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# Agricultural management and Climate Change Impacts on Catchment-Scale Water Fluxes − the Role of Soil Organic Carbon

**Malve Heinz**[1,2,3], Bettina Schaefli[1,2], Annelie Holzkämper[1,3], and Christoph C. Raible[1,4]
[1]Oeschger Centre for Climate Change Research, University Bern, Bern, Switzerland
[2]Hydrology, University of Bern, Bern, Switzerland
[3]Agroscope Reckenholz, Water Protection and Substance Flows, Zürich, Switzerland
[4]Climate and Environmental Physics, University of Bern, Bern, Switzerland

Soil organic carbon (SOC) can be heavily influenced by climate change via temperature-enhanced SOC mineralization and by agricultural management via soil degradation from intensive agriculture. In contrast, climate-mitigation leads to sequestering of carbon and increasing SOC and can enhance soil water retention, which may support agricultural production under increasing summer droughts. Here, we investigate how agricultural management–induced changes in soil organic carbon (SOC) interact with climate change to shape future catchment-scale hydrology. The study area is the Broye catchment in western Switzerland. The study employs scenario-based hydrological simulations with the distributed hydrological model mHM, which is driven by CH2025 climate scenarios for Switzerland. These newly available scenarios combine CMIP5-based EURO-CORDEX regional climate simulations and statistical downscaling techniques with insights from CMIP6, to obtain high-resolution (1km × 1km) Swiss climate scenarios. With this model chain, we contrast a no-adaptation pathway characterized by management- and warming-driven SOC decline with SOC-enhancing management pathways that promote SOC accumulation (organic amendments, minimum tillage, or biochar application). We present and discuss the hydrological responses to the two pathways, focussing on changes in evapotranspiration, runoff, and low-flow frequency and evaluate the robustness of responses to climate projection uncertainty. Given that climate projections are often large sources of uncertainty in hydrological simulations, robustness is evaluated based on inter-model agreement, allowing us to distinguish which SOC-induced changes in key processes and metrics (e.g., evapotranspiration, discharge, and low-flow frequency) are consistent and which remain ambiguous.