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Modeling soil organic carbon stocks at national scales – systematic validation of models and carbon input estimations

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Soil organic carbon (SOC) content of arable soils is an important factor which not only influences soil fertility but also formation of greenhouse gases. SOC models try to simulate and predict the changes in carbon content in soils depending on parameters like temperature, precipitation, clay content and also carbon (C) input. For future climate mitigation strategies, it is necessary to minimize uncertainty while predicting trends in soil carbon stocks. The aim of our study is to conduct model based estimations of trends of local, regional and national SOC contents on German grassland and arable soils and to quantify scale dependent uncertainties arising from input data uncertainty, parameter uncertainty and model structural uncertainty. Preanalysis of SOC models showed that a large fraction of uncertainty in SOC trends is related to C-input estimates from crop residues and organic fertilisation. Therefore, we are going to combine six different SOC models (RothC, C-Tool, Yasso07, Century, ICBM/2, CCB) with five different approaches to estimate carbon input (Bolinder, CCB, C-Tool, ICBM, IPCC). This set of model combinations will be evaluated with data from German permanent soil monitoring sites and long term field experiments. With the best model combinations, we will conduct parameter estimations to calibrate the models for Germany. Finally, the calibrated model ensemble will be combined with data from the German agricultural soil inventory which sampled agricultural soils in Germany in an 8x8 km^2 grid following standardized protocols to quantify German SOC trends and associated uncertainties by Monte Carlo methods.