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Modelling the effects of climate and land use change on soil erosion and sediment yield in two small agricultural catchment systems (Fugnitz - Austria, Can Revull - Spain)

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Accelerated soil erosion by water has been identified as the most severe threat to soils across Europe. Land use and/or cover change and changing precipitation patterns are the main drivers for the loss of soil in agricultural landscapes. Soil erosion modeling allows to estimate the sediment yield and the effect of distinct agricultural land use practices on soil erosion. Additionally, under different climatic scenarios, soil erosion models can provide insights into future challenges and directions on how land use management and policy could be adapted. In this presentation, the main drivers of soil erosion processes in two small agricultural catchments in contrasting climatic regions (i.e. Mediterranean and Central European temperate climate) of Europe are identified. Furthermore, future climate scenarios, especially in terms of precipitation are investigated.

The two small agricultural catchments are sub-catchments of the Fugnitz River in Lower Austria and the Na Borges River in the center of Mallorca, Spain. The widely used Water Erosion Prediction Project (WEPP) and its geospatial interface (GeoWEPP) application are utilized to model soil erosion processes on hillslope and sub-catchment scale. The input data needed to run the WEPP/GeoWEPP applications is topography, soil, land use and climate. Model verification and validation is realized by using event-based in situ data for individual hillslopes, based on high-resolution digital elevation models of difference compiled by aerial photography and terrestrial laser scanning. At catchment scale, the model calibration and evaluation are conducted with runoff and suspended sediment yield data. Geomorphologic and connectivity maps further support the validation of the modeled flow paths within the respective catchments.

The soil erosion model identifies hotspot areas prone to high erosion rates and land use practices with high sediment loss; i.e. conventional tillage and monoculture. Different climate change scenarios elucidate how the soil erosion processes of these catchments in the two climatic regions are distinctly affected by changes in precipitation patterns, as the extent and the processes of soil erosion are depending on the environmental settings of the respective catchment. Our study further demonstrates the importance of studying soil erosion on small spatial scales with high resolution topography data, providing a better understanding of the main drivers of soil erosion in the investigated catchments helping to improvements in management practices and reduce soil erosion.