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The impact of climate change and sustainable land management based adaptation on hydrology and soil erosion of a large semiarid catchment

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Climate change has strong implications for many essential ecosystem services, such as provision of drinking and irrigation water, soil erosion and flood control. Especially large impacts are expected in the Mediterranean, already characterised by frequent floods and droughts, and for which less rainfall and more extreme weather events are projected for the coming decades. Sustainable Land Management (SLM) strategies are increasingly promoted to reduce the risks associated with climate change on ecosystem services. However, there is surprisingly little known about their impacts and trade-offs on ecosystem services at regional scales. The aim of this research is to provide insight in the potential of SLM for climate change adaptation, focusing on regional-scale impacts on soil and water resources.

We applied the processed-based spatially-distributed hydrological model SPHY (Spatial Processes in HYdrology) on a daily timescale to the semi-arid Segura River catchment (18,800 km2) in SE Spain. In addition, we coupled the MUSLE soil erosion equation to the hydrological model to simulate soil erosion and sediment transport. We run the model for three periods: one historic (1981-2000) and two future scenarios (2031-2050 and 2081-2100), with and without implementation of SLM strategies. Climate input data for the historic scenario was based on interpolated measured data and for the future scenarios on output from regional climate models for different emission scenarios (RCP4.5 and RCP8.5). Realistic scenarios of SLM practices were based on a previous stakeholder consultation process.

Analysis of the regional climate models under the most extreme emission scenario showed an average decrease of yearly precipitation of 97 mm (28%) and an increase of average temperature of 4.8 ºC (29%). Preliminary model results, based on these scenarios, show a maximum 80% decrease in discharge under future climate conditions. Wide-scale implementation of SLM can effectively contribute to climate change adaptation by maintaining the soil water retention capacity and soil moisture content in the rootzone. Based on these findings we are currently estimating sustainability of soil and water resources and implications for crucial ecosystem services in the Segura catchment.