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Bayesian calibration of the Biome-BGC C3 grass submodel

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In the framework of a joint Hungarian-Japanese cooperation direct CO_2 flux measurements were performed in 1999-2000 over a species-rich, semi-natural grass field in Western Hungary (Hegyhátsál). Based on the results of these measurements we simulate the activity of the grassland at Hegyhátsál using a process-based biogeochemical model Biome-BGC.
The model requires daily climate data and the definition of several key climate, vegetation, and site characteristics to estimate fluxes of carbon, nitrogen, and water through the ecosystem.
After adapting the Biome-BGC to the Hungarian environmental conditions our goal was to calibrate the model in order to decrease the difference between the measured and the simulated data using Bayesian approach. Generally, process based ecosystem models have many parameters and multiple outputs of interest so the calibration procedure is inevitable but it might be a challenging task. Bayesian approach offers a solution to the calibration problem. It provides parameter estimates with measures of uncertainty and correlations among the parameters. The procedure begins with quantifying the uncertainty of the parameter's values in the form of *a prior* probability distribution. Then based on the comparison of the model output and measurements the parameter distribution is updated by means of the Bayesian approach. This yields to the *a posteriori*, calibrated distribution for the parameters, which can be summarized in the form of a mean vector and variance matrix. Using the results of this calibration method the simulation of the daily net and gross carbon exchange became more realistic.