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Assessment of sediment connectivity in a Mediterranean catchment under different spatial scales and by using distinct approaches

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Sediment connectivity is an emerging property of geomorphic system. Connectivity within a catchment widely depends on its climatic conditions and morphological heterogeneities, and it is accurately influenced by the anthropogenic (cropland, land use changes, infrastructures) alteration of the landscape (López-Vicente and Álvarez, 2018). Sediment connectivity allows to characterize the structural properties of the landscape (topography, soil roughness, drainage network) and, when considered, at a specific spatio-temporal scale, and in combination with forcing processes (e.g., rainfall-runoff and sediment delivery), can perform as a useful tool for an enhanced landscape management. The assessment of sediment connectivity through usable indices or models is a major concern for the scientific community dealing with catchment/landscape management. In this context, the present study evaluates two connectivity indices at distinct catchment scales: (i) an aggregated and new index of connectivity (AIC) developed by López-Vicente and Ben-Salem (2019) to integrate climatic and soil physical data with topographic and land use information and (ii), an index of connectivity (IC) as expressed in Cavalli et al. (2013). IC was computed using the available 'SedInConnect v2.3' software (Crema and Cavalli, 2018) and two scenarios as weighting factor: the topographic surface roughness and the land cover Manning's n values.

The study area is the Vero river catchment (380 km2) that is located in the Southern Pyrenees and within the Ebro river basin (Huesca province, Aragon, NE Spain). The northern part of the catchment is sub-humid, mountainous (deep and sheer gorges are frequent), and covered with forest, whereas the southern part, under semi-arid conditions, has hilly and gentle topography, with alluvial terraces, and it is mainly devoted to agriculture (vineyards, winter cereal, alfalfa, rape, olive and almond groves). Small villages and one village (Barbastro), and many roads and trails appear along the catchment influencing the overland flow pathways. However, there is not any dam that disrupts the permanent river flows. All input (e.g., LiDAR-derived DEMs) and output maps were generated at 5 x 5 m cell size; except for those of a small headwater subcatchment for which 1 x 1 m data were obtained. The analysis in the subcatchment study area aimed at evaluating the effect of different resolutions on indices performance. Results of AIC were compared with those obtained with the two IC scenarios. The major differences of the two approaches were clustered around different cover types and slope values in the different catchment compartments. This can be ascribed to the climatic and soil information integration on the one hand, and to the roughness/slope distribution of upper subcatchments on the other. Further analysis is needed at subcatchment scale.

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