

## STUDY OF ASPECTS TUYAMUYIN WATER RESERVOIR ON WATER FLOWS AND ECOSYSTEM LOWER AMU DARYA, UZBEKISTAN

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**Abstract.** Climate change is causing extreme recession of the mountain glaciers in Central Asia. Also increased evapotranspiration from higher temperatures in arid and semi-arid zones in Uzbekistan. Additionally, climate change has an effect increased exceptional water deficits. In such scenarios Environmental despite for a more sustainable water supply system, available reservoir capacity. Central Asia unlock watershed region, its main rivers are the Amu Darya and the Syr Darya, and its key problems of the region the efficient use of water from these rivers. Supplying water to the Khorezm oasis and Karakalpakstan Tuyamuyin reservoir is the main water resource. With an increasing population of the region and Aral Sea ecological problems, mounting demand exists for a more sustainable water supply system. Water reservoirs of Central Asian river contribute to the improvement of water resources management in the lower part of the region and thus, play a strategic role in regional water supplication. 70% of Central Asia is arid and semi-arid regions and therefore, water supply for irrigation and population purposes is the main water sector of all Central Asian countries.

**Keywords.** Climate change, Ecosystem, Environment, Amu Darya, Water flow

### 1. Introduction

In historical at the lower part of the Amu Darya river had unstable water flow, in principle river provide not enough storage capacity for keeping a strategic reserve for covering water deficits and irrigation all the seasons but after build and operation of the Tuyamuyun water reservoirs water quality in water efficiency increase rapidly. Tuyamuyun water reservoir not just a reservoir also Hydroengineering Complex (THC) which mean water reservoirs should provide economic benefit. It is of critical importance for the water flow Amu Darya river for environmental balance lower Amu Darya region. Water reservoirs of the region play an essential role as they provide the potential to act as an instrument for adapting to ongoing water shortage caused by climate change. The Amu Darya is main river in Central Asia, the Amu

Darya is the largest tributary in terms of run-off to the Aral Sea (lake) with a total mean discharge of 79.3 km<sup>3</sup>. [11]. The Amu Darya river the water flow regime temporal distribution of the annual runoff volume with about 80% within the 6 months of year. High water flow twice a year first period in April-May after the snowmelt in lower maintain area Central Asia and second in June-July after the glacial melting in the high mountains are Central Asia.

## 2. Study are

Tuyamuyun water reservoir is situated in a dry region (Figure 1) with high summer temperatures, where the average annual rainfall is below 150 mm, there was immense evaporation. [7]. The low rainfall was nowhere near sufficient to compensate for the losses due to evaporation; together with the underwater feeder rivers. The high runoff of fertilizers from the irrigated land intensified this process. THC is located on the lower reaches of river of Amu Darya, between Uzbekistan and Turkmenistan, (Figure 1) constructed started 1969 year and opened 1983 year to regulate water flow lower Amu Darya. One of the prior to construction of the reservoir, river Amu Darya carried high quantities of water every year which resulted in flooding of the flanking lands. Unpredictable climate of the region course frequent floods, THC constructions regulating the water flow through canals into the lower Amu Darya region agricultural irrigation system.



Figure 1. Study area Tuyamuyun Hydroengineering Complex (Source: )

The river of Amu Darya largest river in Central Asia, (**Figure 2**) with a total 534,739 km<sup>2</sup> water basin. Catchment area of Amu Darya is located east of the Central Asia Pamir and Khindikush The annual flow regime of the Amu Darya is regulated upstream and downstream by large dams and canals. In the upstream area these are the Nurek and Rogun dams (In Tajikistan), and the downstream area is characterized by the influence of the Tuyamuyun (In Uzbekistan).



Figure 2. Amu Darya watershed (Source: IWMI, WRI)

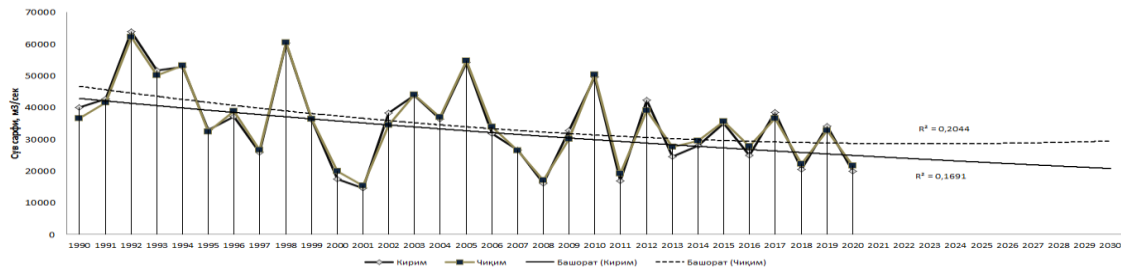
### 3. Methods

Analysis of research data used statistical methods, data was analysed using SPSS Statistics software. Data structure was classified using calculation and similarity matrix on water flow. Data from 1990 to 2020 used data source of Central Asian Scientific Research Institute of Irrigation (SANIIRI). Analysis of water flow data that the level of turbidity of the stream is divided into two stages:

- i) at the first stage, Water inflow out flow dynamics in the THC
- ii) at the second stage, Water balance of inflow and out flow the THC

### 4. Results

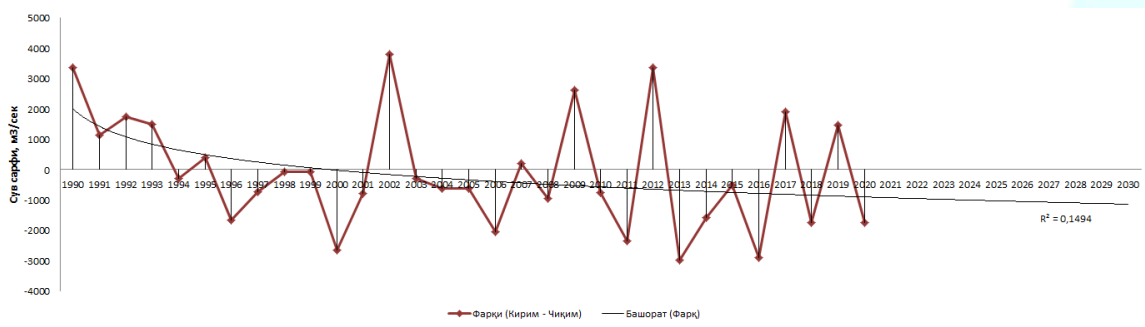
Comparison of the calculation results of with water flow measurements carried out from 1990 to 2020 show water inflow of THC slowly increased. Results show inflow and out flow of water decreasing slowly.



**Figure 3.** Water inflow and out flow dynamics in the THC 1990–2020. Data: (SANIIRI)

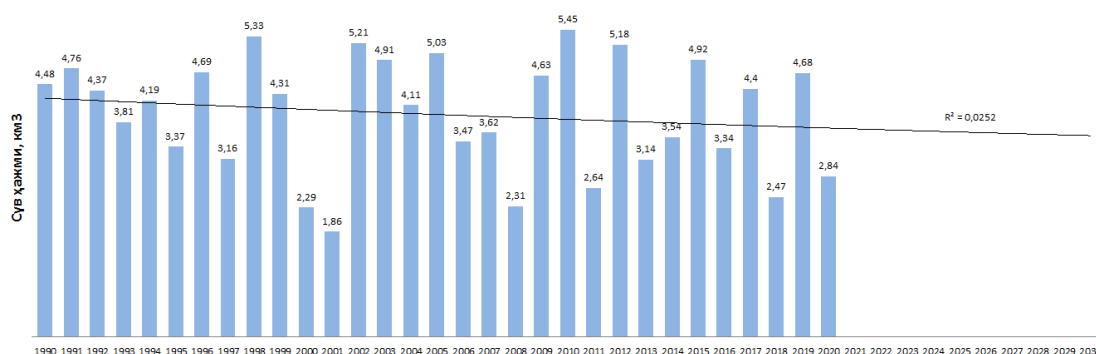
If we look at the water balance from 1990 to 2020. (Fig.3) The analysis shows that the reservoir water balance is gradually decreasing. In this case, it can be seen that the flow of water from the Amudarya has decreased, which is inconsistent with the balance of water taken from it.

In the water balance of 2000 and 2001, we can see a sharp decrease in the amount of water coming into the reservoir, and it is in these years that we can see a large amount of water coming out of the reservoir for irrigation purposes. (Fig.3)



**Figure 4.** Water balance of inflow and out flow the THC 1990–2020. Data: (SANIIRI)

The results of the studies presented here based on data. Considering THC not only irrigation but also electricity generation, it shows how important continuously of monitoring and study TCH water balance. At the same time, of course, it is important to manage the sub-balance inflow and out flow for irrigation requirements and energy requirements. At the same time, THC is the only water resource in the Lower Amu Darya region, which determines the importance of this watershed.



**Figure 5.** Water balance THC. 1990 2020 Data: (SANIIRI)

The results identified for the adapted water balance scenarios a reduced sediment  $R^2$  indexation 0,0252. The annual reservoir storage capacity of water balance shows the highest effect for the dry years’ scenario and the highest effect for the wet year scenario with twice time higher annual sedimentation as in dry years. The research shows the THC water flowing monitoring 30 years, water consumption. There critical importance THC for environmental flow the lower Amu Darya region. Water balance of basin to use existing infrastructure in a better way and adapt the water allocation recently, especially during dry years for example in our case 2000-2001, 2008, 2011, 2013-2014, 2018 and 2020. In this case, the downstream reservoir complex THC gives more stable management water flow for the downstream area of the Amu Darya.

## 5. Conclusion

For water flow of lower Amu Darya region existing reservoir complex of the THC offers the greatest capability for an adaptation of management strategies risk water management. Operation THC for the reservoir complex has been verified as an effective measure for a rapid climate changes and comprehensive improvement of the water flow such a water crisis region of Uzbekistan. Potential of the THC to supply and management of water flow also important solving drinking water of the local population. As same time location of the THC requires rational and specific approach of water management water resources because of its transboundary water resource. THC is still hampered by the difficulties to water consumption and operation regimes water flow increase both the quantity and reliability of hydrological data. The

Sustainable development of the region it's very important sustainable water flow lower Amu Darya river. Securing water supply in the Amu Darya region needs the existing water storage capacities, and water flow management. Monitoring water balance sustainable expectation foe operation water flow regimes be investigated and proposed for the discussion both at environmental and social-economical interstates.

## 6. Reference

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