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The importance of uplift in driving migration of ridges and valleys in landscapes and their dynamic reorganization: a view from experiments

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When landscapes are not in a full steady-state between uplift and erosion, the migration of rivers and ridge crests or river captures are mechanisms that may drive their dynamic reorganization in map view. We will present some insights into these mechanisms and related dynamics from experimental modelling of landscapes in the laboratory. We use an upgraded version of the experimental facility initially developed at the University of Rennes (France) and now set up at University of Toulouse (GET laboratory). We will illustrate how landscapes forced by a continuous and spatially homogeneous rock uplift reorganized in response to spatial variations in erosion rates. In this context we will show that rock uplift is a fundamental component of reorganization because any part of the landscape that is eroding at a lower rate than the rock uplift is uplifted and by the way have the ability to create new hillcrests or divides as already illustrated for example by Bonnet (2009). Here we will specifically focused on landscape dynamics driven by spatial rainfall gradients which induced contrast in the efficiency of erosional processes on opposing slopes. When coupled to ongoing rock uplift such forcing drives wave train migration of hillcrest and channels such as any pinned point in map view becomes alternatively a channel or a divide. This phenomenon is only possible when landscape dynamics is forced by active uplift. We will also illustrate how some river captures are induced by spatial gradients in the rate of divide and channel migration