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THE APPLICATION OF DIGITAL TERRAIN MODELS IN GEOLOGY

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ABSTRACT

The optimal mathematical solution of lytostratigraphie /hystorical construction of soil is found out on the particular selected model.

The components, showed by the spatial - soil systems are searched together with geomorphological parametrs; there are found out the internal connection and the system is computerised.

The developed methodology is tested out on the selected example.

1. General

The use of electronic digital computers is drasticaly widened research , operational and other activities. Great part of the activities dealing with the land use are connected to existing terrain. For computer analysing and planning also the terrain has to be in corresponding digital form /DTM/.
The determinations of the terrain parameters, used for different computer applications are usually subjective. They may be simple or complicated depending on the nature of the problem to be solved.

In the Institute of Geodetski zavod SRS the digital terrain model has been obtained by the well known method of digitising the contours; this is the reason that the method itself /type of digitising, transformation used, data organisation/ is not the subject of this paper.
The main intention of this contribution is to show the use of DTM for particular geologic application.

2. Problem formulation

2.1. Parameters

The solution of the problems, connected to a process of computer geologic interpretation needs the extensive study of geomorphologic parameters. These should be adaptable for the terrain clasification based on the description of the particular parameter in the grid cell of DTM.

2.1.1. Maximum, minimum and Mean Terrain Elevations.

The parameters, indicating the absolute heights are used for analysing the areas with different terrain characteristics. In this case the parameters are identical with absolute heights in the corner points of a grid cell.

2.1.2. Terrain amplitude

The parameter, determined by the difference betwen the highest and lowest point of the particular area is "relative" or "local" terrain. Combined height differences in the characteristics interval are showing the areas with equal values of the terrain amplitude.

2.1.3. Average slope

Important parameter of the soil development /used for analysing the areas of different soil characteristics/ is the terrain slope. The particular stones are differently resistant againts the activity of atmospheric influences, resulting in their different physical and chemical characteristics.
Hard stones build up the positive forms of steep slopes which results /becouse of their greater resistance against mouldering/ also in different morphology. Such sort of stones are dominating in the terrain as isolated peaks or ridges. Softer sediments, non resistant against the activity of atmospheric influence generate gentle terrain forms of low degree of slope.

2.1.4. Slope direction changes /Slope reversals/.

Usefull information for geologic interpretation are the data on degree of terrain relief dissection registered by the azimuth of the slope direction. It is understandable that the process at marl and limestones of the same kined because of their physical and chemical characteristics of mouldering had an easy way. The erosion therefore had an great influence, resulting in heavy ridgeness.

The dependance between geomorphologic parameters and land soil systems is based on theoretical development of topographic forms for different values of parameters.

Eeach parameter for itself does not give complete base for analysing of area; their corresponding combination represent the base for morphologic clasification. The processing is based on theoretical development of topographic forms in combination with all parameters /fig. 1/.

2.2. Mathematical model

The numeric analysing of the soil should be based on the corresponding mathematical model.
The slope and asimuth should be determined for each elementary grid cell. Therefore adjustment plane is determined for each grid cell. It has the form:

$$z = ax+by+c$$

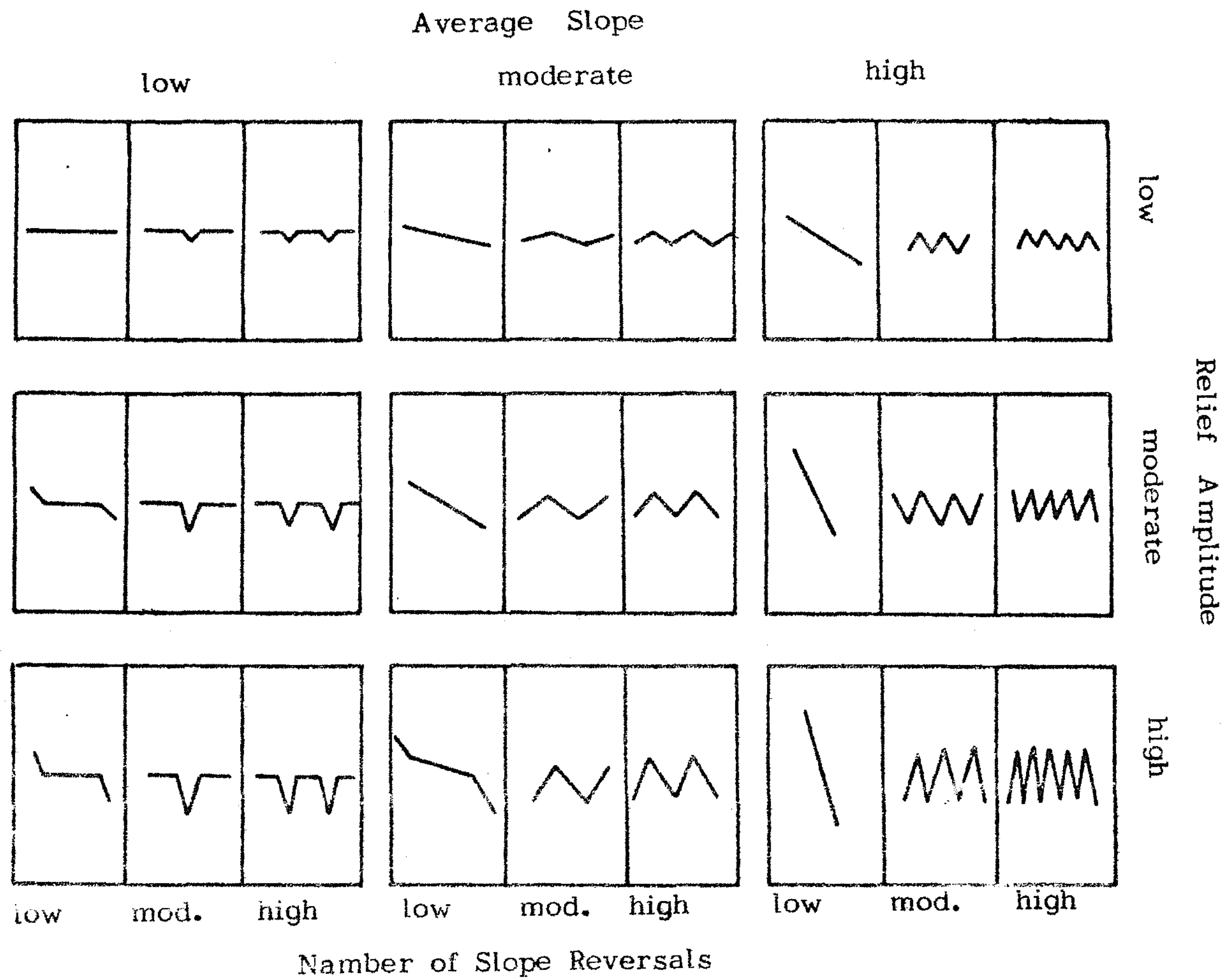


Figure 1

Combinations of all three geomorphological parameters: average slope, relief amplitude and slope reversals are represented by theoretical topographic profiles in the elementary grid cell.

where z - height in DTM

a,b,c - plane parametrs

The slope is computed using the folloving expression:

$$tg\varphi = arctg\sqrt{a^2+b^2}$$

3. Conclusion

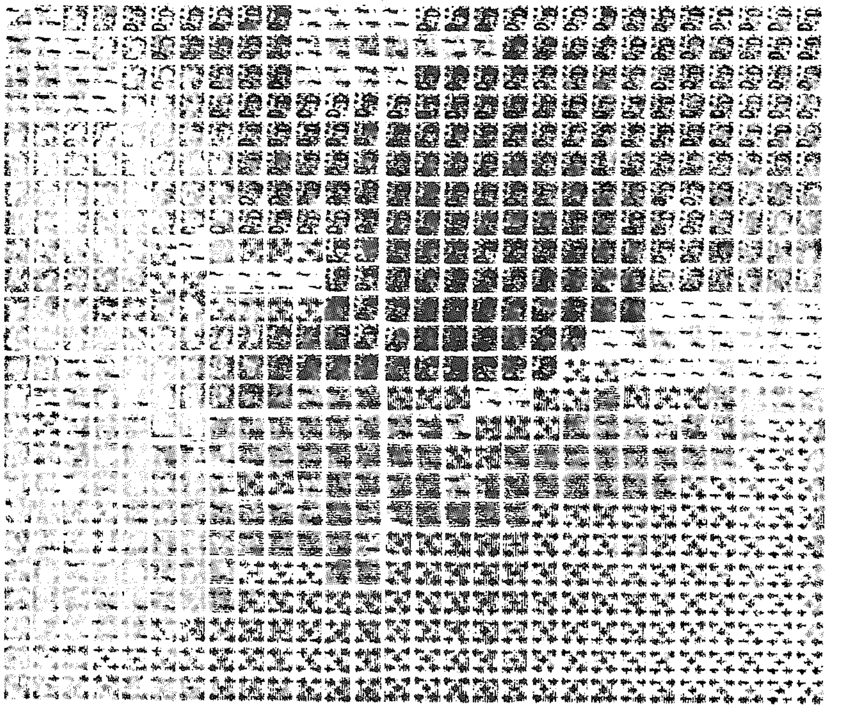
The described methodology has been tested on the area 1,5 x 1,5 km

The area consists of tertiary sediments which are widening in longitudinal bands from west to east and they belong to middle and upper teritory lime-stone and marl. In the southern part of area lies in the base lime-stone with lithotamnium.
Towards south the lime-stone passes on to marl, wich also belongs to middle miocene sediments.
According to age the sarmat layers occupy the lower places. The altitude of these layers changes from 381 to 419 m.
As it can be seen the height differences in the area are small and do not exceed 40 m. /relative height differences/.

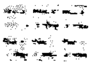
The following system is represented by middle miocene lime-stone and marl, making foundation of younger sarmat layers.
The area under this system is located on the height 419-618 m a.s.l. Somewhat higher position is occupated by lime-stone with lythotamnium of the same ege.

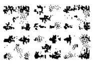
The results of the computer soil analysing show that the sequence of lithostratigraphical units depends from tha age of lithology, important rules are showed also in the degree of slopes and in the degree of terrain relief dissection with characterics of litological base.

DTM 50 x 50m



 marl M_3^2

 marl M_2^2

 limestone with lythotamnium M_2^2

Computer analysing of the selected area according to lithostratigraphic characteristics

M 1:12500

Figure 2

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