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# Climate reanalysis data with global coverage enable sediment load prediction in the absence of systematic field data

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Hydro-morphodynamic models are increasingly popular for predicting sedimentation processes in reservoirs. To leverage the accuracy of such models, their boundary conditions have to be defined as precise as possible. While hydrological models provide efficient routines to establish inflow hydrographs at the model boundaries, the determination of the sediment input is challenging and involves large uncertainties. This study identifies prominent parameters that influence the sediment input into a reservoir, and therefore, expected sedimentation rates. For this purpose, erosion and transport processes in the catchment area of the Banja Reservoir (Albania) are analyzed.

The Banja Reservoir is located on the Devoll River in the Southeast of Albania and has a storage capacity of 400 Million m³. The catchment area has a size of 2,900 km² and lies in a mountainous region. The climate is characterized by dry and hot summers and humid winters. There are significant differences in precipitation patterns in the catchment due to topographical conditions and with increasing distance from the coast in the West of the reservoir. Because snowfall is frequent in winter, the runoff regime of the Devoll River and its tributaries is driven by precipitation and snowmelt.

To calculate the sediment input at the inflow boundaries of the reservoir, a comprehensive analysis in combination with hydrological modelling of the catchment is indispensable. This study applies the Revised Universal Soil Loss Equation (RUSLE) model coupled with the SEdiment Delivery Distributed (SEDD) model, as an integrated approach that bridges interdisciplinary expertise in geomorphology and hydrology. Since measured precipitation data neither fulfils minimum requirements in terms of spatio-temporal resolution nor in terms of time series length, the ERA5 reanalysis dataset is used as input data. The coupled model is calibrated with suspended sediment data measured at a monitoring station upstream of the reservoir over a 2–years period. The model enables to approximate the monthly or annual sediment load for any point in the river network. Thus, the sediment load into the reservoir can be assessed for every major tributary, even in areas with limited data availability. In addition, a high spatial resolution (25 m x 25 m) of the model enables the identification of areas that cause particularly high sediment loads.

The optimized coupled model predicts sediment loads that are in good agreement with sediment loads measured at the monitoring station (Nash-Sutcliffe efficiency: $NSE_{annual}$ = 0.96; $NSE_{monthly}$ = 0.81). Consequently, climate reanalysis datasets are a viable alternative in regions with data scarcity. Furthermore, the spatial representation of the results suggests that the sediment load into the reservoir mainly originates from steep and sparsely vegetated or agricultural areas close to the river network. Intensive rainfall additionally fosters erosion, which is why erosion rates are higher in the Western part of the catchment area.