

## USING GIS TO DETERMINE THE ENERGY OF RELIEF. PATTERN MODULE METHOD

Prof. ALEXANDRU SIMU

The Gr.-Cat. High School "Sfântul Vasile cel Mare", Blaj, Romania

National College "I. M. Clain ", Blaj, Romania

**ABSTRACT:** Geographic information systems allow the development of varied and complex maps and analyzes of geographic components. The quantitative and qualitative results of these analyzes find use in the most varied fields ranging from road and railway systems to land and forest landscaping.

**Keywords:** G.I.S.; energy of relief; S.R.T.M.90; D.E.M; Stereo70; georeferencing; morphometry; Iara;

### 1. Introduction

This study presents a working technique that is used to obtain the statistical and mathematical data necessary for the realization and interpretation of the map of the relief map that underlies the studies and subsequent researches in the field of geomorphology applied.

The area for which this map is made of relief energy overlaps with the basin of the Iara Valley, a tributary to the left of Aries. This basin after the Horton-Strahler classification has the V order and is situated on the eastern flank of the Gilău-Muntele Mare Mountains (Figure.1).

### 2. Stages of work

#### 2.1. The traditional way of working

The traditional method used to determine this morphological parameter implied the use of a rectangular grid system, comprising a set of pans with a surface area of 1 km<sup>2</sup> for each row [1, 2]. The respective carts were drawn on a sheet of paper and superimposed on topographic maps at a scale of 1:25 000. On the basis of the analysis of the altitude differences between the highest and the lower elevations, the altimetric values of the relief energy for each km<sup>2</sup> were established. The values of the quotas were obtained by

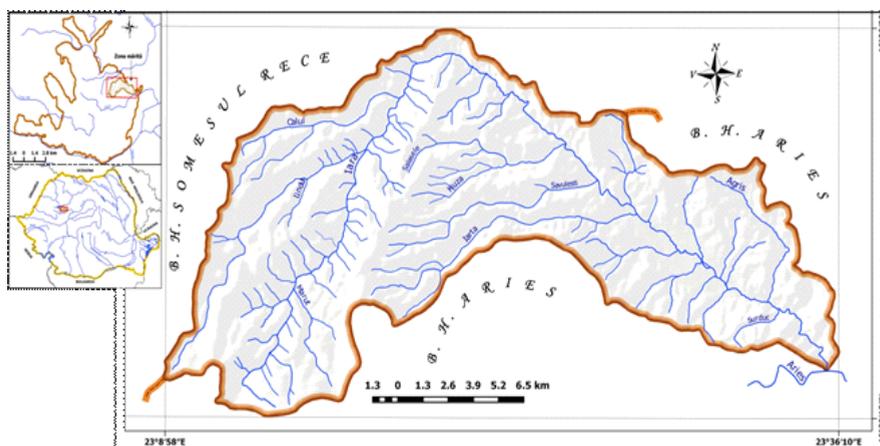


Fig.1 Iara river basin, geographic position

means of the level curve system on the topographic map. In the final stage the cards are colored in pastel style and in the legend the values of the parameter were passed.

## 2.2. GIS technology

This technology involves going through several distinct stages, which we will outline below.

**I.** In order to obtain a relief map it is necessary to have a raster and line vector data package required for the extraction / realization of the numerical model of the land and a package of GIS software necessary for the subsequent processing [3].

**II.** In view of this study, we opted for the opensource QGIS v. 2.18.11 software, downloadable from the organization's website and installed on different platforms (Windows, Linux, Android), and the vector and raster data set containing the baseline traced on the watercourse, the hydrographic network and SRTM90 redesigned in Stereo70 format was downloaded from the official website of the geospatial.

**III.** During the work stages, other vector files (Esri shp.) Will be obtained, necessary for the final processing of the data on the relief energy, for the analyzed area.

**IV.** The practical approach involves the following next steps:

- Choice of project reference system. Given that Romania has its own geodetic reference system, we have opted for it: Piscul Dealul 1970 / Stereo70. Otherwise, when uploading to the workspace of the software, for each raster or vector file, the GIS program requests confirmation of the reference system (Figure 2).
- The stratum containing the SRTM90 is loaded into the project with the whole country. Over this layer the vector layer (Esri shp.) Is loaded with the basin boundaries for the entire Romanian hydrographic network and only the basin or area interested in or the water balance of the previously saved and redesigned Stereo70 basin is selected. Based on this layer, which represents a vector mask, the basal surface to be analyzed (Figure

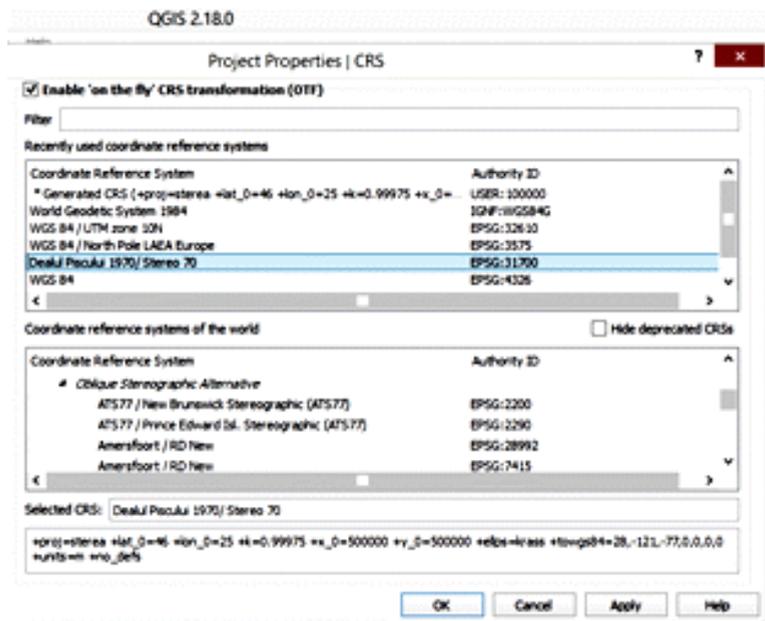


Fig. 2. Interface of the Geographic Coordinate System

3a) of the SRTM90 raster file is cut off. Finally, a raster layer containing altimetric values as shown in Fig. 3 b.

enter the appropriate values and select the mode of subsequent display of the statistical data. We consider that this

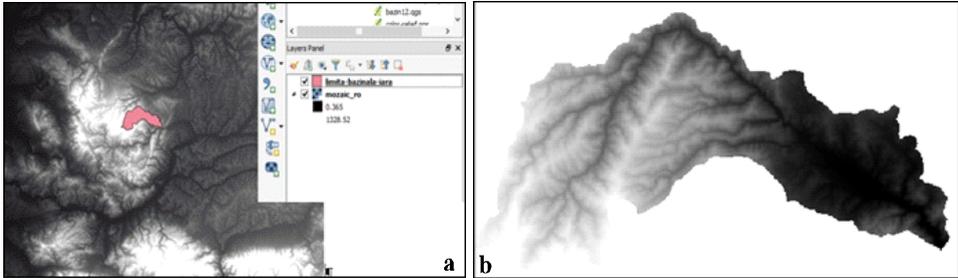


Fig. 3 Overlay of the vector mask over the mosaic SRTM90-Stereo70 (a), and final result, cut (b)

c. The next step involves the insertion of a convenient scale scale so that the vector-resulting raster overlays the workspace as best as possible. At this point the mathematical grid with the area of 1 km<sup>2</sup> will be made, for example. using the Vector> Research Tools> Vector grid menu (Figures 4 a & b),

rectangular grid must be at the level of the cavity of the desktop and not of the vector layer (Figure. 4c). Next, the resulting layer will crop off the contour of water by using the previous vector mask.

d. Calculation of the relief energy values is done with the help of the Geo algorithms

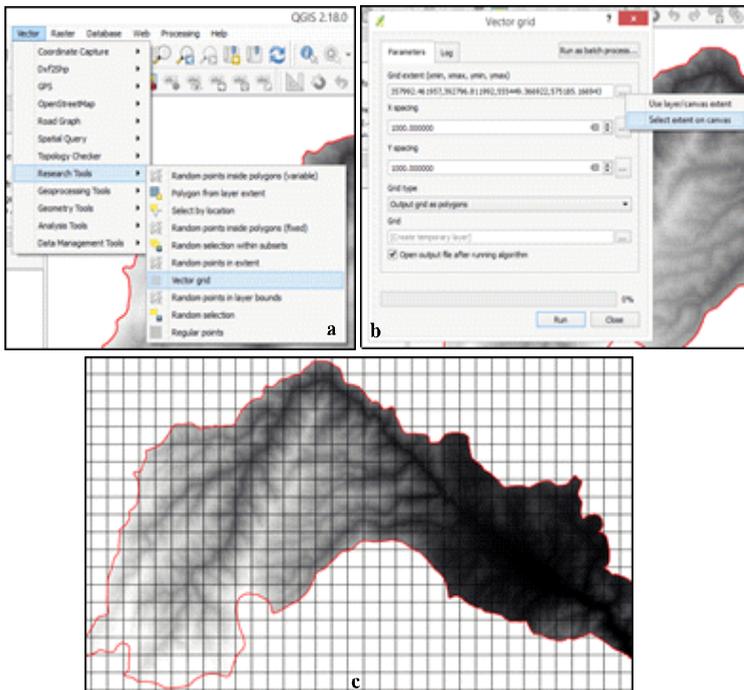


Fig. 4 Making the rectangular grid

in the Processing Toolbox> Raster statistics for polygons menu. Several parameters can be selected in the dialog box, but in our case we are only interested in the Range parameter, which will calculate the difference between the maximum and minimum quota of each cell (Figure 5).

hand, and the degree of deepening / erosion of the hydrographic network, on the other. In this way we obtain valuable quantitative data that highlight the peculiarities of the disturbance, in close correlation with the intensity of the current geodynamic processes, with visible effects in the evolution degree of the relief.

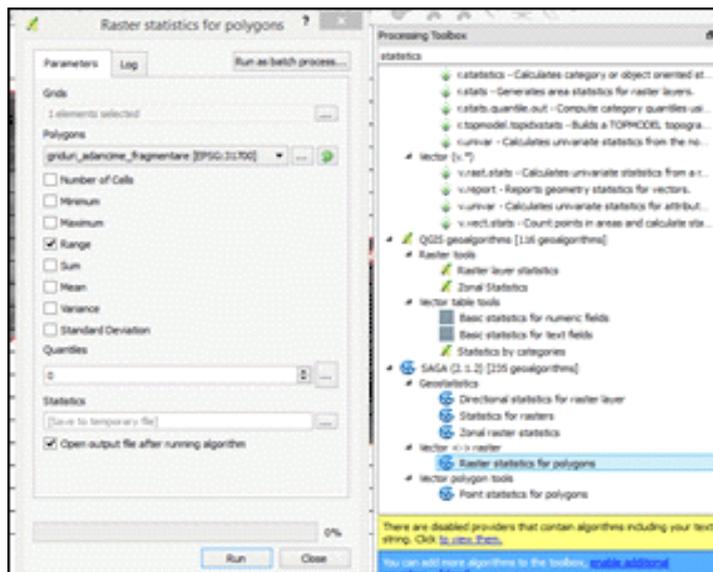


Fig. 5 Geoprocessing Toolbox

- e. Finally, the layer can be loaded with the quantitative values, for the entire workspace canvas and using the method of decoupling after a vector mask, the layer containing the values of the exodus energy can be cut off the contour of the studied area (Figure.6).
- f. The map composer it's uses to make the map, the legend, the scale of representation, etc.

### 3. Results

The result of the investigation of this parameter is the relief energy map (Figure 7). The relief energy highlights the relationship between the geological composition, the basic local level, on the one

For the Iara river basin, there are values ranging from 30 to over 500 m / km<sup>2</sup>. These values are determined by the geological constitution of the Muntele-Mare Massif and the zone of contact with the Colinar Depression of Transylvania, which includes the Iara Depression. Thus, in the mountain area, the predominance of the low and medium values, specific to the Măguri-Mărișel erosion platform, where the erosion speed is slowed by the hardness of the geological substratum made of granite, granodiorite, micaciști, paragnaisse, etc., is observed. Also, values below 100 m / km<sup>2</sup> predominate in the Iara Depression, where the substrate is predominantly made up of soft formations specific to the Transylvanian Plateau.

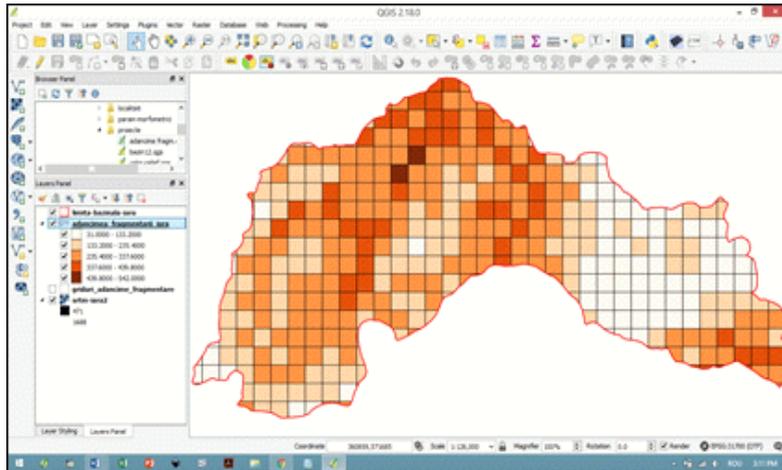


Fig. 6 Stage display and classification of relief energy

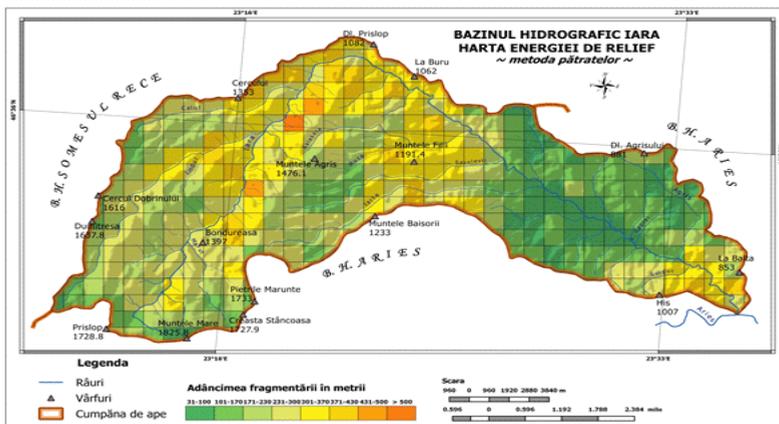


Fig. 7 Relief energy map

The maximum values of 350 - 450 m / km<sup>2</sup> are recorded in the middle of the basin, where the local base level specific to the depression zone imposed an erosion and thus a strong deepening of the river so that the minor bed is located opposite the main peak interfluvial, at altitudes of 800-900 m, peaks separating Valea Ierii, from the tributaries that have their springs on the eastern slope of the Great Mountain (Figure7). At the same time in the confluence area with Arieșul, the parameters of the parameter are large, because the Iara brook grafted the bed over a narrow area where a crystalline

massive is emerging, which requires great energy and geodesivity and for this reason Iara created an impressive gorge.

#### 4. Conclusions

The importance of studying the energy of relief lies in the fact that it highlights the evolution level of the relief, ie the degree of aging. The evolution of the relief forms in time is conditioned by the flow and flow rate of the running waters, the type of rock or geological structure on which the course is grafted, the geodesicity of the slopes, etc. For

the Iara hydrographic basin, we record morphologically the existence of two areas, a mountainous one with a young massive relief, with young, deep valleys, imposed in the landscape and a field that overlaps the Iara Depression, where the substrate made up of the rocks soft, specific to the Depression of Transylvania, imposed a hilly

relief with a low fragmentation depth, low slopes and rounded shapes.

In turn, the anthropic activity is influenced by the characteristics of this morphometric parameter, because urban and road and rail communication systems require many artworks to be placed according to the depth, width and slope of the valleys.

## REFERENCES:

- [1]. Apolzan, C.; Apolzan Alina (2007), *Aspecte ale influenței reliefului în organizarea spațiului municipiului Alba Iulia*, in PANGEEA, no. 7, Ed Aetrnitas, Alba Iulia.
- [2]. Apolzan, C.; Apolzan Alina (2009), *Morfodinamica contemporană a bazinului Ampoiului*, in PANGEEA, no. 9, Ed Aetrnitas, Alba Iulia.
- [3]. Styliadis, A.; Dimen, L. (2009), *E-activities in re-usable GIS applications*, in PANGEEA, no. 9, Ed Aetrnitas, Alba Iulia.

## Used Internet Sites

- 1) <http://www.limnology.ro/water2010/Proceedings/70.pdf>
- 2) <http://forumgeografic.ro/wp-content/uploads/2012/1/Zavoianu.pdf>
- 3) <https://ro.scribd.com/doc/140785403/Bazinul-hidrografic-Teleajen>
- 4) [http://www.silvic.usv.ro/cursuri/ct\\_2.pdf](http://www.silvic.usv.ro/cursuri/ct_2.pdf)
- 5) [http://doctorat.ubbcluj.ro/sustinerea\\_publica/rezumate/2012/geografie/Clivet\\_Claudia\\_Ro.pdf](http://doctorat.ubbcluj.ro/sustinerea_publica/rezumate/2012/geografie/Clivet_Claudia_Ro.pdf)
- 6) <http://www.geo-spatial.org/tutoriale/calcularea-densitaii-fragmentarii-reliefului>
- 7) <http://www.geo-spatial.org/download/modelarea-digitala-a-terenului>
- 8) <http://www.geo-spatial.org/download/romania-seturi-vectoriale>
- 9) <http://www.geo-spatial.org/download/datele-srtm90-reproiectate-in-stereo70>
- 10) <http://forumgeografic.ro/wp-content/uploads/2009/8/Zavoianu.pdf>
- 11) <https://vasileloghin.files.wordpress.com/2014/03/elemente-de-geomorfologie-fluviatila.pdf>
- 12) <http://www.qgis.org/en/site/forusers/download.html>
- 13) <http://www.geo-spatial.org/tutoriale/decuparea-unui-set-de-date-grid-folosind-o-masca-vectoriala>
- 14) <http://geografilia.blogspot.ro/2012/06/tutorial-saga-gis-adancimea-fragmentarii.html>
- 15) <http://www.harti.co/harta-adancimii-fragmentarii/>