Unravelling present days tectonics from channel steepness in a lithologically complex landscape

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Studies aiming to link topography with tectonics have focused on the main erosive engine of non-glaciated landscapes: the river system. The availability and resolution of digital elevation models (DEM) has increased dramatically over the last decade, and topographic analysis has become a widely-used tool to get spatially continuous information about tectonic forcings. Fluvial morphology, however, does not reveal such information easily. Being at the interface between the earth surface and atmosphere, it is affected by a wide range of forcing factors, which can be external, such as faulting and changes in climate, or internal, such as variations in rock hardness or degree of fracturing. When both types of forcing occur coevally, or in the same location, it presents a challenge for geomorphologists to isolate any individual factor. Failure to account for multiple factors leads to potential misinterpretation, for example where steepening of a channel network due to lithologic contrasts could be misinterpreted as a function of increased tectonic displacements. These misinterpretations are enhanced over large areas, where landscape properties needed to calculate channel steepness (channel concavity) can vary significantly in space. Ambiguity is most prominent when faults juxtapose different rocktypes, a common feature of mountain ranges, raising the question whether the fault is active or not.

In this study we investigate the relative channel steepness over the Eastern Carpathians where it has been proposed that ongoing, syn-orogenic rock uplift in the Southeastern Carpathians part gives way N- and NW-wards to ca. 8 Myrs of post-orogenic quiescence. We develop a technique to quantify relative channel steepness based on a wide range of concavities, and show that the main signal shows an increase in channel steepness from east to west across the range. Rock hardness measurements suggest this difference is driven by lithology. When we isolate channel steepness by lithology to test for ongoing rock uplift along the range, we find steeper channels in the south of the study area along tectonic units of the frontal ranges. This supports interpretations from longer timescale geological data that active rock uplift is fastest in the southern Southeastern Carpathians, and indicates that this increased uplift is dominantly a characteristic of the frontal portions of the thrust wedge. It also demonstrates that the use of channel steepness to extrapolate information obtained from expensive discrete analysis (e.g. thermochronometers) is not restrained to homogeneous simple landscapes.

Mots-Clés : Géomorphologie Fluviale, Carpates, Channel Steepness

Merci de ne rien inscrire dans cette zone et ne pas modifier les marges des pieds de page et entêtes.