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Using the concept of hydrological connectivity to integrate physical and social systems

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The concept of connectivity has found great traction in understanding the movement of fluxes across the surface of the earth through disciplinary perspectives including hydrology, geomorphology and ecology (Bracken and Croke, 2007; Bracken et al 2013;2015). Connectivity-based approaches have also generated new understanding of structural-functional relationships that characterise complex systems, for instance in computational neuroscience, social network science and systems biology (Turnbull et al., 2018). Whilst the concept of hydrological connectivity has been used widely, at all scales and with respect to fluxes of both water and sediment, critique and development of the concept is less frequent in the literature. In this paper we revisit the existing body of work around hydrological connectivity to examine whether the concept has been used to its full potential and explore further ways in which the concept of hydrological connectivity could be expanded to continue to drive geomorphological research. One potential avenue for research is to learn from complex systems and use the concept of connectivity to embrace human dynamics (through managing the landscape and guiding policy and regulation) on one hand and climate change (which drives system inputs) on the other. This opportunity is explored here using the water sector as a case study where planning, and managing for, water security under growing population pressures and future climate change are explored through this broader interpretation of connectivity. We see this wider coupling between humans and system inputs playing a significant role in shaping earth surface processes and sediment dynamics and a widening of definition may enable hydrologists and geomorphologists to better integrate socio-ecological systems into our research.