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# Geometrical properties of evolving drainage systems in active orogens

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Geometrical properties of drainage system can be used to infer meaningful information about their geomorphological evolution. Such analyses includes the use of both linear and nonlinear methods in order to study their shape, orientation and similar properties. Quantification of those parameters and their rigorous analysis is increasing. Previously, we have focused on designing theoretical and computation tools to quantify these characteristics using a combination of remote sensing data and geographical information system (GIS). Most of these tools focused on topographic aspects and their derived parameters. However, there are still open questions regarding to the drainage evolution in active orogens e.g. how the drainage system got linearized or how we can construct the paleotopography using such techniques. In order to advance our current state of understanding, we simulated a series of deformation on a synthetic topography and deformed drainage systems were analyzed using fractal measures and basin tilting.

Generating a synthetic or artificial topography is a mathematical/computational task. A MATLAB based code was used to generate a synthetic topography as a combination of convex, flat, and concave surfaces. A synthetic fault was used to bisect the topography into two block. Later on, these blocks were uplifted as a function of uplift angle (ß). Applying this effect, the drainage basins of generated surfaces were tilted. This drainage basin tilting and its respective lateral stream migration is one of the obvious indicators of neotectonics. This phenomena can be easily studied using transverse topographic index (T-Index). It also helps us to rapidly assess the tilted element in active orogens by quantifying the variation of drainage symmetry along the stream length. T-Index was calculated as a ratio of distance between theoretical basin mid-line and actual stream location. Similarly, stream branching ratio (Rb) i.e the ration between number of streams of consecutive Strahler order and stream length ratio (Rl) i.e. ratio between total lengths of stream of consecutive Strahler order were also determined. These ratios were used to calculate fractal dimension using the formula D = Rb/Rl. We intend to demonstrate that T-Index and D is modifying after each deformation cycle. Different parameters i.e. D, T-index, Rb, Rl were plotted agains uplift angle (ß) in order to provide a general understanding about deformation processes. Preliminary results are based on plenty of assumptions e.g. constant lithology and climate. We found that basin tilting is a function of uplift angle and distance from synthetic fault. Similarly, more deformed drainage basins represent linearized drainage systems and their stream length ratio will increase dramatically and affects the fractal dimension.