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Temporal Comparative Analysis of Spatial Sediment Connectivity in two Different Alpine Catchments

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Understanding the evolution and functions of a river system and interpreting the morphology and the dynamics of the channel is a key factor in fluvial geomorphology. For this purpose it is essential to analyse the processes of sediment input and output within and between river reaches and to detect the various forms of storage types on hillslopes and in the channel network. From these processes catchment scale sediment fluxes are derived and result in sediment budgets showing the amount and motion of sediment through the system. Sediment connectivity is a highly important characteristic of catchments when sediment transfer processes are studied. In this context, connectivity controls the sediment fluxes throughout the landscape which means the transfer of sediment from sediment sources to sinks and particularly the potential of a particle to move through the system.
Sediment flux research and sediment budget are the primary concerns of two different projects of the University of Graz. These two projects, ClimCatch (Impact of climate change on the sediment budget of small catchments) and Sedyn-X (Interdisciplinary sediment flux research in the Johnsbach valley) are located in the Eastern Alps in Styria, Austria. The two alpine catchments are characterized by a contrasting geology and morphology. In addition, the catchments show sediment transfer processes of different types and intensities. The main objectives of our research include detailed geomorphological field mapping to identify sediment sources, storages types, and the recent sediment transfer processes. Quantifying erosion and debris flow processes will be achieved by means of yearly TLS surveys and continuous photo monitoring for Structure-from-Motion surface models. The thickness and structure of important sediment bodies at the slopes and in the valleys are investigated using geophysical methods (ERT, GPR, seismics). The fluvial sediment transport is being analyzed using impact sensors, geophone installations and mobile basket samplers.
In this contribution we present the results of the sediment connectivity analysis using a geomorphometric model, implemented via a GIS procedure. From a high resolution digital terrain model we determined the upslope contributing area (upslope component) and the downslope travel path (downslope component) of each raster cell. To implement the local conditions at each cell the slope gradient and a weighting factor (derived from a land cover model or a measure of the topographic surface roughness) are assigned to each component. Finally we performed the sediment connectivity analysis for two points in time to identify changes in the connectivity index over the years due to consequences of severe weather events, land use changes or anthropogenic river regulation. This is the necessary precondition for evolving a sediment budget for each of the catchments.