Change of hydrological regime of foothill small rivers of Uzbekistan

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***Abstract*— This article analyzes water resources and their changes in the hydrological regime of the foothill small rivers Govasay and Podshaotasay (Namangan region, Uzbekistan). The required volumes of water for irrigation of adjoining lands and actually expected volumes of water were estimated based on data for the last 10 years.**

Keywords—rivers, basin, runoff, hydrological regime, foothill zone rivers.

I. INTRODUCTION

Aim of the study is management and use of water resources of the basins of the foothill small rivers of Uzbekistan. The subject of the research is the rational operation of water resources in the basins of small foothill rivers and the proposing of methods for their effective use.

II. METHODS AND MATERIALS

The methodological basis of the study is made up of the results of previously conducted scientific studies in our country and abroad, obtained in the field of the rational management of water resources in the basins of small foothill rivers and to provide methods for their effective use, opinion of scientists on this problem. The research work was carried out on the basis of the systems and comparative analysis methods. The database of research work consists of data obtained in the Basin Administration under the Ministry of Water Management of the Republic of Uzbekistan and materials of field research of the authors.

At present, in the basins of transboundary and local foothill small rivers, as a result of the disconnection between the water flow regime and the water consumption regime (in foothill rivers and creeks, the main volume of water originates in the spring, before the vegetation season), there is a seasonal shortage of water in the summer. These problems demonstrate the need for deeper research to improve the management and use of water resources within small foothill river basins.

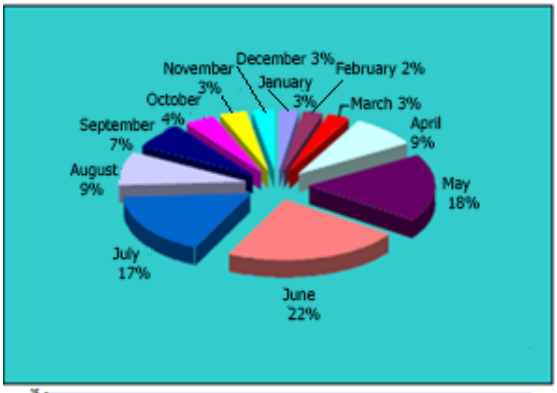
As part of the research, hydrological regimes and the actual use of water resources of the Govasay and Podshaota rivers, which are right-hand tributaries of The Syr Darya River, originating in the southern part of Chatkal and eastern slopes of the Kurama mountain systems [8], were studied.

The Podshaota river is formed in the Chatkal mountain system, located in the Kyrgyz Republic, main part of river's water is used for irrigation of Namangan region, Uzbekistan. The river considered to be rivers of snow and glacial nourishment. The total length of the river is more than 130 km and the irrigated area is 443 km2. The river basin is 389 km2. The river basin is located at an altitude of 2000 m above the sea level. The Padshaota River Basin has more than 6 small glaciers with a total length of 4 km, with the area of 1.9 km2 [7].

The waters of The Podshaota River are formed on the southern slopes of the Chatkal mountain system at an altitude of about 4000 m above the sea level, and the maximum height of the mountain peaks is above 4300 m [1].

The main gauging station of the river is located in the neighboring republic of Kyrgyzstan, not far from the merging of the Tostu River, at a distance of more than 20 km from the border of the Republic of Uzbekistan [1].

According to the data of this hydrological station, the average annual flow rate of the river is 193.0 million m3/year, the average annual water discharge is 6.2 m3/s, the maximum discharge is observes in June (an average of 16.1 m3/s), the minimum - in February (average 1.5 m3/s) [2], [10].



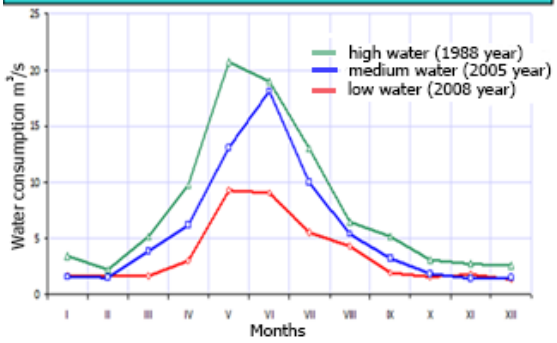


Fig. 1. Long-term annual distribution of flow rate, The Podshaota River.

In the Podshaota river, the high-water period observes in April-September (about 75% of the total river water flow), the low-water period - in the October-March months [5]. The assessment of the flow of the Podshatota river was carried out on the basis of data on the average annual values of water discharge for the period of 1963-2017.

The Govasay River is located in such an area of the Ferghana Valley, where mudflows often take place and maximum water discharges in the river are frequently observed. Analyzing by the data of the gauging station located near the village of Gova, the average annual flow of the river is 195 million m3 per year, and the average long-term water flow rate is 6,2 m3/s. The maximum flow rates (on average 22 - 32 m3/s) are observed in the period May-June, the minimum flow rates (on average 1.2 m3/s) are observed in the period from of January-February [6].

III. Results and Discussions

The high-water period in the river happens in spring-summer, about 70% of the total river runoff runs from April to June (Fig. 2). In the formation of the Govasay River, snowmelt is considered the main source of nourishment and the average annual water discharge of the river varies depending on the amount of snowfall in the mountains.

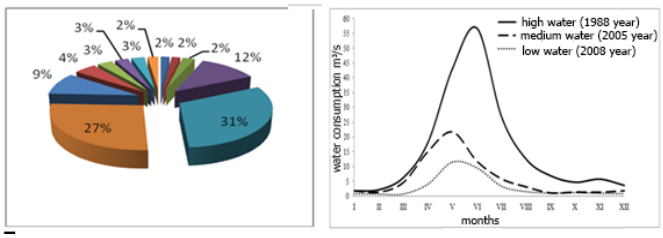


Fig. 2. Fig. -2. Changes of the Govasoy River hydrograph over different water content years.

To find out the level of water supply in the Govasoy River basin, the total amount of water resources of all sources of water supply was studied: for high-water (1988), mid-water (2011) and low-water (2008) content years, water flow regimes were determined and hydrographs were built.

Analysis of data by the different water content years depicts that in some high-water years, spring water supply is good, and in some years, it is much lower than the demanded water volumes.

The results of the analysis of data for the last ten years (2008–2017) show that the average long-term fluctuations in river runoff are insignificant, however during the year [9], fluctuations in water flow in rivers increase, and the number of mudflows growth within high-water years. Under the impact of global climate change in the region, there are changes in the number and timing of the formation of the flow of the rivers Podshaota and Govasay. In particular, the monthly fluctuations in the hydrographic indicators of the Podshaota and Govasay rivers over the year show a shift of the river hydrograph to the left (Fig. 3).

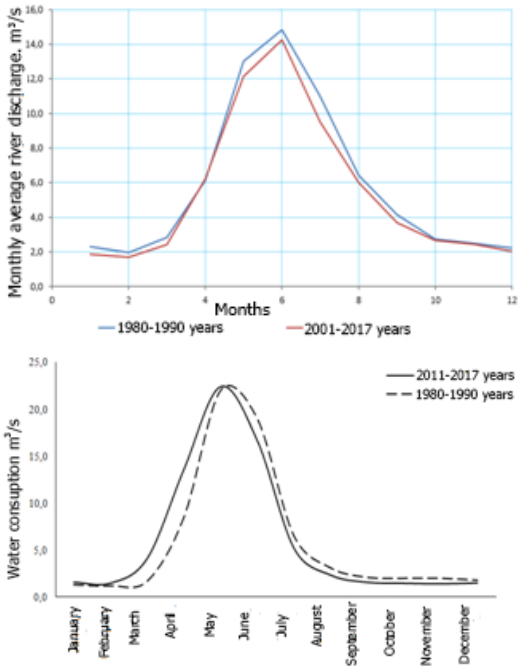


Fig. 3. Inter annual change in hydrograph of the Rivers of Podshaota and Govasay.

According to the results, during the year an increase is observed 1.5-2 months before the start of the growing season in the flow of the Podshaota and Govasay rivers in the northern part of the Ferghana valley.

A shift to the left and a decrease in the annual distribution of the hydrographic indicators of the Podshaota and Govasay rivers summon specific difficulties when using river water, which means the most of the water in the river, passes ahead of the time of active water consumption, while during the vegetation season there is a shortage of water resources respectively.

Water runoff of rivers forming on the southeastern slopes of Chatkal Mountains can change during global climate change and this have to be taken into account when using water resources. Due to the fact that Podshaota and Govasai are transboundary small rivers, to assess the water availability of irrigated lands of river basins in Uzbekistan is important and therefore, data on the required and actual volumes of water over the past 10 years were collected and analyzed [3]. The results of the analysis and comparison of the studied data present that the amount of water for irrigation differ significantly from the actually required amount.

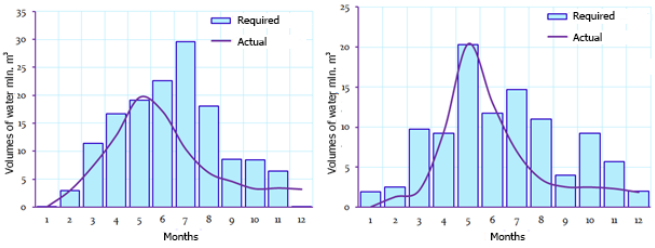


Fig.-3. Change in irrigation required and factual withdrawn average annual amount of water volumes from the Podshaota and Govasay rivers for irrigation purposes of Uzbekistan.

IV. CONCLUSIONS

On the studied rivers, the water resources actually used for irrigation differ significantly from the required amount of water, which leads to a shortage of water during the vegetation period. To improve the situation in the region, it is necessary to take additional activities of better water resources management for consumers.

Thus, in modern conditions, in order to comply with river flow regimes, special attention should be paid to the creation of seasonally controlled small water reservoirs in the Podshaota and Govasai river basins in Uzbekistan, the selection of a suitable place for the construction of reservoirs for managing river flows and the choice of cost-effective options for the delivery of controlled river flows.

For more efficient use of the water resources of the Podshaota and Govasoy rivers, it is indispensable to build small reservoirs to regulate the flow of these rivers during the non-vegetation period, improve water use based on the operational management of river water resources, organize reliable monitoring of river flow which is used for irrigation, equip water supply networks with gauging stations and increase accuracy water metering. As a result of the introduction of modern irrigation water-saving technologies in the upper and downstream of the river basin and their practical application, they will ensure the efficient use of water resources and reduce water shortages in dry years.

REFERENCES

[1] Water – is crucial resource for future life of Uzbekistan. Tashkent, Representative of UNDP in Uzbekistan, 2007, – 136 p.

[2] Mamatov S.A. The development of proposals on enhancement of management of transboundary small rivers of Fergana. Scientific and technical essays, Archives of The Institute of water problems, 2010.

[3] Mamatov S.A., Ibragimov F.I., Akbarova K.X. Increasing water provision in small river basins of Uzbekistan. “Amelioration and tasks on enhancement of environment, increasing the effectiveness of water resources of Uzbekistan”: Materials of republican scientific and research conference. Tashkent, 2012. 48-51 pp.

[4] Soliev E.A. Change in water flow rate of The Govasay River // The history of Geography – memories and worth: Materials of republican scientific and research conference. – Namangan city: NSU, 2005 - .43-45 pp.

[5] 5. Sikan A.V., Malisheva N.G., Vinokurov I.O. Statistical methods of analyzing Hydrometeorological information. Laboratory practices. For fields "Hydrology". Specialty "Hydrometeorology". - Saint-Petersburg.: Publishing House of RSHU. 2014.-pp. 75.

[6] 6. Sokolovskiy D.L. The river stream. Theoretical basics and the methods of estimations. Tutorial. – Leningrad: Publishing House of Hydrometeorology, 1968. – pp. 538

[7] 7. Shults V.L. The rivers of the Central Asia. – Leningrad: Publishing House of Hydrometeorology, 1965. – pp.691.

[8] Gulomov P.N., Vakhobov H., Barotov P., Mamatkulov M. «Physical geography of Uzbekistan and The Central Asia», Publishing and polygraph creative house «O’qituvchi», Tashkent – 2013. – 160 pp.

[9] Reference book for Climate of USSR. Volume 19. Air and soil temperature Leningrad: Publishing House of Hydrometeorology, 1965. – 96 pp.

[10] Reference book for Climate of USSR. Volume 19. Air humidity, precipitation and snow cover. – Leningrad: Publishing House of Hydrometeorology, 1967. – 143 pp.