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The role of lithology in controlling the rate of landscape response to perturbations

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Rivers form the primary link between external climatic or tectonic forcings and the rest of the landscape as any perturbation is communicated to the entire landscape through upstream propagation of transient signals along the fluvial network. The transmission rate of these signals determines the response time of the landscape to a given climatic or tectonic forcing. Understanding the controls on the propagation rate of transient signals is therefore key to predicting the sensitivity of landscapes to future tectonic or climatic change.While lithological characteristics, drainage area and amplitude of the forcing have all been identified as controls on transient landscape behaviour, the relative influence of each factor remains unclear. The influence of lithology is particularly poorly quantified, as isolating relevant rock characteristics and formulating them as quantifiable parameters is challenging. The Sorbas basin (SE Spain) represents an ideal site for studying the extent to which the propagation rate of transient signals is affected by lithology: A large-scale river capture event in the late Pleistocene is thought to have been facilitated by a difference in lithology between the two catchments concerned, allowing for more rapid headward erosion along the aggressor stream. This study aims to quantify the extent to which lithology affects transient landscape behaviour through a combination of topographic analysis of the Sorbas basin and numerical modelling experiments using the recently developed LithoCHILD model. Detailed topographic and stream profile analysis will be employed to quantify the expression of the Pleistocene capture event in both catchments, and to calibrate numerical modelling experiments simulating the evolution of the Sorbas basin throughout the Quaternary. The study will test whether the Sorbas capture event was facilitated by the difference in lithology between the two catchments alone, thereby providing better constraints on the extent of lithological control on the propagation rate of transient signals and the evolution of the drainage network.