Evaluation of EU-DEM over the Eastern Mecsek Mountains – assessing its applicability for landform classification using the geomorphons approach

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Introduction & Aims

A freely available DEM…

- requirements: accurate, free, unified structure, actual elevation model

…it's evaluation…

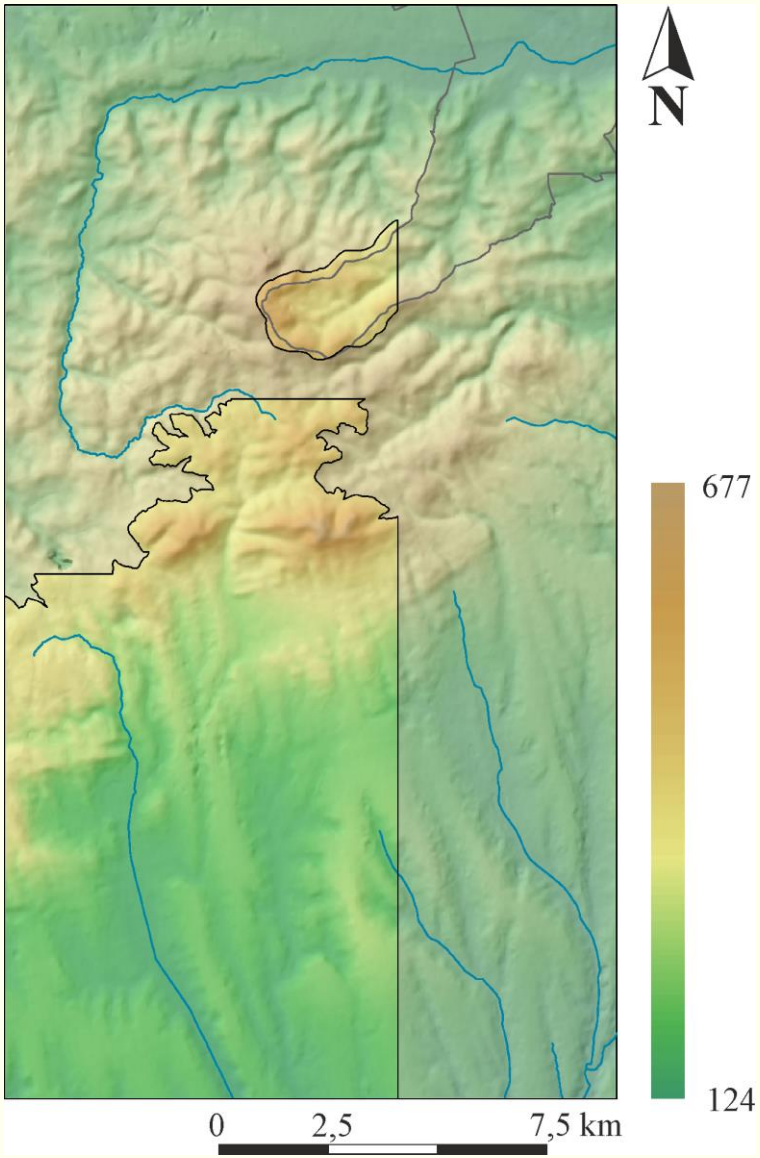
- general and area specific errors
- knowing the geographical conditions – opportunity to correct

…and geomorphic applicability

- use of DEMs in geomorphology
- possibility of numeric comparison of the literature and the „reality"

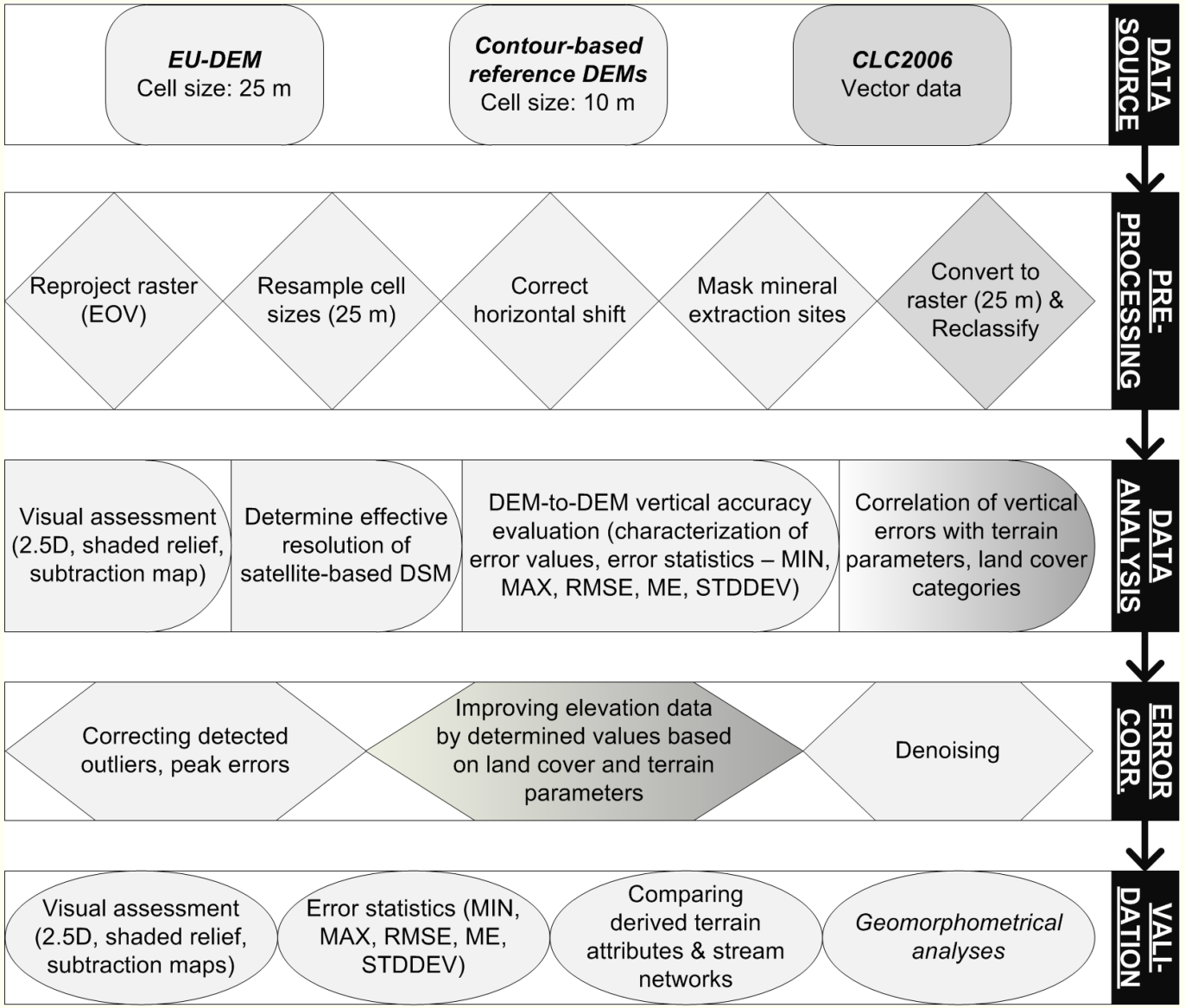
The major goal of the study was to develop a method which allows the user to modify the EU-DEM model in order to make it suitable for geomorphological researches.

The study area



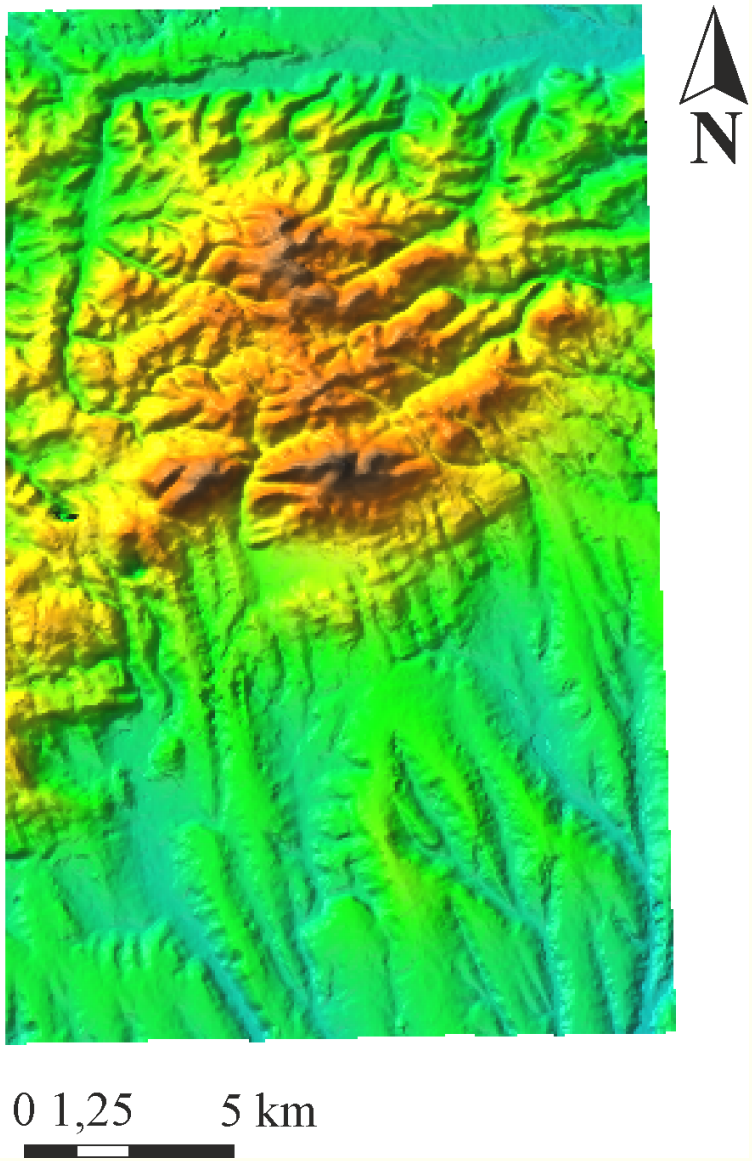
Elevation of the study area shown on the EU-DEM.

Methods



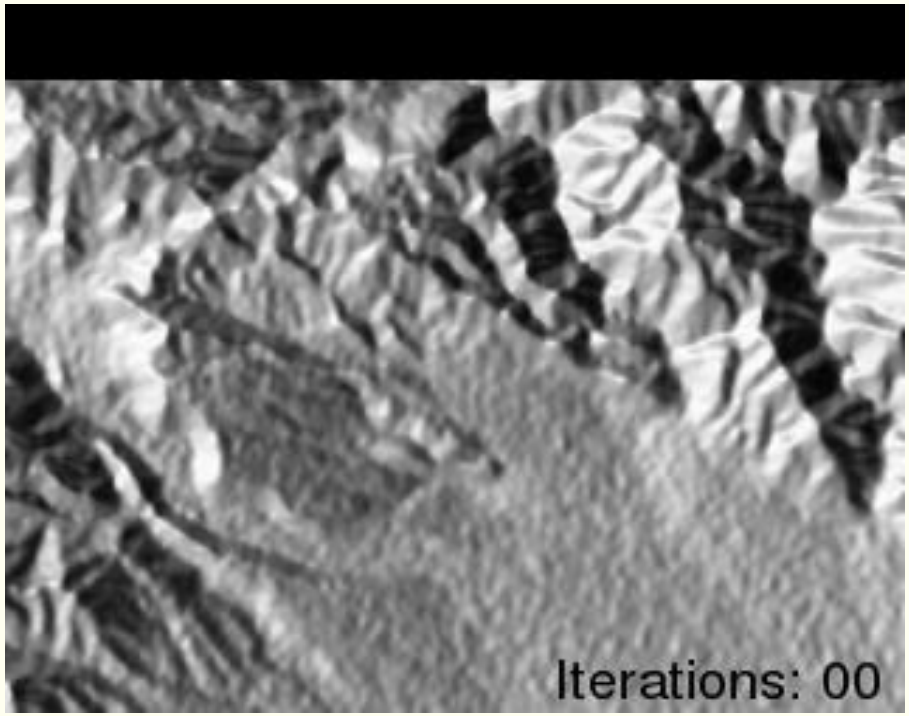
Research workflow.

Results



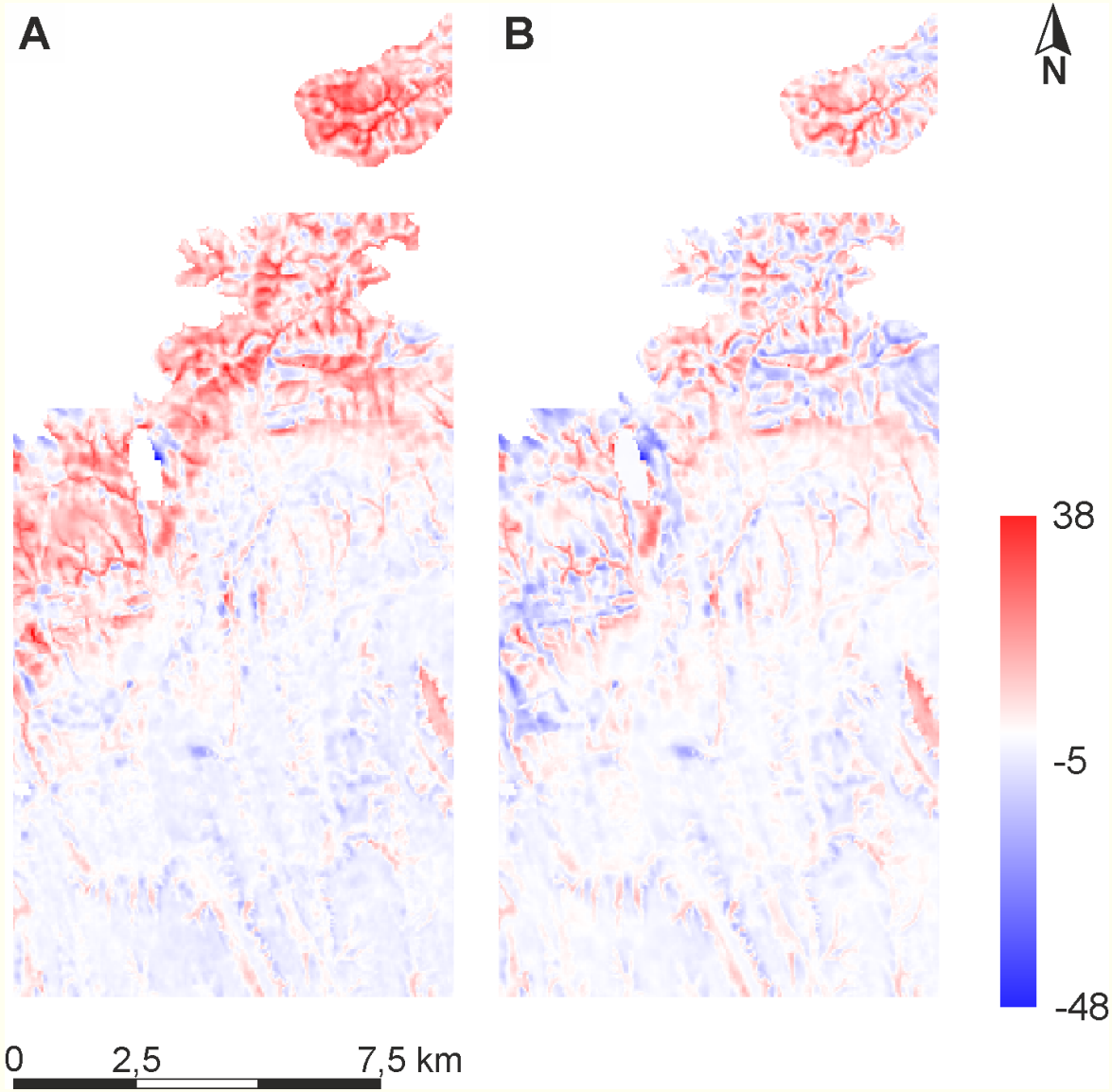
The research area in NVIZ with doubled Z exaggeration.

Results



The working methodology of the denoising method from SUN, X. et al. (2007).
http://personalpages.manchester.ac.uk/staff/neil.mitchell/mdenoise/

Results



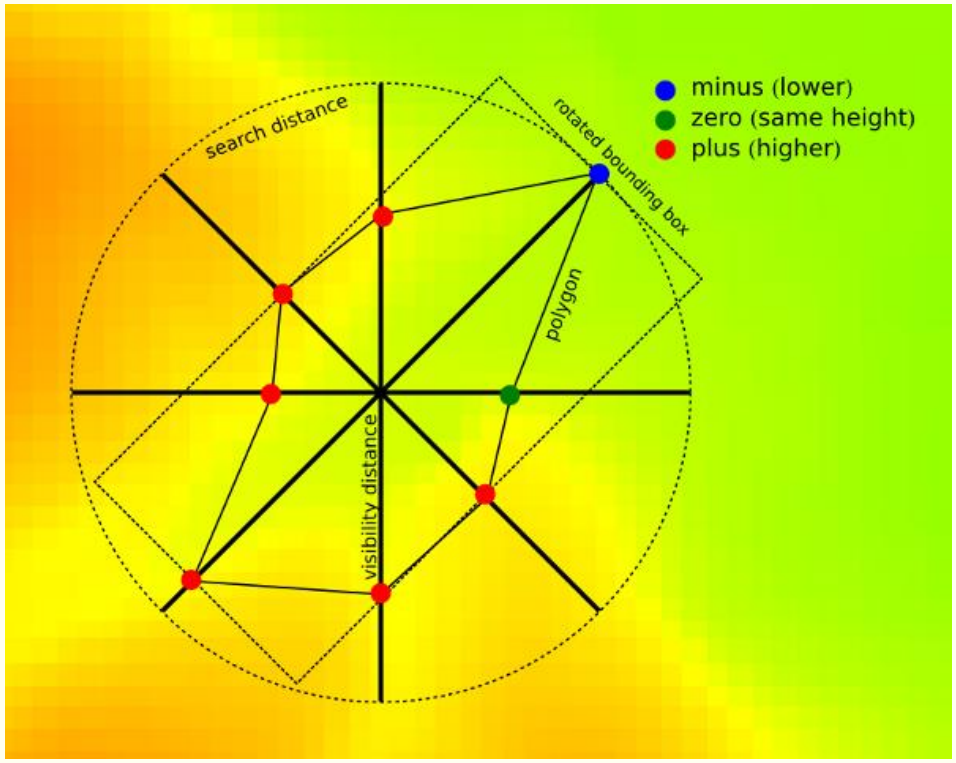
The subtraction map of the EU-DEM and the reference DEMs before (A) and after corrections (B).

Results

	Original EU-DEM	Outlier correction	LC correction	Denoising, smoothing
Min. elev. (m)	123.4	125.8	126.1	127.1
Max. elev. (m)	677.4	677.4	670.9	667.8
Min. error(m)	-55.4	-48.0	-48.8	-47.5
Max. error (m)	43.3	43.3	36.2	37.9
RMSE (m)	7.6	7.6	5.7	5.7
3σ RMSE (m)	6.4	6.4	5.0	5.0
ME (m)	2.0	2.0	~0.0	~0.0
ESD (m)	7.3	7.3	5.7	5.7

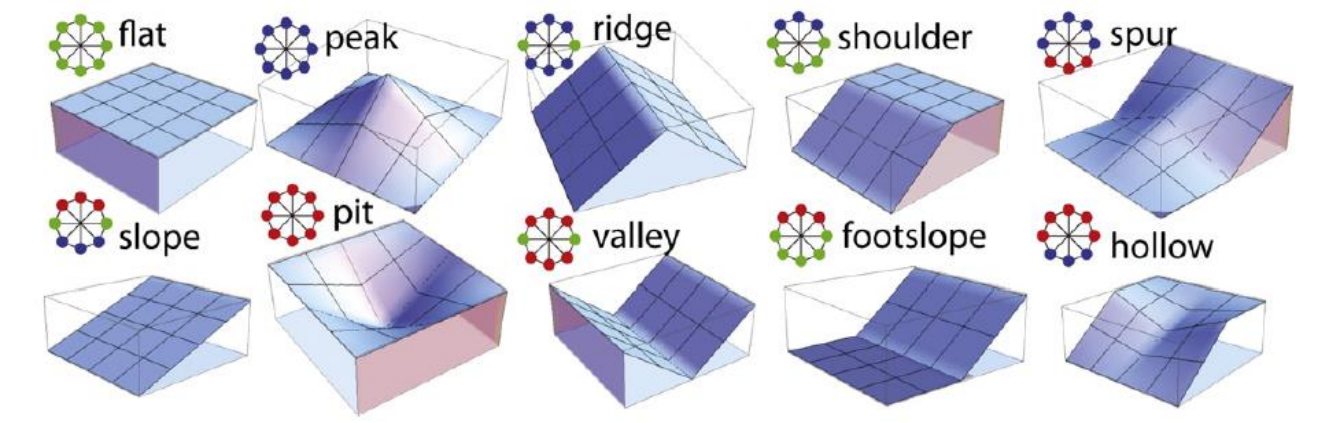
The error statistics of the EU-DEM.

Results

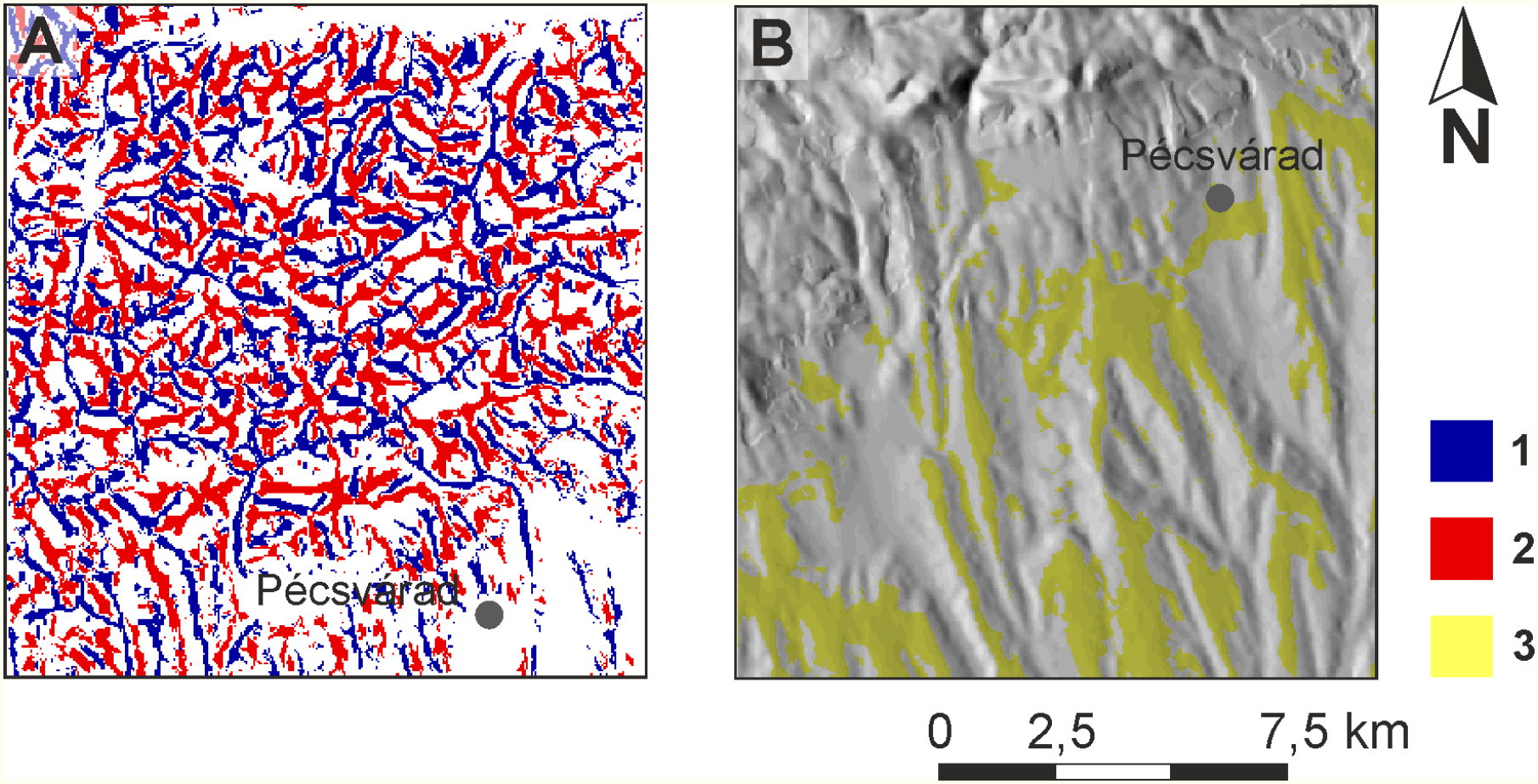


Representation of a geomorphon.
http://grass.osgeo.org/grass70/manuals/addons/r.geomorphon.html

Symbolic 3D morphologies and their corresponding geomorphons (ternary patterns) for the 10 most common elements.
Source of figure: Jasiewicz, J. – Stepinski, T. F. 2013



Results



The valley network and ridge lines of the Eastern Mecsek Mountains (A), and the piedmont-like surfaces stretched on the shaded relief map of EU-DEM (B) based on the TPI map. – 1 = valleys; 2 = mountain tops, high ridges; 3 = piedmont like surfaces

Conclusions

Quality assessment of EU-DEM	*Geomorphic analyses*
• The elevation errors specific to satellite-based DSMs proved to be present on the EU-DEM.	• r.geomorphon add-on proved to be an easy to use, computationally efficient surface analysing tool
• Correcting the outliers, the erroneus height values caused by the land cover and using the denoising method led to a more accurate model, according to the visual and statistical error assessment.	• The selected regions of the southern part appears to be the lower interfluves interpreted as glacis surface remnants between the consequent valleys.
• The results confirmed the improvement of the model. Setting more precisely the parameters of the correction methods could lead to even more reliable outputs.	
• The good match of the generated valley network and analysed landform elements suggest, that despite the remaining errors, the EU-DEM could be a potential height database for geomorphological researches.	

Thank you for your attention!