

The topographic grain concept in DEM-based geomorphometric mapping

Edina Józsa

Doctoral School of Earth Sciences, University of Pécs, Faculty of Sciences, Pécs, Hungary (edina.j0zs4@gmail.com)

A common drawback of geomorphological analyses based on digital elevation datasets is the definition of search window size for the derivation of morphometric variables. The fixed-size neighbourhood determines the scale of the analysis and mapping, which can lead to the generalization of smaller surface details or the elimination of larger landform elements. The methods of DEM-based geomorphometric mapping are constantly developing into the direction of multi-scale landform delineation, but the optimal threshold for search window size is still a limiting factor.

A possible way to determine the suitable value for the parameter is to consider the topographic grain principle (Wood, W. F. – Snell, J. B. 1960, Pike, R. J. et al. 1989). The calculation is implemented as a bash shell script for GRASS GIS to determine the optimal threshold for the `r.geomorphon` module. The approach relies on the potential of the topographic grain to detect the characteristic local ridgeline-to-channel spacing. By calculating the relative relief values with nested neighbourhood matrices it is possible to define a break-point where the increase rate of local relief encountered by the sample is significantly reducing.

The geomorphons approach (Jasiewicz, J. – Stepinski, T. F. 2013) is a cell-based DEM classification method for the identification of landform elements at a broad range of scales by using line-of-sight technique. The landforms larger than the maximum lookup distance are broken down to smaller elements therefore the threshold needs to be set for a relatively large value. On the contrary, the computational requirements and the size of the study sites determine the upper limit for the value. Therefore the aim was to create a tool that would help to determine the optimal parameter for `r.geomorphon` tool. As a result it would be possible to produce more objective and consistent maps with achieving the full efficiency of this mapping technique.

For the thorough analysis on the applicability of the proposed methodology a test site covering hilly and low mountainous regions in Southern Transdanubia, Hungary was chosen. As elevation dataset the freely available SRTM DSM with 1 arc-second resolution was used, after implementing necessary error correction. Based on the delineated landform elements and morphometric variables the physiographic characteristics of the landscape could be analysed and compared with the existing expert-based map of microregions.

References:

- Wood, W. F. and J. B. Snell (1960). A quantitative system for classifying landforms. - Technical Report EP-124. U.S. Army Quartermaster Research and Engineering Center, Natick, 20 pp.
- Pike, R. J., et al. (1989). Topographic grain automated from digital elevation models. - Proceedings, Auto-Carto 9, ASPRS/ACSM Baltimore MD, 2–7 April 1989.
- Jasiewicz, J. and T. F. Stepinski (2013). Geomorphons — a pattern recognition approach to classification and mapping of landforms. - *Geomorphology* 182(0): 147-156.