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The use of Digital Elevation Models for sediment connectivity assessment: state of the art and perspectives

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Geomorphic coupling, i.e. linkages between geomorphic system components, and sediment connectivity, i.e. the degree of linkage that controls sediment fluxes throughout landscape, have important implications for the behavior of geomorphic systems and have become key issues in the study of sediment transfer processes.
The detailed characterization of the topographic surface plays a fundamental role for studying sediment dynamics in a catchment. Digital Elevation Models (DEMs) can both improve geomorphological interpretation (e.g. individuation of sediment source areas) and enable the quantitative modeling of sediment fluxes and connectivity. In particular, the availability of LiDAR-derived high-resolution Digital Terrain Models (DTMs), exploited using geomorphometric analysis, extends the applicability and potentialities of topography-based modeling approaches. Indeed, geomorphometry allows to derive detailed characterization of drainage pattern and surface roughness, which are two of the most important parameters in the study of sediment delivery.
Since the late 1990s, some GIS-based approaches mainly based on stream-power have been developed for modeling the topographic potential for erosion and deposition and evaluating the impedance to sediment conveyance. But it is in the more recent years that an increasing interest for the quantitative characterization of the linkage between landscape units can be observed in literature. The development of geomorphometric indices, such as the sediment connectivity index (IC) by Borselli et al. (2008) and the version of IC proposed by Cavalli et al. (2013), and related freeware applications, has certainly contributed to this increased interest.
In this work, the state of the art on the use of DEMs for sediment connectivity assessment, with a specific focus on the sediment connectivity index and following applications, will be presented. Future perspectives will be also discussed.

References

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