Rakhmonov K.R., PhD
associate professor, lecturer of Terrestrial Hydrology Department
National University of Uzbekistan named after Mirzo Ulugbek
Uzbekistan, Tahkent
Nazarbekov A.K.
Magister student
Karakalpak State University named after Berdakh
Uzbekistan, Nukus
Dosjanov B.O.
Geography teacher at the school №9 of Chimbay district
Uzbekistan, Chimbay

EVALUATION OF THE EFFECT OF METEOROLOGICAL FACTORS IN THE FLOW OF THE CHIRCHIK BASIN RIVERS

Annotation: *The article provides a statistical assessment of the impact of meteorological factors recorded at the Piskom meteorological station on the flow of the Chirchik Basin rivers, i.e. the Piskom and Chatkal rivers, in the context of climate change. The flow of the studied rivers is unevenly distributed over the months of the year, with the main part of the annual flow occurring in January. The flow in the basin increases from May to July.*

Keywords: *river basin, river, flow rate, water consumption, meteorological factors, climate change, statistical assessment.*

The flow of rivers varies not only throughout the year, but also varies from year to year. Many years of water quantities are mainly related to cirrhosis of air masses in the atmosphere, which is exposed to many years of climate. Atmospheric precipitation in almost years, the amount of water increases or can be the opposite. In addition, the perennial vibration of the amount of water depends on geological, tectonic processes. At the same time, the air temperature is of great importance in the rivers for glaciate waters. [3, 4]. Considering these cases, the study of the impact of climatic factors for the flow of rivers, which is reduced to a reservoir is one of the current issues of today.

Rivers of Chirchik Basin were selected as an object of research facilities. The quantitative assessment of meteorological factors in the flow of rivers will determine the study of the work.

The main purpose of this work is to quantify the impact of meteorological factors on the flow of rivers in the Chirchik basin. The following tasks have been identified in achieving the goal set in the research work:

- Coverage of the natural conditions and hydrometeorological study of the area where the Chirchik basin is located;

- Study of distribution of rivers flow throughout the year;

- Assessment of annual fluctuations of river flow and the impact of meteorological factors on it;

- Statistical assessment of river flow variability.

The scientific novelty is displayed in the following:

- The hydrometeorological study of the rivers of the Chirchik basin was covered from the point of view of the subject;

- the annual and inter-annual variation of river flow was studied;

- the multidimensional relationships between river flow and meteorological factors were statistically assessed;

- the variability of river flow was statistically assessed.

The scientific significance of the results of the study is that they can be used as an important scientific resource in the rational use and protection of river water resources, as well as in the development of action plans for the efficient use of water resources in the study area. The practical significance of the work is determined by the fact that the main conclusions and recommendations made on the basis of the results of the work, the information collected in it, serve to improve the quality of the educational process in the relevant areas of education and specialties.

The first studies on the influence of meteorological factors, including atmospheric precipitation and air temperature, on the formation of rivers in Uzbekistan, including the Chirchik Basin, were conducted in the early twentieth

century. Issues of formation of mountain river flow and study of natural geographical factors determining it have been studied by V.G. Glushkov, E.M. Oldekop, L.K. Davidov, N.L. Korjenevskiy, V.L. Shults, O.P. Sheglova, A.N. Vajnov, M.N. Bolshakov, A.M. Vladimirov, I.S.Sosedov, F.H.Hikmatov and others. The distribution of annual runoff can be calculated for any period of time in rivers based on water consumption monitoring data. Therefore, in the study, the monthly distribution of the Piskom River (Mullala village) flow throughout the year was studied for multi-aquatic (1969), average perennial (1965-2018), and low-aquatic (1982) years.

According to the results of calculations, the estimated costs for extremely high-water years increase in hot summer periods. The main reason for this is related to the sources of saturation of the river. This is because the constant snow and glaciers in the high mountains begin to melt under the influence of summer temperatures, and the water in the river increases during these months [2].

Based on the results of calculations of the distribution of the flow of the river Piskom on a monthly basis during the year, diagrams of the monthly distribution of the flow during the year were drawn (Figure 1).

It can be seen from this diagram that in a multi-aquatic year (1969) the flow of the Piskom River is unevenly distributed throughout the year. For example, while January accounted for 4.11 % (79.6 million m^3) of the flow, by February, these values had declined slightly (3.49 % or 68.5 million m^3). Since March, the water level in the river has increased to 140.4 million m^3. This is 7.26 % of the annual flow. The river had relatively high water levels in May, June, July and August. While the flow in July was 989 million m^3 (52%), the amount of water in the river has been declining since September (795 million m^3). The flow rates in the river, determined on the basis of low water and average perennial values, are also unevenly distributed over months (Figure 1).

Annual changes in river flow occur as a result of meteorological factors (atmospheric precipitation, air temperature, humidity). The fact that the annual

rainfall in rivers saturated with rain and snow is higher than the norm also leads to an increase in river flow. In rivers saturated with constant snow and glacial water, summer temperatures are higher than normal, which leads to an increase in river flow. In both cases, other factors affecting river flow remain secondary [1, 3, 4].

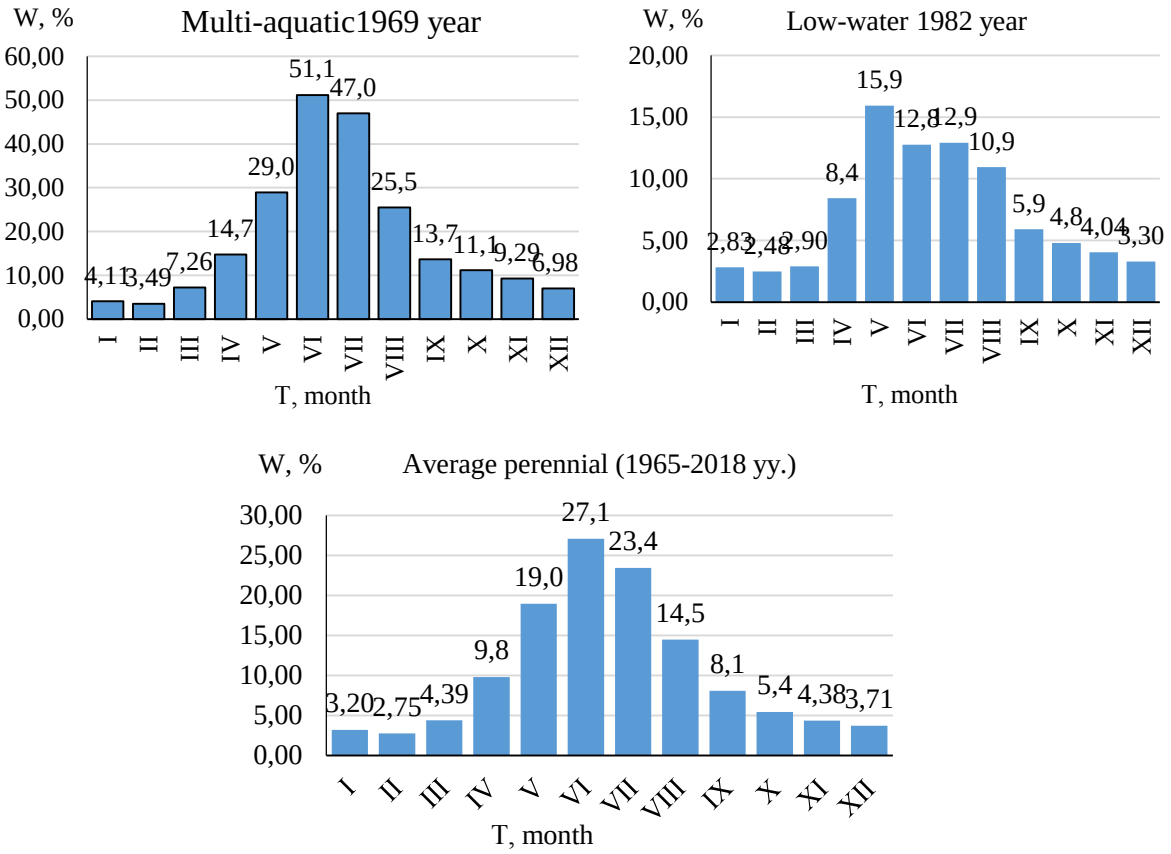

Figure 1. Distribution of the Piskom River flow by months during the year

Based on the above, diagrams of meteorological factors, in particular atmospheric precipitation and air temperature change, with the flow of the Piskom and Chatkal rivers were drawn (Figure 2 and 3). It can be seen that the influence of atmospheric precipitation on the formation of the Piskom River flow is much greater Changes in atmospheric precipitation with the flow of the Piskom River are often mutually exclusive. In the diagram drawn for river temperatures and air temperatures, however, such compatibility is not observed in some years.

To increase the accuracy of the relationship between river flow and meteorological factors, it is necessary to take into account air temperatures along with atmospheric precipitation. In this case, the multidimensional relationship between river flow and meteorological factors is statistically assessed [1, 3].

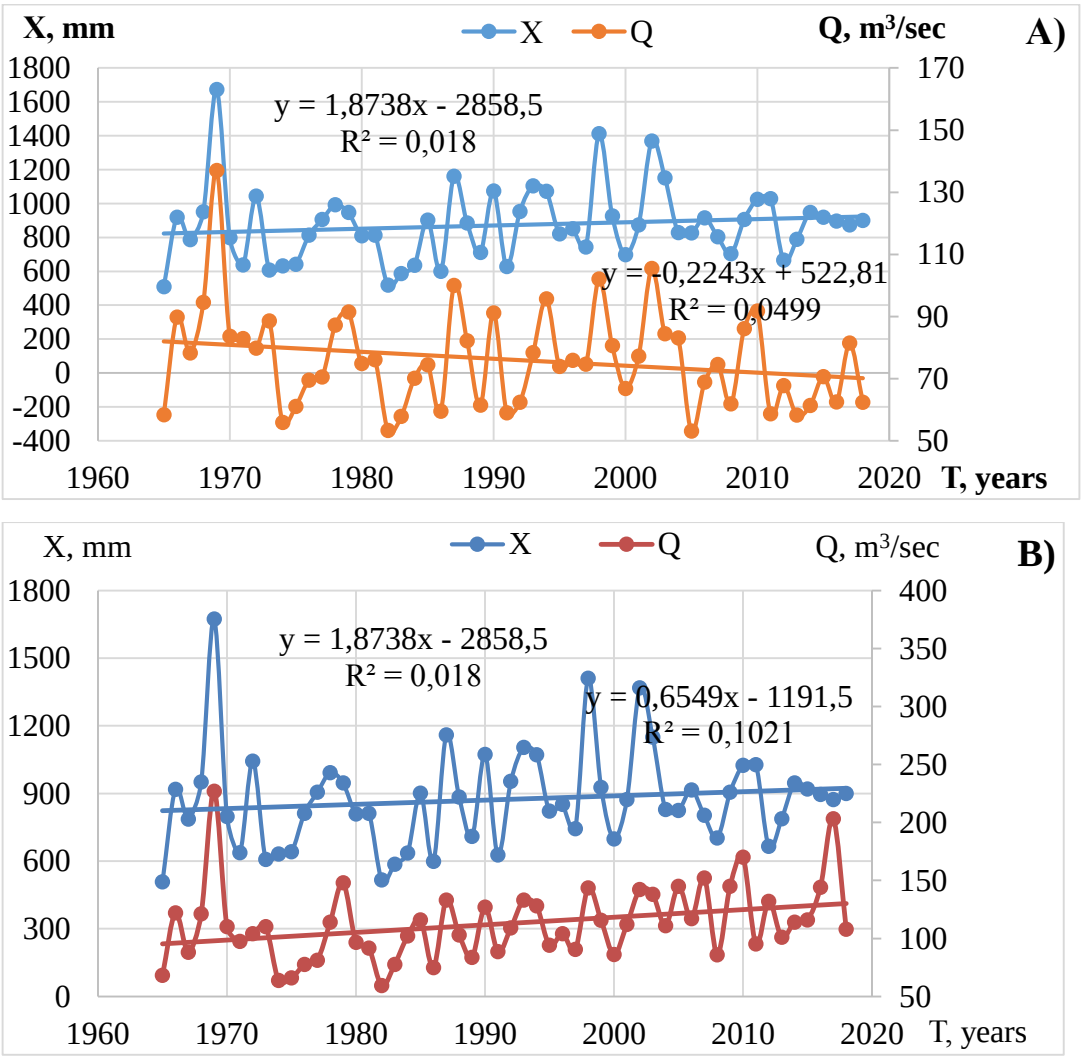

Figure 2. Annual variation of atmospheric precipitation recorded at the Piskom meteorological station with the flow of the Piskom (A) and Chatkal (B) rivers.

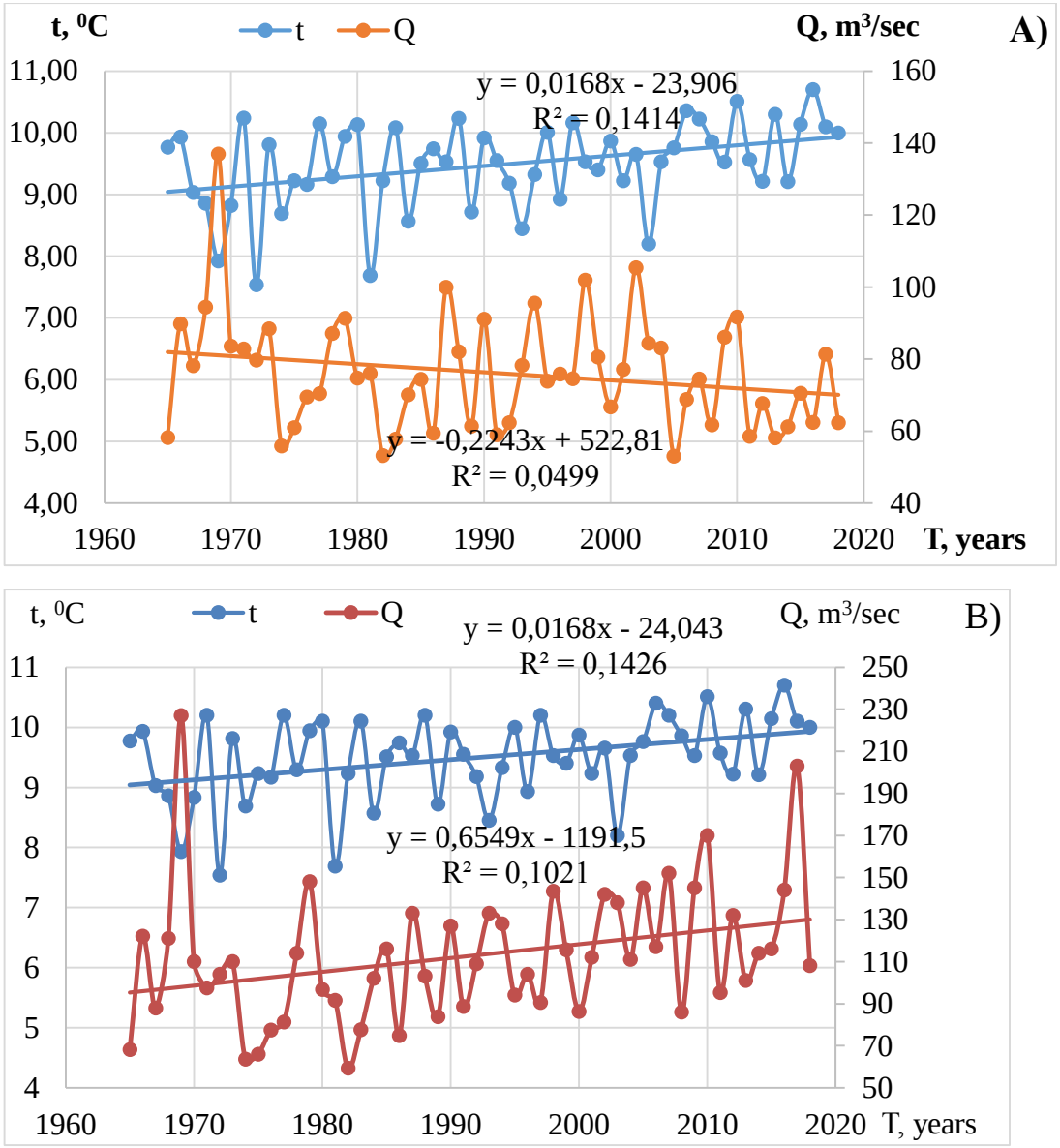

Figure 3. Annual change in average annual air temperature at Piskom meteorological station with the flow of Piskom (A) and Chatkal (B) rivers

At the Piskom meteorological station, the trend line drawn on the graph of air temperature changes shows that it is rising upwards (Table 1).

Table 1. Air temperature and precipitation trends recorded on the Piskom and Chatkal rivers and at the Piskom meteorological station

Piskom (Mullala v.)	Chatkal (Hudoydodsoy v.)	Piskom MS
Trend equations		
Q = -0,224x + 522,8	Q = 0,655x – 1191,5	X = 1,874x - 2858
		t = 0,017 - 24,04

The analysis of the graphs shows that the effect of atmospheric precipitation on the formation of the studied river flow is noticeable. Changes in atmospheric precipitation with the flow of the Piskom and Chatkal rivers are often mutually exclusive. In the graph drawn for air temperatures with river flow, however, such compatibility is not observed in some years. Given all the above considerations, it is necessary to take into account air temperatures along with atmospheric precipitation to increase the accuracy of the relationship between river flow and meteorological factors. In this case, the multidimensional relationship between river flow and meteorological factors is statistically assessed.

Based on the results obtained in the study, the following conclusions were made:

1. The month-to-month distribution of the Piskom River flow over the year was studied for multi-aquatic (1969), low-water (1982), and average perennial (1965-2018) values. At perennial averages, river flow is unevenly distributed over months. In January, 61.9 million m^3 of annual flow, or 2.6 percent, flowed, while in February it decreased slightly (2.2%). Starting in May (367 million m^3), the flow in the river increased and continued until July (280 million m3 or 11.6 percent);

2. The maximum value of the average monthly water consumption observed in the Chatkal River is Q = 314 m^3/sec, which corresponds to July. The value of the flow volume in July was $W_{VI} = 813 \cdot 106$ m^3, which is 22.6 per cent of the annual flow. According to the calculations, the flow volume in February amounted to only 2.4% of the annual flow rate.

3. Graphs of the combined changes in meteorological factors, in particular atmospheric precipitation and air temperature, with the flow of rivers were drawn. These graphs used data on average annual water consumption observed at the Mullala and Hudoydodsoy hydrological posts of the Piskom River and the annual atmospheric precipitation and average annual air temperatures recorded at the Piskom meteorological station.

References:

1. Alekseev G.A. Objective method of alignment and normalization of correlation connections. - M: Hydrometeoizdat, 1971. -363 p. (in Russian), [Алексеев Г.А. Обеъктивные методы выравнивания и нормализации корреляционных связей. – Л.: Гидрометеоиздат, 1971. - 363 с.]

2. Monin A.S., Sonechkin D.M. Climate fluctuations according to observations: triple solar and other cycles. -Moscow: Nauka, 2005. -191 p. (in Russian), [Монин А.С., Сонечкин Д.М. Колебания климата по данным наблюдений: тройной солнечный и другие циклы. -М.: Наука, 2005. -191 с.]

3. Rasulov A.R, Hikmatov F.H., Aytbaev D.P. Fundamentals of geology. Tashkent: University, 2003. -327 p. (in Uzbek), [Расулов А.Р., Ҳикматов Ф. Ҳ., Айтбаев Д.П. Гидрология асослари. –Тошкент: Университет, 2003. -327 б.]

4. Rakhmonov K. The R., Hikmatov F. H. Floating consumption of mountain rivers of Uzbekistan and assessing the intensity of soil leaching from their basins. Tashkent: "Innovative development publishing house", 2021. -148 p. (in Uzbek), [Рахмонов К.Р., Ҳикматов Ф.Ҳ. Ўзбекистон тоғ дарёлари муаллақ оқизиқлари ва улар ҳавзаларидан тупроқ-грунтлар ювилиши жадаллигини баҳолаш. –Тошкент: “Innovatsion rivojlanish nashriyot matbaa uyi”, 2021. -148 б.]

5. Hikmatov F.H. et. al. Methodology for studying the hydrological regime of mountain rivers. Tashkent: "Science and technology", 2016. 172 p. (in Russian), [Хикматов Ф.Х. и другие. Методика исследования гидрологического режима горных рек. -Ташкент: “Fan va texnologiyalar”, 2016. -172 С.]

6. Hikmatov F.H. Water erosion and suspended sediment runoff of mountain rivers of Central Asia. – Tashkent: " Science and technology ", 2011. 248 p. (in Russian), [Хикматов Ф.Х. Водная эрозия и сток взвешенных наносов горных рек Средней Азии. – Ташкент: «Fan va texnologiya», 2011. - 248 с.]

7. Chub V.E. Climate change and its impact on Hydrometeorological processes, agro-climatic and water resources of the Republic of Uzbekistan. Tashkent:

Voris-publishing house, 2007. 132 p. (in Russian), [Чуб В.Е. Изменение климата и его влияние на гидрометеорологические процессы, агроклиматические и водные ресурсы Республики Узбекистан. –Ташкент: Voris-nashriyot, 2007. -132 с.]