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Sediment connectivity assessment through a geomorphometric approach: a review of recent applications

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Sediment connectivity, defined as the degree to which a system facilitates the transfer of sediment through itself by means of coupling relationships between its components, has recently emerged as a paramount property of geomorphic systems. The growing interest of the earth sciences community in connectivity led this property to become a key concept concerning sediment transfer processes analysis and one of the building blocks of modern geomorphology. The increasing availability of high-resolution Digital Elevation Models (DEMs) from different sources as LiDAR and Structure from Motion (SfM) paved the way to quantitative and semi-quantitative approaches for assessing sediment connectivity. A geomorphometric index of sediment connectivity, based on DEM derivatives as drainage area, slope, flow length and surface roughness, has been developed along with related freeware software tool (SedInConnect). The index aims at depicting spatial connectivity patterns at the catchment scale to support the assessment of the contribution of a given part of the catchment as sediment source and define sediment transfer paths. The increasing interest in the quantitative characterization of the linkages between landscape units and the straightforward applicability of this index resulted in numerous applications in different contexts. This work presents and discusses the main applications of the sediment connectivity index along with a recent application in the frame of the Interreg ITAT3032 SedInOut Project (2019-2022). Being a topography-based index, it is focused on structural aspects of connectivity, and quality and resolution of DEMs may have a significant impact on the results. Future development should consider process-based connectivity and incorporate temporal variability directly into the index. Moreover, this work demonstrates that, when carefully applied considering the intrinsic limitations of the topographic-based approach, the index can rapidly provide a spatial characterization of sediment dynamics, thus improving the understanding of geomorphic system behavior and, consequently, hazard and risk assessment.