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GENERAL ANALYSIS AND DESCRIPTION OF PHYSICAL AND GEOGRAPHICAL FACTORS OF RAINFALL IN AZERBAIJAN

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Abstract. The maximum flow of the mountain rivers are formed by snow melt waters and rain waters, downstream of the basins are formed by the rain waters. That's why genetic similarities and non-similarities between these series are of interest. Complex analyze of rain and river flow and hydrometeorological conditions allows us to say that, they have more affect in forming of rainfall more than 30 mm daily.

Keywords: *hard rain, rainfall floods, maximal flow, showers, underground water, storm water.*

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1. Introduction

In general, the study of regularity between maximum daily rainfalls and maximum water consumption of rivers is still a poorly studied area. This is primarily due to the complexity of its development and by the fact that the maximum sediments are caused by the occurrence of rainfall. At the same time, this process becomes even more complicated by the complex orographic conditions of the Caucasus and its highlands including Azerbaijan. It also confirms the fact that there are no concrete methods in this area (Imanov, 2015).

The occurrence of rainfall in the rivers the Republic of Azerbaijan along with the meteorological conditions also differs in its diversity for different river basins, due to the influence of the height, direction of the slope, influence of soil surface elements. In most rivers, snow, rain and groundwater are involved in the formation of high flows. Snow water solvent dominates by high altitudes (over 2500 m). In the rivers located in low altitude zones, rainfall is higher. This law is also observed along the rivers. As the snow depths in the downstream from the height of the river leading upstream from the high altitudes, the share of rainfall in the formation of flow begins to increase. Feeding from snow water in the downstream of the river is negligible (Chin *et al*., 2000; Museyibov, 1998).

Rainfall intensity depends period of rain and its fallen area. Several methods have been proposed to investigate the rainfall intensity. By the proposed modern methods it is possible to assess the risks of heavy rains and determine its impact rate on economy. It has a special significance for national economy. The assessment of the maximum flow which occurred as a result of rain floods is very complicated process. They are irregular which usually accompanied by high speed (Chin *et al*., 2000; Klibashev & Goroshkov, 1970) .

The gold standard for rainfall measurements are rain gauges, which simply look at the height or weight of water collected in a container. Today there are about 6,000 of these around the world, contributing data to international databases like the Global Precipitation Climatology Project, with some national compilations dating back to the 1860s or earlier. But these records still present problems. Like temperature sensors that are sometimes installed accidentally in the cool shade or near hot slabs of concrete, rain sensors are sometimes placed comically too close to trees that grow and eventually shelter the buckets (Ahrens, 2012; Imanov, 2002).

2. Materials and methods

H. Beefani, Y. Vinogradov, R. Mahmudov and others used the experimental models, which reflect the general features of separate basins, since there are many factors affecting the flow of drift into the stream and there is no necessary information on all of them. The highest ordinates of the flow hydrographs do not always occur at the expense of daily maximum rainfalls or that the maximum daily rainfall does not always coincide with the annual maximum water consumption, not only in our area but also in the Sakhalin Island, the Carpathian rivers and etc. It also occurs in the study of the flood-raising rains (Imanov, 2015; Klibashev & Goroshkov, 1970).

Therefore, the study of the role of daily precipitation in the formation of the highest flood waters is of great importance. The data analysis shows that these two maximums can best be overlapped in half of the common cases at best (Imanov, 2009).

Floods don't distribute often large area but extending more discrete form. All of these make difficult to observe floods and their maximum, as a result it is possible only after floods to determine the maximum water flow according to their traces. The formation of rainfall floods is different from the formation flood flow. At that time the main role is duration and character of rainfalls. Firstly determined the rainfall area, its duration, quantity, average and maximum intensity and then on the basis of these determined the scale of the floods. Depending on all of them rainfall flood is the most dangerous for forming flooding in river (Snorrason *et al*., 2002).

The works of A. Vajnov, L.A. Vladimirov, S.H. Rustamov, P.M. Gashgai may be noted. These works are mainly devoted to the study of rainfall in the Caucasus. It is possible to use the isotope method along with the vertical shredding method when determining the rainwater content in stream. In this case, the isotope method takes into account the transformation of various genetic components into the flow under the conditions of anthropogenic impact (Snorrason *et al.*, 2002 ; Museyibov, 1998).

3. Discussion

Formation of the rain floods differs from the high water flow. At the rain falling period, its character and duration play a key role. The spread area of rains, their duration, quantity are determined firstly, at the same time being investigated the scale of the floods which caused by average and maximum intensity of rains. Depending on all of them the most dangerous is the shower rains (Intensity 10-20mm/h, only 2-4 hours) which generates the flooding. During heavy rains, 100-150 mm precipitation may fall and as a result, probability the high floods into the rivers which till 100-2002km can occur. Longer term and small intensity rains cover a wide area but their maximum rainfall is lower than heavy rains (Snorrason *et al.*, 2002; Madatzade & Sichlinskij, 1968).

Generation of water layer not only depends from the duration and intensity of precipitation, this is also related the intensity of water absorption into the ground. When the intensity of precipitation is more than the intensity of water absorption into the ground then water layer is formed. The intensity of the water absorption is water, that is given to cycle of basin (Chin *et al*., 2000).

The maximum flow from the main Caucasus and the rivers flowing from the Lesser Caucasus is mainly caused by rain and snow waters. The highest flow goes through the end of summer and the begging of the summer. This often happens when the heavy rainfalls are falling as rivers flow through intense snow melting. These maximums are the highest in the year and rarely the maximum water consumption of the floods that fall during fall tunes is higher than those in the fall. In the rivers that start from the relatively small altitudes of the southeastern slopes of the Greater Caucasus, the maximum flow is formed mainly by rainwater observed in summer and autumn seasons of the year. The rainfall in Lankaran, Mughan rivers, which has low water logging rates increases in altitude and in other rivers of natural region, rainfall decreases altitude (Snorrason *et al*., 2002; Despatovic, 2009). Rainwater in the Greater Caucasus, the low water river of the Lesser Caucasus and the Lankaran natural region play a major role in the hydrological regime of rivers, creating various flood disasters. Despite the fact that in rivers with a high altitude basin, the main place in the formation of maximum water consumption is snow water sometimes it is impossible to overlook the importance of falling intensive rainfalls. Splitting distributions have a very complex structure. In spite of a numerous studies have been conducted in this field in the past 100 years, the solution to the problem remains open. So that in some areas, precipitation doesn’t fall for many years but in other areas no precipitation is flooding (State of the climate in 2011).

Atmospheric precipitation in Azerbaijan for the first time in 1950 has been investigated by Shikhlinski. In 2008 the solution to this issue was redeveloped on a larger database. Based on numerous studies of climate change, it has been established that the frequency of replication of extreme values of climatic elements on the global and regional scale has begun to increase. Such cases have begun to show itself in the form of more frequent repetitions of the acceleration of air temperatures over the last decade, the high drought and the catastrophic floods of different countries. In connection with this it is necessary to study the trends of change for several other important parameters (Shikhlinsky, 1968). These include relative humidity, air velocity and direction, air and max temperature, and so on can be attributed. Studies on the assessment of the long-term fluctuations in atmospheric precipitation in the territory of the Republic of Azerbaijan have shown that significant variability of this climate element has not been observed in the period until 1997. One of the simplest ways to determine the role of each source (rain, snow, mixed waters) that generates the flow during the flood is to split the flow hydrograph into food sources. If the role of snow water is great, then thermal analysis should be carried out reflecting the process of handling, the snow and ground waters should be calculated individually and the share of rainwater should be determined (Mamedov *et al*., 2010).

S.H. Rustamov divided the Azerbaijani rivers into four groups, depending on the source of food and its superiority. The first group includes the rivers of the Greater Caucasus in the North East (Gusarchay Basin) and South (Slopes of Turyanchay, Demiraparanchay and Tikanalanchay), flowing from the Zangezur slope (Gilanchay) and with substantial groundwater, rainwater is not more than 20% of annual flow. The second group includes rivers flowing from the Lankaran region rivers, which feed from the rainwater, as well as underground water, up to 2500m above sea level, flowing from Gobustan and Southeast to the Greater Caucasus (Junction, Girdimanchay and Goychay).Snow water is less than 10% in Lankaran and Gobustan rivers, and in other rivers more than 20% (Rustamov, 1961).

S.H. Rustamov indicates that, in these small rivers, Akhincacay, Tovuzchay, Asrikchay, Kahrikchay, Gargarchay, flowing from the north-eastern slopes of the mountains; Gonagalay, Guruchay and others flowing from the southwest slope. Feeding at the expense of snow water reaches 25% here. The Shirvan rivers (Turyanchay, Alianchay, Dashagilchay, etc.), which are mainly fed with underground water, are included in the third group with the significant amount of rainfall.The fourth group includes rivers (underground waters of the Araz River, high-altitude rivers of the Shaki-Zagatala zone, Tartarchay etc.). Grouping is important for distributing the flow throughout the year and feeding the rivers in different chapters (Mamedov et al., 2010; Rustamov, 1961). The food types of tea vary greatly in seasonal varieties. In this case, the height of the water holder should be emphasized. Rainfall floods are observed in the North-East slopes of the Greater Caucasus, the North Plateau of the Lesser Caucasus and the Garabagh Range, in many rivers of the Nakhchivan Autonomous Republic, Azerbaijan). During this period, up to 70% of the annual flow is passed. During this period up to 70% the annual flow is passed. In the Lankaran rivers, which is the flood of rainfall during the cold season of the year, the flow from falling rainfall is 80% of the annual flow. According to snow water, it is possible to find rivers flowing in the Talysh Range (up to 10%). Snow’s role of Peshtasar and Burovar rocks is very low (Imanov, 2015; Museyibov, 1998).

M.A. Mammadov studied the formulas of reduction and maximum intensity of flow for calculate maximum water flow of rainfall in the river which unexplored yet. Reduction formulas are offered for rivers which catchment area more than 50 km^2, while formulas of maximum intensity of flow are offered for rivers which smaller 50 km^2 (Mamedov *et al*., 2010).

He studied a group of Caucasus rivers according to their flood parameters. At the same time he has established territorial changes this parameters which showing ratio of maximum water flow to annual average water flow. He has offered the formula for more precisely determine the empirical provision of little guaranteed prices of floods.

Methods was developed for calculate the maximum water flow of rainfall flood and calculation of the hydrograph by investigating formation of rainfall flood in Azerbaijan rivers (Imanov, 2011).

4. Results

The maximum value of rainfall floods in Talish Rivers is observed in the spring and in other rivers in spring and autumn. In many rivers of the country, especially in the rivers flowing from the southern slopes of the Greater Caucasus is snowing in spring and fall floods. The amount of rainfall in these rivers is about 30%. Rainfall is also involved in the flow formation during the period of fertility. Rainfall floods are possible throughout the year in Gobustan Rivers. Here, 70-90% of the rivers are groundwater with 10-15% of the rainwater, and less than 5-10% of snow water (Museyibov, 1998;

Shikhlinsky, 1968). The cost of rainfall flows in Azerbaijan ranges from 0 to 900mm. Rainwater is about 40% of total water resources. The highest precipitation is observed in Lankaran (25% of total reserves). The flow of rainfall from north to south and from west to east is increasing here. Its highest value lies at 200-300 m in the Lankaran river basin (Shikhlinsky, 1968).

The highest flow of rainfall in the Southern slope of the Greater Caucasus, which holds the 2nd place, is 300 mm. As the altitude decreases, rainfall decreases to 50mm. The flow of rainfall at the north-east slope of the Greater Caucasus is 250mm, Absheron – Gobustan is 25-30 mm, if Lesser Caucasus and Nakhchivan is 100 mm (Rustamov, 1961).

The role of rainfalls in the rivers in the Nakhchivan Autonomous Republic is evident in the analysis of the legality of distribution of annual precipitation by territorial and yearly distribution.

Rainfall in spring, summer and autumn prevails mainly by falling in liquid form. The amount of precipitation in the spring varies from 100mm (1000m altitude) up to 320mm (2500m). The maximum rainfall in summer is 130mm, in the autumn 180 mm and in the winter - 150mm. Generally, during the winter 10% of annual precipitation and 50% fall in the spring (Shikhlinsky, 1968).

Spring rains cause water to increase in rivers. Most precipitation is falling in April and May. There should be sufficient and accurate information to analyze flows in the river basin, assess their hydrometeorological conditions and determine their interaction with the geographical environment. Generally, the factors contributing to the formation of river flow are divided into two groups: climate factors and soil surface factors (Imanov, 2011). The latter group also includes factors related to man's economic activity. These factors have many components that play an important role in stream formation. These components are mainly generated by flow, or current loss. First group components are primarily used for information on atmospheric precipitation and groundwater, f or the second group of components, the temperature and humidity of the evaporation, air and soil, including land, relief and other information are used. In addition to meteorological factors, (soil characteristics, plant cover, etc) the effect of soil factors on the flow of precipitation has been widely studied (Klibashev & Goroshkov, 1970; Rustamov, 1961).

Most dependencies used to calculate the time-dependent change in absorption intensity are as follows:

$$i_t = i_0 e^{-ct} \qquad (1)$$

or

$$i_t = k + \frac{i_0}{t^{\alpha}} \quad . \qquad (2)$$

Here i_t is a quantity, t is the severity of absorption during the time;

i_0 is the initial severity of absorption.

c and a are the parameters that depend on the type of soil (Klibashev & Goroshkov, 1970).

Here it is described the sequence of decreasing the variability of rainfall intensity (Table 1) and their guiding curves (Figure 1) for the meteorological observation stations of Mashtaga.

Table 1. Reduction of rain intensity (Mashtaga station)

№	Hτ (mm) Time interval - τ min								P%
	1	5	10	20	40	60	90	150	
1	0.7	2.38	4.1	7.35	10.33	12.18	15.82	17.04	7.7
2	0.7	1.94	3.08	5.04	7.2	8.48	11.86	14.26	15.4
3	0.36	1.8	2.2	3.8	6.16	7.8	9.24	13.35	23.1
4	0.3	0.95	1.9	3.67	4.87	6.07	7.57	12.82	30.8
5	0.2	0.85	1.9	3.08	4.48	5.28	7.53	12.21	38.5
6	0.19	0.8	1.3	2.45	3.95	5.23	7.17	9.53	46.2
7	0.19	0.74	1.2	1.76	3.25	4.49	6.18	8.18	53.8
8	0.18	0.66	1.09	1.54	2.8	4.29	5.19	7.4	61.5
9	0.13	0.65	0.76	1.4	2.34	4.2	5.15	6.35	69.2
10	0.1	0.35	0.7	1.09	1.79	1.99	2.29	3.24	76.9
11	0.07	0.34	0.44	0.64	1.04	1.44	2.04	2.89	84.6
12	0.01	0.05	0.1	0.2	0.4	0.6	0.9	1.5	92.3

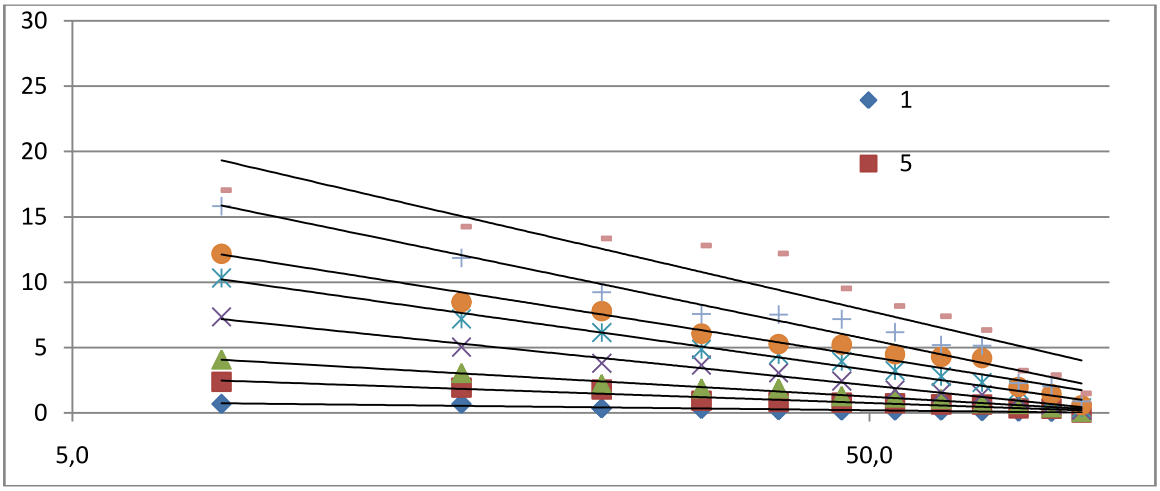

Figure 1. Rainfall intensity (Mashtaga station)

Hydrology research methods are based primarily on the application of geographical and statistical methods to experimental and land measurement data. One of the most commonly used methods is the genetic analysis of data. During the genetic analysis of observational data, the formation and subsequent development of the physical process is taken into account. Through this method, the genetic theory of flow has been developed. Depending on the validity of the observation data, the separation of the regions with the same conditions for the formation of the flow or the classification of the rivers according to the water regime or food sources is carried out with certain accuracy. Genetic analysis is often used to analyze relationships between factors that determine the flow (Imanov, 2002; Imanov, 2015).

Observations of atmospheric precipitation, which is the main factor in the formation of the current, have been started from the last century. As is known, rainfall in any water body is based on measurements or water balance calculations when there are observation data, and if not available on the basis of common law. Genetic approach involves physical models that analyze rainfall flows. Those models take into consideration the initial loss of the falling rainfall and impact of rainfall on the local physical and geographical factors (Imanov, 2015).

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