

ESTIMATION THE MUDFLOW PROCESSES IN THE MOUNTAIN AREAS OF AZERBAIJAN

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Despite the development of high technology decisive methods for the study of hazardous emergencies till now are not received. One such of problem - to explore the formation of mudflow processes, to define and simulate the hotbed mudflow with use the modern technology and with of space images, develop science-based methods.

Flooding, at a very high concentration of mineral particles, stones and fragments of rock mountain that occurs the resulting heavy rains or rapid melting of snow called mudflow processes.

To predict and prevent the falling of such flows necessary is carried the regular monitoring and to research the processes of mudflow, and the hotbed its formation. In this activities invaluable assistance was rendered to us modern software GIS technology and the data of GNSS, to allowing the complex analysis of the conditions of formation of mudflows and to assessed the impact of their descent. As the investigated object, was selected river basin Kish of Azerbaijan Republic (Fig.1, a).

For investigation of the test areas the mudflow of dangerous region was used the various resource of information, including the cartographic materials, the topographic maps of investigated objects, the data Remote Sensing, the different description (Fig.1, b). This resource was used for fulfilling GIS, for conducting researching, for the creating different thematic maps and the maps of hotbed mudflow.

It is known, that the river basin of Kish of Azerbaijan over the last 80-100 years have seen increasing activity mudflow processes, caused by deforestation, by destruction of vegetation and by increased erosion processes on the slopes. Here the mudslides are formed annually and produce destruction of populated point, ways of transport, and agriculture areas. There are many hotbed of mudflow, which occupy large areas [1]. This is give possibility for formation mudflow processes by high intensity.

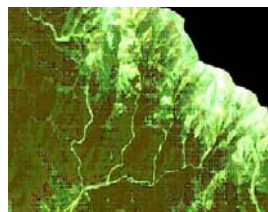
In order to set the danger of formation of mudslides, it is necessary to determine the source of mudflow hotbed. And therefore in this work is developed the method for determining the hotbed of mudflow in the mountainous areas.

At first, with the use of topographic maps of the object and the modern GIS software - technology was created a digital relief model (Fig.2). Because, the basis for the GIS of mudflow areas has been the data of Remote Sensing (RS) (Fig.1,a) and the topographic maps of studied regions (Fig.1,b), a digital relief model (DRM), which is a GRID with a spatial resolution. Using these data (data of RS, data of GPS-measurements, data of DRM, and derived from topographic maps, and data of statistics) had collected to the database for creating the thematic maps.



a)

Fig.1. a) The topographic map of the basin river Kish; b) the space image of the basin river Kish



b)

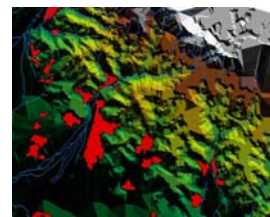


Fig.2. Digital relief model of the basin the river Kish

We knew, that for formation the strong of mudflow processes must be created the corresponding geological, geomorfological and climate condition, the object of soil and vegetable must be to suitable to creating the mudflow processes [2]. The geological situation is ensure the mudflow processes with destructive stones of the basin from mountain. The geomorfological situation is creating the stream with great concentration and this flow is spreading quickly. In the soil is leaving the processes of denudasion and weathering, and this factor is reason for forming the mudflow processes. The climate is creating the situation pouring of raining and to the continued lasting period of drought. Kind of vegetable object and his external view depended of his density and composition from the root, all this is impacting to the mudflow processes with different form. If disturbed accordance some of this 5 condition, then will not formed the strong mudflow processes.

Therefore, we studied the objects of vegetation, soil and geological, geomorphological structure of the river basin of Kish on the various published data, aboveground measurements and data derived from space image. With the decoding, interpretation and classification of satellite image acquired new, updated materials on the investigated area. On the received data have created various electronic maps - geological, geomorphological, land use, soil and vegetation - investigated region by means of GIS-technologies. With use of data received from global navigation satellite system (GNSS) was filled a database by new information (table 1 and 2. Was shown only 2 from 5 table). And with use this information was updated the maps, which has received. Two maps of all received of 5 maps (fig.3) shown below. Entrance information and results was collected in a database (Tabl.1 and tabl.2).

Table 1

Geological structure of the basin river Kish

№	Name of rock	Height, m	Slope , °	Existing area	Situation of the danger (under system of 5 ball)
1.	Clays, sands, lime a few	2600-3600	40-80	The area lower of the river Damarcin, top and middle areas of the rivers Cuxadurmaz, Sariguney and Qaynar, north of the village Kish, middle of the river Kish	5
2.	Clay-siderik layers group	1600-2860, at times ≤3000	30-45, at times 50	Near the rivers Cuxadurmaz, Donuzca, Qaynar, Sariguney, Damarcin	4
3.	A bunch of the layers of clay	1700 – 2550	25-38		
4.	A bunch of the layers of quartz -rock	1600-1835	15-30	In the area near a combining branch of the rivers Damarcin	3
5.	Mergel-Clay grey colors			In the basin of rivers Sariguney, Damarcin, Qaynar	
6.	The big and fine sands of stony	≤2000	≤20	In the middle areas of river Damarcin, between of the village Kish and Oxut	2

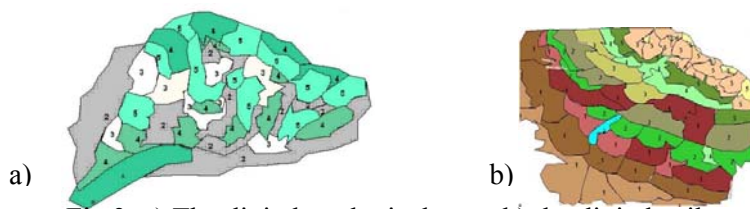


Fig.3. a) The digital geological map; b) the digital soil map

Table 2

The species of soil for the basin of river Kish

№	The species of soil	High, m	Slope, °	Situation of danger
1	The mountain-forest soil, of the dark-brown	800 – 1000	10	1
2	The soil of brown	1000 – 1200	10 – 15	
3	The soil of brown and red-brown	1200 – 1300 (at times 1700)	15 – 20	
4	The soil of red and red-brown (the beech zona)			
5	The soil of light-yellow and light-lime	1400 – 1700 (at times 1900)	20 – 25	2
6	The soil of lime	1600 – 2000 (at times 1500)	25 – 40	3
7	The soil of weathered			4
8	Pass to the mountain-meadow			
9	The zone of mountain-meadow	1700 – 2300	30 – 45	5
10	The soil of naked	2300 – 2800	45 – 60	
11	The soil of non-developed	top from 2800	45 – 60; 50 – 80	

Based on these data and the maps were developed combined maps. All these processes conducted according to the following structure (Fig. 4).

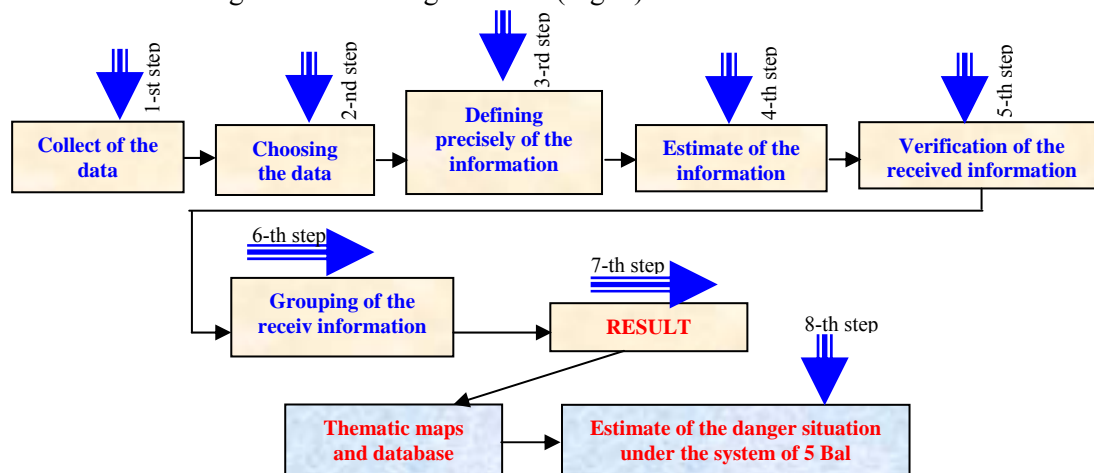


Fig. 4. Structure of the creating combined map’s and estimating danger situation of mudflow processes

All objects which danger of mudflow was estimated by 5 points are together grouped, 294 layers have accepted as formation sources the mudflow processes. In the end of this work has been received digital maps together with sources the mudflow processes and with other layers (Fig.5,a).

As a result turned out, that the sources of mudflow can be formed in those places, where the danger condition of mudflow processes had received on 5 ball in all objects (soil, vegetation, geological, geomorphological, land tenure).

Often enough in the course of work required visual comparison of two and more sources. And consequently, we compared the maps of mudflow obtained with field studies and with our methods. As a result, came to the conclusion that obtained with our methods the hotbed of mudflow more accurate (Fig. 5, b).

For verifying of the offered method, obtained us hotbed of mudflow, was compared

hotbed of mudflow, which was defined by M.S.Gagoshidze. When was appeared the mudflow processes, at the time for the defining the sources of mudflow Gagoshidze was in the basin of river Kish. He had learnt characteristics of the territory of basin of river Kish and processes of mudflow by the field investigation, by measuring the volume debris of mudflow and on the basis of thoughts indigenous population, and in the result he has defined the hotbed of mudflow. This process both have taken a lot of time and has demanded many finances means. But the new method, that we offered, is defined the hotbed of mudflow more exact and is demanding less means and less finances.

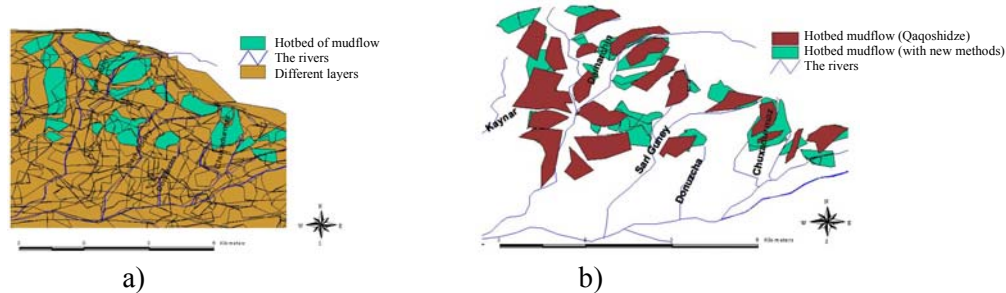


Fig.5. a) Maps of the hotbed of mudflow with other layers on the basis of river Kish, b) map comparison of two sources

That is to say, with use opportunities of the modern program of GIS technology, the data from GNSS, space images of high resolution and information by received from sources literature published in the different years, had defined territories, which arised the dangerous processes of mudflow, estimated dangerous region of mudflow processes on system of 5 bal, was defined the hotbed of mudflow.

Comparison have been shown at the fig. 5(b). Hotbed mudflow from Gagoshidze been indicated in the brown colour, but hotbed mudflow which I received, been indicated in the green colour. The apparently from the picture, hotbed mudflow have coincided in many places. Hotbed mudflow which received by us, is been more exact. Turned out that new method, where I offered, has justified yourself.

Prepared structure of GIS can be apply for geoinformation of mapping of mountainous regions. By using the proposed method can predict the mudflow processes, to prevent the danger of the mudflow. Basic practical importance of the new method is that for define the hotbed mudflow in the investigated territory is requested less labours for and less finances means and may be inform the population about this possible.

In the result, may be putting limitation grazed cattle, prevent felling tress without a plan in the same territories and strenght of the soil to be possible to raise greatly. At the same, in the same territory can be plant a new trees, can be clean the debris of mudflow, which gathered in the valleys of river.

References

1. Budagov B.A. Genetical classification the hotbed of formation mudflow (in the example river Kish), Baku, publish. A.R., volume 17, N4, 1961, pp. 35-42.
2. Sh.F. Muttalibova, I.R. Bakhishov. Exploration of the relief and physical-geographical characteristics of southern slope of Big Caucasus on the basis of GIS-technologies. News of National Aerospace Agency of Azerbaijan. Baku-2008, pp. 27-32.