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Bayesian calibration as a tool for initialising the carbon pools of dynamic soil models

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Most soil carbon models partition the soil organic carbon (SOC) into two or more kinetically defined conceptual pools. The initial distribution of soil organic matter between these pools influences the simulation of SOC turnover, both within the conceptual pools and at the total SOC level. Like many other SOC models, the DayCent model is initialized by assuming equilibrium at the beginning of the simulation. However, as we show here, the initial distribution of Soil organic matter between the different pools influences simulations notably, and the appropriate distribution is dependent on the climate and management at the site before the onset of a simulated experiment. If the soil is not in equilibrium, the only way to initialize the model is to simulate the pre-experimental period of the site. Most often this information is not available at site and regional level. Our objective was to identify a method that can be applied to initialize the model when soil is not in equilibrium, and historic data are not available, and which quantifies the uncertainty associated with initial SOC distribution. We outline a method using Bayesian calibration with Accept - reject algorithm, and use it to calibrate the initial distribution of soil organic carbon pools against observed soil respiration measurements. It was shown that even in short-term simulations; model initialization can have a major influence on the simulated results. The Bayesian calibration method quantified and reduced the uncertainties in initial carbon distribution.