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The connectivity framework: a way forward in understanding the surface processes and dynamics

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The surface processes are dynamic and act at multiple spatio-temporal scales and contain embedded hierarchies to generate complex landscapes. It is, therefore, necessary to understand the linkages or 'connections' of landscapes across various scales and levels to gain insights on their interactions and feedbacks in association with such processes. Recently, there has been a surge in the application of the concept of connectivity to the multitude of geomorphic systems with varying scales, objectives, and field of study. A large number of review articles and special issues published in the last few years is a testament to the utility of this concept. It, therefore, implies that the connectivity concept could be a way forward to understand the earth's surface processes and dynamics and their associations with the landforms. This work presents a 'connectivity framework' by establishing (a) the interrelationship and interdependencies among its types (sediment connectivity, hydrological connectivity, landscape connectivity), components (structural and functional connectivity), and dimensions (spatial and temporal), (b) the inherent feedback among various components under a process-response framework and under varying terrain characteristics, and (c) its utility in different geomorphic systems at variable scales and physical settings.

In a geomorphic system, connectivity accounts for static and dynamic properties of the landscape, and therefore, establishes structural and functional frameworks of the landscapes and process-response systems. This concept is applicable at all spatial and temporal scales and can be used to understand evolutionary pathways of landscapes and their dynamics. Further, the connectivity approach has the potential to be applied extensively to the hydro-geomorphic systems to understand their complexity as well as for designing effective management practices for river systems and wetlands, water resources for agriculture, and for assessment of ecological flows in rivers. It can also be aligned to a multitude of problems from river basin management to hazard and risk assessment to wetland management and restoration. We, therefore, argue that the connectivity concept is emergent as well as a fundamental property of landscapes and the connectivity framework presents a robust tool to understand the surface processes and dynamics.