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Projected changes of soil organic carbon in agricultural soils of southeast Germany in the 21th century under different carbon input scenarios

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As climate change may have a distinct effect on soil organic carbon (SOC) stocks, projections of the future SOC development on larger spatial scales on the basis of soil carbon models are needed. In this study we simulated the SOC development in cropland and grassland soils of Bavaria (southeast Germany) between 2000 and 2095 using the RothC model. At 51 sampling locations detailed model input data as C pools derived by soil fractionation, C input, clay content and climate variables were determined to run the model. Projections for each sampling location were performed on the basis of an average climate scenario (A1B) and three C input scenarios as a realistic range of possible crop yield developments: stagnation of the C input (1) increase by 20% (2) and decrease by 20% (3). The results showed a general decline of SOC stocks of 12% during the 21th century under C input scenario 1 and a decrease of 21% under scenario 3. Remarkably, even the optimistic scenario 2 resulted in a noticeable decline of SOC stocks by 5%. Our study indicated that C inputs in agricultural soils of Bavaria have to increase by 30% until 2095 (given the A1B climate scenario) in order to maintain present SOC stocks. However, projected SOC changes largely depended on the soil unit and regional site characteristics. The modeling approach provides the basis for a further evaluation of changes of the land use management and enables a site-specific delineation of measures for a sustainable supply of soil organic matter under climate change.