Reconsidering the sediment connectivity and sediment transfer under the influence of hydraulic structures and coal mining in the Jiu river basin

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The key to an efficient basin management, taking into account both the liquid (river water runoff and its quality) and the solid (sediment sources and delivery) components lies in the way we approach the complex problem of sediment-generating areas in a river basin. This complexity is manifested both through the primary geomorphological processes that contribute to the mobilization of significant amounts of alluvia from the slopes and along the river valleys, and the various environmental and anthropogenic factors that act as restrictors or catalysts of sediment transfer.

In the present study, we aim to analyze the various categories of anthropogenic factors, operating at different spatial scales (local or at subcatchment/river sector level), which contribute, together with the intrinsic geomorphological potential, to the sediment supply or, conversely, to the inhibition of erosion, transport and accumulation processes.

Tracking sediment mobilization, transfer, intermediate storage and final delivery in a lithologically and geomorphologically complex environment, such as the Jiu River Basin (10,070 km²), located in SW Romania, is a difficult task which can become even more challenging when we factor in the contribution of some additional elements of an anthropic nature. In our study area, represented by a Carpathian and Danubian river basin, some of the most significant issues impacting the research include, on the one hand, the existence of reservoirs and dams, the strengthening of anti-flood embankments or the presence of water diversions, to cite only hydrotechnical interventions, or the impact of coal mining on landforms, slope processes and sediment sources, on the other hand. All these factors can act locally or regionally and they can surpass the influence exerted by the natural factors, thus being responsible for the reduction, storage, or, on the contrary, for the acceleration of specific hydro-sedimentary fluxes on certain paths.

In order to connect these two categories of potential factors regulating sediment generation and transfer, the methodological approach consists in evaluating the internal – geomorphic upstream-downstream connectivity in relation/contrast with the disruptive anthropogenic factors. The proposed workflow can be divided in two steps: 1) the identification of the upstream sediment
generating areas which are most connected to the downstream delivery/ storage/ accumulation areas (river network and river mouth) by applying the connectivity index (IC) proposed by Cavalli et al. (2013); and 2) the evaluation of potential hotspot areas exhibiting the highest degree of connectivity, as seen through the lens of the additional coupling or decoupling effects induced by the anthropic activities specific to the Jiu river basin: hydraulic structures and coal mining.

Outcome discussions will focus on mapping problematic sediment production, storage and transfer sectors, as evidenced by the impact of hydrotechnical works and artificial landforms from coal mining on the connectivity potential of the Jiu river basin.