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Automated detection of past river-blocking landslides based on valley geometry

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Landslides damming rivers are a common occurrence in active mountainous areas. Although the lifespan of landslide dams is typically very short (half of them last only a few hours to a few days [1]), remnants of the dam and the sediments deposited on the sides of the river can stay in place for a longer time. It has been demonstrated that the half-time of those deposits is about 5 to 25 years [2]. We are interested in automatically detecting landslide dams and remnants of river-blocking landslides based on their morphological characteristics.
We tested different approaches to analyze landscape geometry. The normalized channel steepness index (ksn) is a widely used metric to quantify the morphology of mountain ranges. It relies on the well-established stream power model to describe the erosional potential of rivers. However, it only considers the river bed elevation and does not represent valley shape. Therefore, we compared it to an approach that reports the cross-sectional and longitudinal shape of the valley floor, taking into account the landslide deposits on the entire valley floor.
In a benchmark test we applied the two approaches to artificial landscapes created with a landscape evolution model with a manually implemented dam. Three different scenarios were compared: i) a fluvial topographic steady state with a uniform uplift pattern, ii) a fluvial topographic steady state with hillslope diffusion and a uniform uplift pattern, and iii) a fluvial topographic steady state with hillslope diffusion and a spatially variable uplift pattern.

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[2] Croissant, T., Lague, D., Steer, P., & Davy, P. (2017). Rapid post-seismic landslide evacuation boosted by dynamic river width. Nature Geoscience, 10(9), 680.