STRUCTURAL GEOMORPHOLOGY COURSE

Normalized longitudinal stream profile exercise

Prepared by: Bojan Matoš & Bruno Tomljenović

Needed material:
MS Excel
Ruler & paper

Normalized longitudinal stream profiles and their concavity indexes are usually computed to recognize vertical deformations along stream channel. These vertical deformations are possibly product of either active tectonic deformation or possible lithological anomalies which often manifests itself as sharp convex knickpoints. Ideally, the most graded "equilibrium" streams are concave-upward in shape with high concavity (Cf) and maximum concavity (Cmax) close to source area. Normalized profile shapes are considered as dimensionless, giving us opportunity to directly compare streams with variable lengths and gradient.

Workflow of normalized longitudinal stream profile construction:

1. Definition of principal stream channel with its source area and mouth
2. Delineation of stream points (intersections between isohypse and stream channel) with its elevation (e) and distance values (d-cumulative distance from each source point) along analyzed stream channel
3. Normalization of acquired elevation (e/E) and distance values (l/L) for each stream point
    - stream point elevation normalization (e/E) consider normalization of point local relief value in relation to total stream channel local relief value:
      $$\mathbf{e/E} = (e_{point} - e_{min})/(e_{max} - e_{min})$$
    - stream point distance value normalization (l/L) consider normalization of point distance value (from source point) , **l** to total stream channel length value, **L.**
4. Computation of total area under profile curve (*Fig. 1*):
    - it implies application of cumulative trapeze area equation defined as:

$$\mathbf{\Sigma\ trapeze\ area} = \Sigma(h_1\,(b_1+b_2)/2 + h_2\,(b_2+b_3)/2 + \ldots\ldots h_n(b_n+b_{n+1})/2)$$

where ***h*** *is trapeze hight (*$(l/L)_n - (l/L)_{n-1}$*), and* $b_1((e/E)_1)$ *and* b_2 *(*$(e/E)_2$*) are trapeze bases*

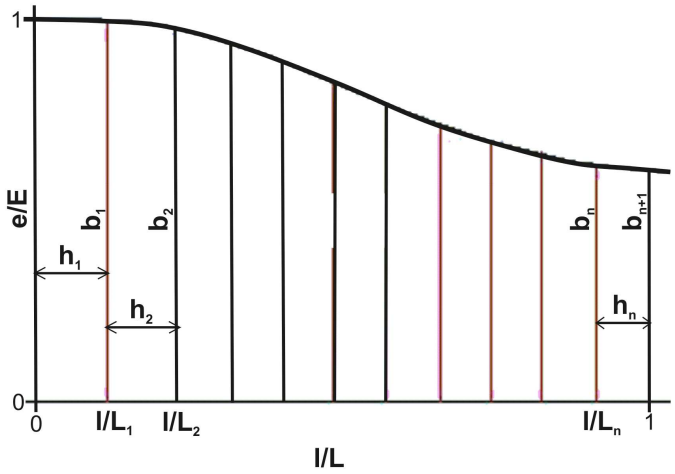

Fig. 1. Schematic illustration of total area under the profile curve computation via trapeze area equation.

5. Computation of concavity factor (Cf), maximum concavity (Cmax) and its position in relation to source area (distance from source, Δl/L) (*Fig. 2*)

6. Construction of normalized longitudinal stream profile graph with outlined values of computed statistical parameters (*Fig. 2*).

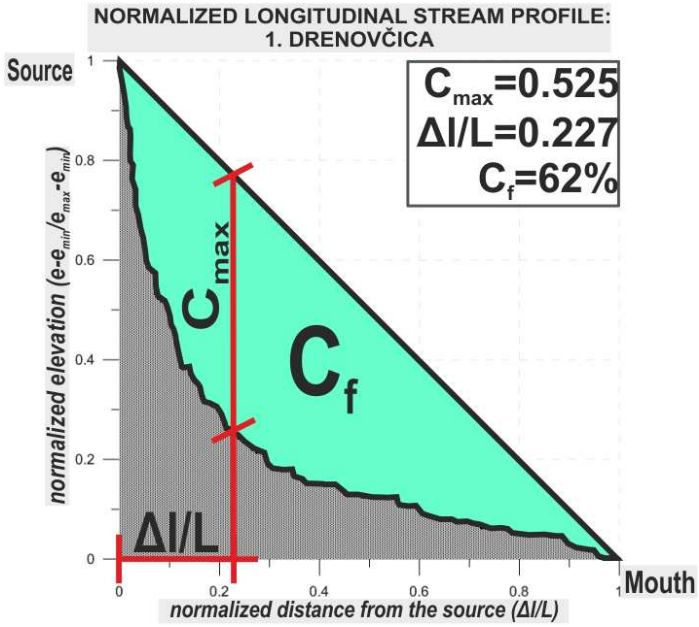

Fig. 2. Example of interpreted normalized longitudinal stream profile with delineated concavity factor, maximum concavity values and its position in relation to source area.