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CHARACTERISTICS OF EXODYNAMIC PROCESSES IN THE NAKHCHIVAN RIVER BASIN

Abstract. In the article, we attempt to characterize adverse natural phenomena in terms of intensity in various river valleys of the Nakhchivan river basin. In the Nakhchivan river basin, flood events attract significant attention due to the damage they cause to populated areas and the economic system, as well as the repetition of widespread hazardous natural processes. The villages of Bichenak, Kolani, Daylagli, Selasuz and the city of Shahbuz are most exposed to the risks and dangers caused by flood flows. Stabilized landslides of ancient and relatively recent origin have developed in almost all river valleys of the basin. The zone where the landslides spread most actively covers the upper part of the Nakhchivan river basin, the Batabat massif, the Bichenak forest, the middle course of the Kuku river, the settlements of Kechili and Zirnel. Both glacial and debris landslides are widespread here. The factors that cause avalanches in the area differ between low mountains and high mountains. Thus, while in some places frost weathering plays an important role in avalanche formation, in other a sharp change in temperature, the physical and chemical composition of rocks, vegetation, color affecting the heat capacity of rocks, lithological bedding, slope exposure, and degree of inclination, etc., also plays a role. Through the joint analysis of satellite images and field research, for the first time in the basin area, we distinguished some of the dangerous exodynamic processes and were able to prepare maps of them.

Keywords: natural-destructive processes, flood flow, landslide, avalanche materials, anthropogenic impact, space images.

Introduction. In the modern ecological-geographic division of Azerbaijan, the studied area is characterized by belonging to very tense and tense ecological-geographic zones. The complex geological and surface structure of the basin, especially its surrounding by mountain ranges, its location in different natural zones, as well as the sharp change in inclination depending on the orography, have a fundamental impact on the development of dangerous natural processes of various genesis, especially hydrometeorological dangerous processes. At the same time, the density of population and the concentration of economic subjects here, the spontaneous and unscientific anthropogenic intervention in the structure of geosystems create favorable conditions for the disturbance of the ecological balance in the landscapes. The active involvement of the majority of the territory in the tourism economy cycle has accelerated the anthropogenic loading and intensive exploitation of natural landscapes in recent years. This, in turn, leads to the emergence of a number of undesirable changes and an increase in the strength and intensity of recurrence of risky natural disasters.

River valleys, which are the result of hydrodynamic processes, are one of the main landforms here. The structure of river valleys also changes depending on altitude. The river and its numerous tributaries pass through mountainous terrain torn by intense erosion along its entire route, up to the mouth of Jahrichay. This division is more evident from the source part to the junction with the Zarnatunçay river.

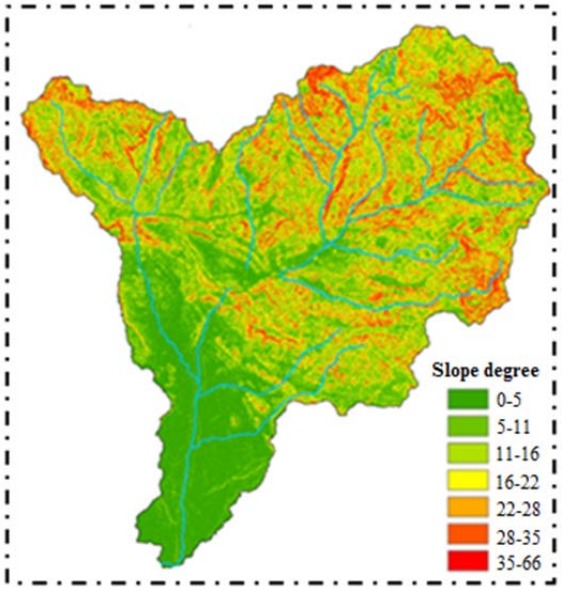

Figure 1 –
Propensity map of Nakhchivan river basin based on GIS

V-shaped valleys sometimes narrow up to 5-10 m and sometimes widen up to 30-50 m. Other rivers flowing into the main river in most cases flow through deep and narrow gorges, forming cones 80-120 m wide only at the mouth. In the lower parts, the height of the slopes reaches 600 m and their slopes go up to 40-60°. Although the maximum indicator is recorded as 66° in the GIS-based slope map (figure 1), the slope sometimes reaches 90° in places where valleys narrow along the river. In such places where the slope is high, slope erosion becomes active, causing the formation of dry streams with a depth of 70-150 m every 200-400 m.

Like other river basins of the autonomous republic, the slopes are devoid of vegetation in many places. Only near Bichenak, there is a forest cover of 2500 hectares, which is not specific to the region [1].

In addition to the climatic conditions and the density of the river network due to the orography of the region, the dominance of gravity-slope processes has a stronger impact on the formation and dynamics of floods, increasing the ecological stress of the basin and causing serious damage to the country's economy.

Lithological and petrological structure of the basin Although it consists mainly of volcanogenic and volcanogenic-sedimentary rocks, landslides are observed. Since this region has a seismicity of 9 points, it is considered a dangerous area in terms of landslides.

The factors that cause avalanches in the area are different from low mountains to high mountains. Thus, while in some places, frost weathering plays an important role in the formation of avalanches, in other places, sharp changes in temperature, physical and chemical composition of rocks in another area, vegetation, color affecting the heat capacity of rocks, lithological bedding, exposure and degree of inclination of the slopes, etc. plays a role. In a number of cases, excessive rainfall in the area can be considered as an additional factor in the occurrence of avalanches. Thus, on March 18-19, 2024, as a result of the intense rains that fell on the village of Bichenak, large pieces of rock fell near the bridge of Zarnatun and caused traffic restrictions on the highway (figure 2).

Figure 2 – Bichenak village of Shahbuz region (19.03.2024)

In this respect, the study of geodynamic processes and their impact on economic objects remains a constant problem in the Nakhchivan Autonomous Republic with complex natural conditions.

Learning level of the problem. In the field of ecological geomorphology, which has recently been developed as the most modern and promising direction of general geomorphology, D. A.Timofeyev, Y. G.Simonov, S. K.Gorelov, V. I.Krujalin and others in Azerbaijan and its separate regions H. A.Khalilov, E. K.Alizade. S. A.Tarikhazar, X. K.Tanriverdiyev, A. S.Safarov and others conducted research and obtained relevant results. Although the object of research is a geologically and geomorphologically studied area in the autonomous republic, natural destruction processes are not studied almost to the required level. Separate informationt appears in the works of S. Y. Babayev, S. O. Alekbarova, T. N. Kangarli, R. M. Qashgai and N. S. Bababayli E. K. Alizade, H. A. Khalilov, S. A. Tarikhazar, Z. A. Hamidova and others. [2-10].

Studied area. Located in the central part of the Nakhchivan Autonomous Republic, the river system with a symmetrical basin is surrounded by the Alinja river from the east and the East Arpachay basin from the west. The source part is located on the southern slope of the Darelayaz range, and the main tributaries located at the source are located at the watershed of both Darelayaz and Zangezur mountain ranges and their side slopes [11].

Research aims and objectives. The main purpose of the study is to evaluate the intensity of negative natural phenomena in individual river valleys of the Nakhchivanchay basin.

Material and methods. During the research process, scientific studies, recommendations and results of scientists conducting research in the Nakhchivan Autonomous Republic, current materials of field scientific research, as well as multi-regional space photography, lactation and spectral shots and large-scale topographic maps were used.

Analysis and discussion. Flood flows are considered an extreme form of water erosion in mountainous conditions. They damage the economy by millions of manats in individual years and disrupt the rhythmic activity of the economic complex. In some cases, it results in deaths and injuries. One of such catastrophic events took place on 21.07.2005 in the Ghabab river valley [12]. During the incident, 2 people were killed in addition to serious damage to private houses and yards. This event once again proves that the study, evaluation and forecasting of floods for various purposes is always relevant and the organization of continuous measures against them should always be in the focus. Unfortunately, this natural phenomenon is very difficult to predict due to the sudden occurrence of floods. A lot of research work is being done in this field both in Azerbaijan and in different countries of the world [3, 13-15]. However, despite these, the issue of forecasting processes has not yet been resolved.

Recently, flood research methods have been updated and improved, and the most complete of these methods is the visual and instrumental processing of aerospace materials. Visual and instrumental processing of multi-zone spectrozonal images facilitates a detailed analysis of the natural environment and a number of processes taking place there (the dynamics of the development of floodplains and their impact on settlements) and is considered very promising from both a scientific and an applied point of view [16].

With the help of space information means, it is possible to weaken the effect of the disaster caused by them by recording the parameters observed in the atmosphere and actively causing floods (heavy rains). However, the scale of spontaneous events continues to expand in the Nakhchivan river basin, as in recent years throughout the world. For example, the reduction of water in river valleys results in the construction of residential houses and tourist facilities near river beds, and in some cases even on river beds. At present, this process is observed in many river valleys, mainly in the villages of Bichenak and Kuku, where tourism is widespread. Building constructions in the transit and accumulation zones of flood flows without thinking of the population and without carrying out certain planning, it is inevitable that a large amount of material damage will be accompanied by serious social and ecological consequences. From this point of view, the population should be constantly educated about the probability of occurrence of this type of natural destructive processes and the scale of emergency situations that may arise in connection with it, their warning system should be created, as well as regular measures to combat natural disasters should be taken. Because, due to global climate changes, due to long periods of dry weather with little precipitation, we observe a large amount of flood material accumulated on the slopes, which is fragmented and ready for denudation. Reading University meteorologist dr. Rob Thompson likens the effect of rainfall after a prolonged drought to pouring water at high speed on concrete. Therefore, this natural phenomenon can occur in the pre-flood period with sufficient soil moisture, but also after a long dry period.

The occurrence and destructive capacity of floods is primarily related to the amount and intensity of precipitation. However, the amount of precipitation that causes floods is not the same everywhere. This is confirmed by the analysis of research materials conducted in different regions of the world. For example, floods often occur in the Carpathian Mountains during daily precipitation of more than 30 mm, and in the Crimean mountains during daily precipitation of more than 40 mm. In the Nakhchivan Autonomous Republic, this ratio is 20 mm [17].

The main reason for this diversity is the inclination of the slopes, hydrothermal and botanical factors. Thus, in the mountainous zone of the autonomous republic, floods can occur even during less rainfall, as inclined and crumbly slopes, where bare rock outcrops come to the surface, dominate.

The chronology and analysis of flood events show that from 1945 until today, there have been 21 strong flood events in the Nakhchivan river basin. In particular, the years 1949, 1969, 1972, 1974, 1986, 2000, 2012 are more distinguished by the activation of floods [3, 18]. Relatively weak floods occur almost regularly in some river valleys. But on average, these rivers cause catastrophic destruction every 10 years.

From the analysis of our research materials we came to the following conclusion: Bichenak, Kolani, Daylagli, Selasuz villages and Shahbuz city are the areas most exposed to the risks and dangers caused by flood waters. The flood risk is low in the settlements of Kuku, Kizil Kishlaq, Yukhari Kishlaq, Ayrinc, Mahmudoba, Kechili, Kulus, Shahbuzkand medium, Yukhari Buzgov, Ashagi Buzgov, Garmachatag, Payiz, Gulshanabad, Jahri, Nazarabad, Gahab (figure 3.).

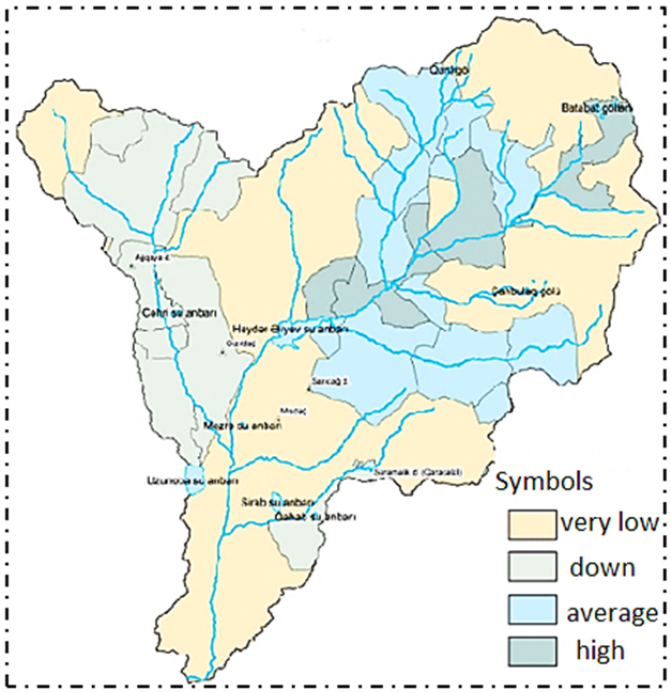

Figure 3 – Flood risk in the Nakhchivan river basin

The main reason for the destructive power and speed of floods in the Nakhchivanchay basin is the large number of flooded river tributaries. Thus, on the southwestern rocky slopes of the Zangezur range, There are floodplains such as river basins Salvartı, Gomür, Nursu, and Shahbuz, as well as Sirab river, Gahab river, Nahajir river with a temporary stream, and on the southeastern slopes of the Deraleyaz range, Kızlakhsu, Kapıdashgara, Küku, Selasuz, Türkesh and Jahri rivers. There are floodplains such as river basins. During periods of heavy rainfall, all rivers carry large amounts of solid debris. Although the river valleys are close to each other, the floods do not occur at the same time. Because in most cases, cumulus clouds cover small areas.

Bichenak pass (2346 m) facilitates the entry of humid air flow from the Caspian Sea into the area. Therefore, unlike other river basins of the autonomous republic, heavy rains are repeated frequently. In some years, the amount of precipitation reaches the maximum (about 1000 mm) for the Lesser Caucasus by the middle of June [1].

The area of sedimentation furnaces in the Nakhchivanchay basin is 211 km^2 or equal to 17.8% of the total area of the basin up to the cone. The analysis of the vertical fragmentation map of the relief shows that the flooded river basins in the area are characterized by intense fragmentation. Thus, the area of flood centers increases with the increase of the inclination of the area and the density of vertical fragmentation. Researchers such as G. M. Beruchashvili and D. A. Lilienberg mean only the bottom of the valley where eroded mountain materials are collected when they say floodplains [19-20]. In our opinion, the concept of floodplains should be taken in a broader sense, that is, along with the bottom of the river valley, its slopes rich in debris materials should be included here as a whole. Even bare rocks can be considered as potential flashpoints.

From large pieces of rock to pebbles, gravels and sand particles of different sizes collected in the flow cones of the rivers, it is possible to get detailed information about the flow of the rivers. Since it is not possible to collect the necessary materials about the bottom and suspended substances during the rainy season or during floods, the materials about the mechanical and chemical composition of the sediments are determined based on the coastal sediments, siltiness of the river, geological, climatic, and plant conditions of the basin. This methodical approach also allows to get information about the erosion module in the basin.

Researches show that the consumption of the average annual quantity of fetches in the Nakhchivan river is 1.5 kg/second or 4800 tons/year. Erosion module reaches 106 tons/m^2. The diameter of about 80% of the hanging leads is below 0.05 mm [9]. During floods, the indicated quantities change dramatically, and the diameter of individual stones brought by the floods can reach several meters. Such large flood deposits (15-25 m^3) are more evident in the Upper Kyzyl Kishlaq river valley. As the strength and volume of floods increases, various sectors of the national economy, especially highways and agricultural fields, are damaged. It also further exposes the slopes, making the riverbeds unusable with stones and other sediments, reducing the biological potential as a whole, thus increasing the development of the desertification process.

The analysis of the numbers shows that today's flow values of the quantity of transportation can lower the absolute height of the Nakhchivanchay basin by 1 m every 13 thousand years according to the flow indicators. The annual quantity of this indicator is 0.1 mm. For comparison, let's note that the decrease in the eastern part of the autonomous republic is 0.08 mm per year, and in the western part it is 0.05 mm [21]. As can be seen from the analysis of the research materials, washing in the rivers of the Nakhchivan river basin is more intensive than Ordubad rivers, which are more active in the autonomous republic.

One of the characteristic features of the sliding process is that in flood basins they are also flood centers. This feature is more noticeable for our research object in the territory of the autonomous republic. Thus, in almost all river valleys of the basin, partly at the foot of the slopes, stabilized landslides of ancient and relatively frequent modern origin have developed (figure 4). Although natural factors (the energy of the relief, the state of the gravity field, and the seismic activity of the area) played the main role in their formation, anthropogenic activity had a great influence on their development and acceleration. Since volcanogenic-sedimentary rocks are widespread within the basin, most of the landslides are characterized by covering surface sediments. Therefore, the soil subjected to landslide erosion does not have a great thickness. In addition, landslides covering thick layers of volcanogenic-sedimentary rocks are also observed. An example of such landslides is Bichenak forest massif, where ophiolite rocks are exposed, mainly around Batabat lakes [22].

In space images, these parts stand out sharply from the surrounding areas. This is because the vegetation-free area with a noticeable light homogenous tone in the forest area shows that the landslide process is taking place here. Some authors, for example, A. M. Johnson [23] consider vegetation on the slopes as one of the main factors aimed at preventing landslides. Our observations show that this idea is not true in the upper part of the Nakhchivan river, especially in the parts where there is a lot of inclination on the slopes. Thus, the trees increase the gravity with their mass, at the same time they protect the moisture in the soil through the root system, prevent evaporation and erosion on the surface. On the contrary, the effectiveness of trees is greater on slopes with less inclination.

Landslides play a certain role in the evolution of slopes regardless of where they develop [8-9]. In all landslides, the initial process begins with the formation of local cracks on the slopes. Then, during intense heavy rains, the soil mass in the lower part of the cracks is separated and the slope begins to move down.

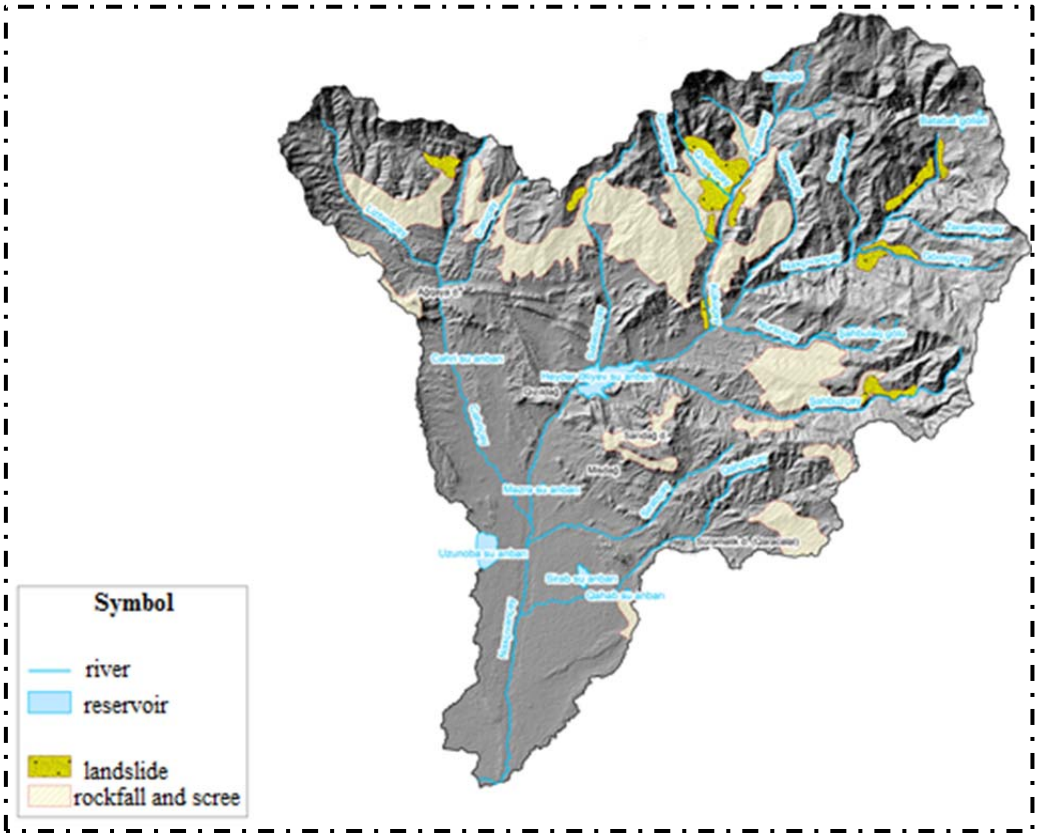

Figure 4 – Spreading areas of landslides, avalanches and scree in the Nakhchivan river basin

When it reaches the river valley, it undergoes erosion and, as a rule, becomes saturated with muddy and stony mass, turning into typical mud floods. Our scientific research on the landslide event shows that the flood materials produced by the landslides have a more solid and cohesive structure than the ordinary stony-muddy flood materials.

In the territory of Azerbaijan, mud floods of landslide, landslide-flood origin, which are typical for the rivers of the southeastern slopes of the Greater Caucasus, are rarely observed in the Nakhchivanchay basin.

In some cases, several landslides occur on the same slope. From this point of view, the left bank of the Dibsu tributary of Nakhchivanchay is of great interest. Thus, there are active landslides that have been repeated several times in the northeast of the place where Dibsuy meets the Nakhchivan river. Since the sliding process took place in the forest area, the trees bent and formed "drunk forests". Also, it is possible to observe lakes stretching along small fold lines at the place of the rock break and at the bottom of the slope. On the opposite side of this landslide, on the right bank of the Nakhchivan river, a forest area of about 2-3 hectares was involved in the landslide process and lost all its morphological structure.

A combined analysis of aerial photographs and field surveys shows that the landslide process is progressing to high elevations. Landslides are common here, although they do not cover a very large area. Such manifestations are characteristic of intensively fragmented parts of the slopes around Camisholen (2920 m) and Salvartı (3161 m) peaks, as well as in the upper part of the Kaha valley [8, 9].

The occurrence of landslides in the main valley of the Nakhchivan river creates bigger problems. Thus, as a result of the impact of the landslide that occurred on the right and left slopes of the river, in the territory of Bichenak village, several private houses were seriously damaged. The fact that the landslide extends its range up and down the slope further increases the danger in the settlement. Similar landslides are observed near the village of Kolani along the left bank of the Nakhchivan river to the village of Agbulag. This type of landslide causes the formation of furrows on the slopes, which turn into ravines. In such areas, the erosion processes intensify, the parent rocks come to the surface and are subjected to intense physical wear.

To the east of the place where Gomurchay meets Nakhchivan river, 3 landslides occurred one after the other in the area called "Willow spring" [5]. Additional new layers are formed on the slope that is inclined to the river valley. Avalanches and landslides have intensively developed along both banks from the intersection of the Nakhchivan river with the Kuku river. They form a component of mud floods during the rainy season, after intense rains and snowmelt.

The largest and most widespread landslides located in the active landslide zone are in the Kuku River basin. To the west of the village of Kuku, on the right bank of the river of the same name, in the area called "Piri's Castle", 2 landslides are clearly visible at the contact of Eocene and Lower Pliocene sediments. The development of the landslide in the area can be explained by natural and anthropogenic factors. Natural factors include inclination of the slope, the inability of groundwater to surface, and anthropogenic factors include the construction of irrigation ditches in the lower part of the slope.

Analysis of space images shows that the landslide is likely to expand further in the future.

Another large slide is located 200 m to the south-southeast of this slide. Observations show that this slide is similar to the previous slide in terms of formation characteristics. However, the landslide encountered a tectonic fracture, weakened its movement and divided into 2 parts.

As a result of the deepening of the river erosion base and the action of groundwater, many small field landslides have formed on the right and left slopes of the river bed in the area called "Dere bosphorus", which stretches along the Kuku river valley towards the Kanli lake. Ancient and solidified landslides are mostly found in the high mountain zone. From the village of Kükü to the south-southwest, in the north-east of the watershed between Kishlag river and Kuku river, on the slope where dense bushes are located, the "drunken" shape of the bushes on the land slide, which is 250 m^2, attracts more attention.

The Kizil Kışlaq river valley is more prone to landslides. Thus, in the north-east of the village, on the right bank of the Kishlag river, landslides moving towards the bottom of the river often occur. Also, in the west of the village, landslides continue to operate in the form of terraces in the area called "Lake place". There are sliding cracks in all directions except the northern part of this semi-conical area. According to the local population, during the landslide that occurred on the slope of the Kara Kaya mountain, stones and pebbles flowed along the steep cliff and filled the valley with large volumes of stones in a short period of time. The truth of the idea called observation time can be seen in the surrounding landslides.

In the upper reaches of the Shahbuz river, around the villages of Kulus and Kechili, landslides develop at the contact of fluvioglacial sediments with sedimentary rocks of the Upper Eocene. As a result of the landslide that occurred on May 8, 2011, 5 houses were completely unusable, and 9 houses were in an emergency situation. It should be noted that this landslide was activated after heavy rains that took place on May 26, 2007 and lasted for two days, and reached its peak 4 years later.

One of the areas where landslides occur regularly is the Jahri river basin. It is often observed especially in the contact zone of Konyak and Santon derivatives, which are intensely dislocated in the middle highlands. Large landslide units occupying large areas continue around the village of Ashagi Buzgov, while smaller landslide processes continue around the villages of Yukhari Buzgov and Garmachatag.

There are numerous small river valleys between the separate ridges of Darelayaz and Zangezur ridges, as well as rich in avalanche and scree materials. Analysis of large-scale space images shows that avalanches are more active in river valleys and along tectonic fault lines in the lower part of the middle highlands. In the visible region of the spectrum, between 780 nm and 420 nm wavelength, avalanches are distinguished primarily by their shades and tones [8]. Thus, plants usually do not grow on the avalanche materials, and at the same time, the slopes on which they fall are distinguished by their steep appearance.

Unlike other slope processes, the movement is very fast and can happen at any time of the year or day. In most cases, scree products are also included in the composition of the avalanche materials. In the high mountain belt, the wear materials caused by physical erosion, especially by ancient glaciers, were collected at the foothills of the slopes overlooking the Nakhchivan river of Kukudag, Agdaban, Kecheldag and Salvartı peaks. The main reason for this is that the south-western and south-eastern slopes of the indicated peaks are steeply inclined with intensively fragmented rocks and cliffs, which is related to the active activity of the gravity process here. In some cases, avalanches create conditions for avalanches and repeated avalanches. Their mechanical effect also becomes the main driving force.

In modern conditions, avalanche processes in high mountain areas are often caused by human anthropogenic activity, especially by the artificial disturbance of the stability of the slopes by the

construction of defensive fortifications and roads. Since these areas are located far away from settlements and economic facilities, although they do not have the nature of a natural disaster, mountain-meadows play an important role in disrupting the structure of landscapes.

In the intensively fragmented denudation-structural folds of the middle highlands, the upper courses of the rivers give the terrain a sharply fragmented appearance. Widespread fluvioglacial sediments contain many large boulders and rocks related to gravity processes. They are extremely widespread in the upper reaches of rivers. Some of them have a diameter of more than 5 meters. Between the villages of Kulus and Kechili, the diameter of some avalanche materials is more than 10-20 m. The fact that rivers brought some of these materials to the lowlands reflects the once abundant river flows here.

Selasuz river basin is one of the areas where avalanches are widespread in the middle highlands. Here, the valley depression consisting of proluvial-deluvial sediments is surrounded by monoclinal structures. Very large avalanches are found around the villages of Turkesh, Selasuz, Badamli and Shada, which are located within the slump.

In the study area, the most active area of mechanical erosion is the low mountains. In addition to avalanche processes, avalanche scree processes have developed on exposed mountain slopes. Eocene rocks of volcanogenic-sedimentary origin, especially tuff-conglomerates, tuff-breccia, porphyrites, and limestone rocks undergo intensive decomposition. In some places, especially on the northern slopes of Nahajir mountain, the mass of the avalanche blocks exceeds 800-850 tons [7]. Around the village of Türkesh, west of Selasuz and south of Badamli, there is a large avalanche mass at the foot of the monoclinals. Avalanche materials of different sizes can be seen in the middle reaches of the Jahri River at the foot of Chalkhan Mountain, as well as around Aggaya Peak.

Because screes are formed from rock fragments of different sizes, they are partially balanced and break up less often than avalanches. They spread in the form of a cone in ravines and valleys, creating dangerous flood areas, and from time to time flood events with great destructive force develop. The development of such floodplains is observed more often in the areas of Aguchuk, Gotursu, Zarnatun, Khinzirak, Salvartı, Gonaggormez and near the village of Kuku. When flood flows occur, these materials are completely removed to the periphery and are clearly visible in the topography of the bringing cone (figure 5).

Nakhchivan river (Kolani village district) Zarnatun river

Figure 5 – Bringing cone in individual river valleys

Another reason for the bareness of slopes is the process of solifluction. Like other slope processes, it can become part of a flood after intense rains. The area of activity of solifluction processes in the Nakhchivan river basin is within the subnival belt, and it is not so large in terms of its development degree, strength and area. Therefore, these relief forms are poorly expressed in space images. Many places become leaner on the exposed slopes of solifluction processes, and leaching becomes active in the leaner areas. In addition to the movement of pomegranate scraps, which contain a lot of jagged wear products, the movement of creamed areas with a diameter of several cm to 2-3 m is observed. The development of solifluction processes in the mentioned areas is more noticeable in the north of the Batabat massif.

Against the background of arid climate and intense elevation of the mountains, the trough valleys, which are the result of the destructive erosion activity of the glaciers, have been able to leave certain traces in the geomorphology of the area, despite being subjected to sharp fragmentation. It is the Nakhchivan river that takes its source from such a trog valley located between the peaks of Agdaban (3093) and Kecheldag (3118). The length of valleys with different widths and steep slopes is about 2-2.5 km. According to M. A. Abbasov [24], the small troughs formed in the source parts of the left tributaries of the Nakhchivan river were completely destroyed in the later stages by neotectonics, surface currents, as well as climate elements.

The largest deafs are observed in the Kecheldag, Kukudag and Batabat massifs, as well as numerous other small deafs in the upper reaches of the Salvartı, Jamışölen, Toglugaya, Gömür, Nursuchay rivers. The areas of these fields vary from 0.005 to 12 km^2 [25]. Their semicircular slopes are precipitous and steep, their bottoms are jagged and covered with a lot of debris products of volcanic origin as a result of erosion. The moraine sediments collected mainly in the trough valleys are washed by the erosion activity of the rivers and actively participate in the structure of the high terraces (60, 80, 120 m) of the Nakhchivanchay river in the lower parts. This process occurring between Agdaban and Kecheldag is also manifested in the source parts of Salvartı river, Gomur river and Nursu river. Based on the research conducted in the area and the decoding of aerial images, it was determined that the distribution area of moraine-glacial sediments continues from 2800 m absolute height to 2000 m absolute height. This also plays a special role in the feeding and formation of floods.

Since these sediments are resistant to erosion, the process of ravinement develops rapidly during the period of active snowmelt after short-term torrential rains. The development of erosion in the middle and high mountains is due to the relatively large amount of precipitation, as well as the inclination. The lithological composition of the rocks here causes the depth of the erosion basin to be low, but the ratio of ravinement and fragmentation of the area is high. Active grazing worsens the ecological condition of the soil and results in the creation of new gullies. In space images, these dynamically developing erosion furrows and ravines are deciphered by open and light-gray photography.

On the slopes with dense vegetation areas, the speed of surface flow decreases, it creates an opportunity for their filtration, and most importantly, the development of erosion is weakened. In this case, even if the inclination of the slopes is high, the soil erosion process is not observed. The thickness of the root system of plants and the total weight of the mass depends on the thickness of the soil layer, as well as its sleeping conditions. Because there are no favorable conditions for the development of plants on the slopes with a low soil layer, the erosion process is active on the slopes with an inclination of up to 20-30^o degrees. In these parts, as well as in areas with an inclination of more than 30^o degrees, the vegetation usually develops poorly and the probability of soil erosion is high [26].

There is an interaction between the dynamics of glacial and perennial snows and the amount, type and mass of flood deposits. Thus, during periods of active melting of multi-year snows, an increase in moraine sediments, which are a part of floods, is observed.

The effect of global warming affects the snow-ice cover more and causes serious disturbances in their morphological structure. Observations show that the sensitive response of perennial snow and glaciers to climate changes is becoming clearer, and their volume, area, thickness, and duration continue to decrease. This is evident both from satellite images and from the results of field research observation data conducted in the area. As the border of the snow line changes, the border of the area of moraine sediments also changes accordingly. Because the snow cover preserves the exogenous effect and protects the soil-vegetation cover of the mountain meadows from surface and linear washing.

The result. For the first time, floods, landslides, avalanches, etc., which are considered the main sources of landscape-ecological danger and risk in the Nakhchivanchay basin. studied in a complex systematic way and corresponding large-scale maps were drawn up. The complex research and analysis of natural components made it possible to provide accurate and concise information about floods, landslides, avalanches and scree in advance. Obtaining information allows preventing damage to the population in residential areas, as well as to agricultural areas, which makes it possible to evacuate the population and take security measures in agricultural facilities before the incident occurs. The importance of determining this information is also that it is taken into account the destructive power of natural-destructive processes and in which areas they will occur when houses are built in extremely dangerous places where the population is mainly inhabited.

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ЭКЗОДИНАМИЯЛЫҚ ПРОЦЕСТЕРДІҢ ЕРЕКШЕЛІКТЕРІ НАХИЧЕВАН ӨЗЕНІ АЛАБЫНДА

Аннотация. Нахичеван өзені бассейнінің жекелеген өзен аңғарларында қарқындылығы бойынша қолайсыз табиғат құбылыстарын сипаттауға әрекет жасалды. Нахичевань өзені бассейнінде елді мекендер мен шаруашылық жүйесіне ең үлкен зиян су тасқыны, сондай-ақ басқа да кең таралған қауіпті табиғи процестердің қайталануы салдарынан болады. Биченак, Колани, Дайлагли, Селасуз ауылдары мен Шахбуз қаласы тәуекелдер мен қауіптерге көбірек ұшырайды. Ежелгі және қазіргі кездегі тұрақталған көшкіндер бассейннің барлық дерлік өзен аңғарларында дамыған. Көшкіннің ең белсенді таралу аймағы Нахичеван өзені бассейнінің жоғарғы бөлігін, Батабат массивін, Биченақ орманын, Куку өзенінің орта ағысын, Кечилі және Зирнел ауылдарын қамтиды. Мұнда мұздық та, көшкін де кең таралған. Бұл аймақта қар көшкінін тудыратын факторлар төменнен биікке дейін өзгереді. Сонымен, егер кейбір жерлерде қар көшкінін қалыптастыруда аяздың әсер етуі маңызды рөл атқарса, басқаларында – температураның күрт өзгеруі, тау жыныстарының физикалық-химиялық құрамының, өсімдіктердің, жыныстардың жылу сыйымдылығына әсер ететін түсі, литологиялық құбылыс, экспозиция және көлбеу еңіс дәрежесі, т.б. d. Жерсеріктен түсірілген суреттер мен өзіміздің далалық зерттеулерден алынған мәліметтерді талдау арқылы бассейнде алғаш рет кейбір қауіпті экзодинамикалық процестер анықталып, олардың карталары құрастырылды.

Түйін сөздер: табиғи бұзылу процестері, су тасқыны, көшкін, көшкін материалдары, техногендік әсер, спутниктік суреттер.

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ОСОБЕННОСТИ ЭКЗОДИНАМИЧЕСКИХ ПРОЦЕССОВ В БАССЕЙНЕ РЕКИ НАХИЧЕВАНЬ

Аннотация. Предпринята попытка охарактеризовать неблагоприятные по интенсивности природные явления в отдельных речных долинах Нахичеванского речного бассейна. В бассейне реки Нахичевань наибольшой ущерб наносят населенным пунктам и хозяйственной системе наносят наводнения а также повторение других широко распространенных опасных природных процессов. Наиболее подвержены рискам и опасностям, села Биченак, Колани, Дайлагли, Селасуз и город Шахбуз. Стабилизированные оползни древнего и современного происхождения развиты почти во всех речных долинах бассейна. Зона наиболее активного распространения оползней охватывает верхнюю часть бассейна реки Нахичевань, массив Батабат, Биченакский лес, среднее течение реки Куку, поселки Кечили и Зирнель. Здесь широко развиты как ледниковые, так и деляпсивные оползни. Факторы, вызывающие сход лавин в этом районе, различны в зависимости или низкогорья до высокогорья. Так, если в одних местах важную роль в формировании лавин играет морозное выветривание, то в других – резкое изменение температуры, физико-химический состав горных пород, растительность, цвет, влияющий на теплоемкость пород, литологическое залегание, экспозиция и степень наклона склонов и т.д. При анализе космических снимков и данных собственных полевых исследований впервые на территории бассейна выделены некоторые опасные экзодинамические процессы и составлены их карты.

Ключевые слова: природно-деструктивные процессы, паводковый сток, оползень, лавинные материалы, техногенное воздействие, космические снимки.