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# Hydrological connectivity for catchment management: research approaches, pathways and future agendas

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The concept of hydrological connectivity is an overarching framework for understanding runoff and runon that has come to the fore in the last decade. Catchment management is a vital end-use of research around hydrological connectivity. The purpose of management is usually to maintain appropriate (dis)connectivity for different niches (hydrological, ecological, geomorphological), especially to be able to deal with what happens when structures are perturbed. Thus, for effective management and intervention in catchments a process-based understanding of connectivity is required so that: i) the conceptual rather than solely empirical understanding drives how managers interpret a system; and ii) there is an understanding of how continuous flow fields develop under different sets of environmental conditions to enable managers to know when, where and how to intervene successfully in catchment processes. Presently there is confusion around the structure: process dichotomy, shifting focus from understanding static indices influencing hydrological connectivity, to understanding the dynamics of process. Understanding different types and states of connections in catchments is helpful, but it is better to have an appreciation of processes to know that intervention is occurring in the most suitable way, or to prioritize limited resources.

The aim of this presentation is to: i) evaluate the extent to which different concepts of hydrological connectivity have emerged from different approaches to measure and predict flow in different environments; ii) discuss the extent to which these different concepts are mutually compatible; and iii) explore what further research needs to be carried out to contribute to a unified understanding of hydrological processes. Approaches to investigating hydrological connectivity can be categorised as those: evaluating soil-moisture patterns (soil-moisture connectivity); understanding hillslope runoff patterns and processes (flow-process connectivity); investigating topographic controls (terrain connectivity) (including the impact of road networks on hydrological connectivity and catchment runoff); developing models to explore and predict hydrological connectivity; and finally developing indices of hydrological connectivity. The emphasis in this paper is on understanding where and why differences in perception, measurement and modelling have arisen, in particular to clarify the process-based approach and how this may form the foundation for developing a unified approach to hydrological connectivity.