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Erosion and Sediment Transport - Measurement and Modelling from Headwaters to large Catchments: A Research Project to reduce Reservoir Sedimentation in semi-arid Environments

A. Bronstert (1), E.N. Müller (1), J.C. de Araujo (2), R.J. Batalla (3,4), T. Francke (1), A. Güntner (5), G. Mamede (1,2)

(1) Institute of Geoecology, University of Potsdam, Germany, (2) Department of Hydraulic and Environmental Engineering, Federal University of Ceara, Fortaleza, Brazil, (3) Department of Environmental and Soil Sciences, University of Lleida, Spain, (4) Forest Technology Centre of Catalonia, Solsona, Spain, (5) GeoForschungsZentrum Potsdam, Germany

(enmue@uni-potsdam.de / Phone: 0049-331-977-2975)

In dryland environments, the water supply depends strongly on the water stored in artificial reservoirs. However, storage capacity of the reservoirs is often threatened by severe sedimentation due to upland soil erosion. An international research group is currently developing and applying a modelling system for the quantitative assessment of sediment mobilisation in catchments, sediment transport in the river system, and sediment retention in reservoirs. The focus is laid on meso-scale river basins (several hundreds to thousands of square kilometres in size) in semi-arid regions. An existing hydrological model tailored for specific semi-arid characteristics is extended with components representing erosion and sediment transport processes.

With the aim of implementing adequate process formulations, hydrological multi-scale data sets from dryland catchments, rivers, and reservoirs in Spain and north-eastern Brazil are used and expanded by own measurements. Modelling approaches and supporting measurements are designed according to a multi-scale approach in order to capture the effect of small scale processes and landscape features on the large-scale overall hydrological dynamics.

This contribution presents the current state, progress and first results of the ongoing research project. It provides an overview on the conducted field campaigns and the implemented monitoring programme in the study areas with focus on sediment generation on the hillslopes, sediment conveyance and temporary storage in the river and sediment budget in reservoirs. Theoretical background on modelling concepts and model components are presented. First preliminary modelling results concerning an adequate representation of erosion-prone landscape units, the role sediment transport and temporary storage in dryland rivers and the effect of small and large reservoirs to trap sediments are highlighted. The current findings underline the importance of an integrated management of all aspects of the sediment budget, i.e. from the catchment scale with its intrinsic land-use characteristics over sediment transport in rivers to reservoir sedimentation as a prerequisite of a more sustainable management of reservoirs in dryland environments.