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Same soil - different climate: crop model inter-comparison with lysimeter data of translocated monoliths

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Crop model comparisons have mostly been carried out to test predictive ability under previous climate conditions and for soils of the same location. However, the ability of individual agricultural models to predict the effects of changes in climatic conditions on soil-ecosystems beyond the range of site-specific variability is unknown. The objective of this study was to test the predictive ability of agroecosystem models using weighable lysimeter data for the same soil under changing climatic conditions and to compare simulated plant growth and soil-ecosystem response to climate change between these models. To achieve this, data from the TERENO-SOILCan lysimeters-network for a soil-ecosystem at the original site (Dedelow) and data from the lysimeters with Dedelow soil monoliths transferred to Bad Lauchstädt and Selhausen were analysed. The transfer of the soils took place to a drier and warmer location (Bad Lauchstädt) and to a warmer and wetter location (Selhausen) compared to the original location of the soils in Dedelow with the same crop rotation. After model calibration for data from the original Dedelow site, crop growth and soil water balances of transferred Dedelow soil monoliths were predicted using the site-specific boundary conditions and compared with the observations at Selhausen and Bad Lauchstädt. The overall simulation output of the models was separated into a plant-related part, ecosystem-productivity (grain yield, biomass, LAI) and an environmental part, ecosystem-fluxes (evapotranspiration, net-drainage, soil moisture). The results showed that when the soil was transferred to a drier region, the agronomic part of the crop models predicted well, and when the soil was moved to wetter regions, the environmental flow part of the models seemed to predict better. The results suggest that accounting for climate change scenarios, more consideration of soil properties and testing model performance for conditions outside the calibrated range and site-specific variability will help improve the models.

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