and the mean NEE flux for each microform type over the investigated period, 2. upscaling based on areal weighting which accounts for main wind direction and 3. upscaling based on footprint modelling which simulates the varying source fraction of the CO_2 fluxes. First results indicate a substantial discrepancy between the flux estimated from EC data and estimates obtained by upscaling from chamber measurements. At larger scales, LPJ-GUESS is a process-based model of vegetation dynamics and land-atmosphere carbon and water exchanges and is suitable for regional (10^{3}-10^{5} km^2) to continental (10^{6}-10^{7} km^2) simulations on the time scale from days to millennia. We will discuss the outputs of the LPJ-GUESS model for the investigated region and compare the model flux estimates to the measured and upscaled CO_2 fluxes.