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Geomorphometric assessment of spatial sediment connectivity in small alpine catchments

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Small alpine headwater catchments show high variability of erosion and sediment delivery processes, which are strongly influenced by the surface morphology and the geo-structural setting. An important aspect related to sediment dynamics is represented by sediment connectivity, i.e. the degree of linkage between sediment sources and downstream areas. The control of morphological conditions on connectivity acts both through hillslope-channel coupling and decoupling, and through sediment delivery along the channel network. The spatial characterization of the connectivity patterns in the catchment is fundamental in the analysis of sediment dynamics because it permits to estimate the contribution of a given part of the catchment as sediment source, and it defines sediment transfer paths. The availability of high-resolution digital terrain models (DTMs), such as those derived from aerial LiDAR, improves our capability to quantify extensively sediment connectivity. A geomorphometric index, based on the approach proposed by Borselli et al. (2008), has been developed to assess spatial sediment connectivity in three small headwaters catchments of the Italian Alps. This index is aimed at evaluating the potential connection between hillslope and sinks (channels, lakes, wetlands, basin outlet). The geomorphometric analysis is coupled with field surveys, which enable the comparison with field evidences and the collection of experimental data related to sediment sources and transport processes. The Strimm and Gadria catchments (Autonomous Province of Bolzano, Eastern Alps) have been chosen as study areas because they are two adjacent basins with contrasting morphology and affected by different types and intensity of sediment transfer processes. A third catchment, the Rio Cordon (Dolomites, Eastern Alps), has been selected in order to evaluate the connectivity of sediment source areas, since a detailed inventory map of sediment sources, complied by means of field survey and LiDAR data analysis, was available. The approach followed revealed to be very promising for the characterization of sediment dynamics in the complex morphological settings of alpine headwaters.

Reference:

Borselli L., Cassi P., Torri D., 2008. Prolegomena to sediment and flow connectivity in the landscape: a GIS and field numerical assessment. Catena, 75(3), 268-277 .