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# The Ahangaran River basin runoff features: which parameters are shifting in reality?

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***Abstract:*** *The article presents the Ahangaron River Basin hydrological features and the results of changes in air temperature over the past 30 years, precipitation and snow cover, and long term fluctuations in air temperature. According to observations, in the last 30 years there is a little change in long-term amount of precipitation, but there is significant change in its form.*

***Key Words:*** *Ahangaron River Basin, fluctuations of air temperature, shift of precipitation form, decrease of snow cover, global climate change*

## 1. INTRODUCTION:

It is well known that agricultural production in Uzbekistan is based on artificially irrigated agriculture. However, global climate change and quick population growth over the past few decades and the increase in demand for water as new lands are being developed and these in turns, leading to changes in river surface flow. This proved that we have to use the water of our existing rivers in a strictly targeted manner, and the study of the hydrometeorological regime of rivers is one of the most important issues. At the same time, the reserves of snow cover and glaciers in the mountains, which are the main source of nourishment of rivers flowing through the country, are directly related to climate change, and one of the main problems of hydrology [1].

The purpose of this article is to study the impact of meteorological factors on the surface flow of the Ahangaron River. In order to achieve the goal, the following tasks were identified and estimations were made to find a solution:

- ✓ Network of meteorological stations in Ahangaron River basin and their location;
- ✓ Long-term fluctuations in air temperature and atmospheric precipitation in the Ahangaron River basin;
- ✓ Graphical analysis of the impact of air temperature on snow cover;

## 2. MATERIALS AND METHODS:

In total 25 meteorological stations opened in Tashkent region at different times of the last century, 14 are currently operating, 5 of which have an observation period of more than 70 years. Regular observations at the Tashkent-Observatory meteorological station in Tashkent, the first in the country, began in 1892 [2]. In the Ahangaron River Valley and at its exit there are Kokorol, Toytepa, Tuyaboguz, Almalyk, Oblik, Angren, Turk, Dukant, Kizilcha, Kamchik and Angren-plateau meteorological stations, some of them are not currently operating. Only 6 of the stations are in operation, and only the Kamchik station is located in the unregulated (place without water reservoirs) flow basin of the Ahangaron River (above the village of Ertosh), which is the object of our research [3].

2.1-Table

**List of The Ahangaran River meteorological stations**

| Name of station | Elevation above the sea level, m | Observation period, years | Characteristics of the location |
|---|---|---|---|
| Kukorol | 340 | from 1936 | Plain-mountainous part of the region |
| Tuytepa | 388 | 1933-1966 | Plain-mountainous part of the region |
| Tuyabugiz | 404 | from 1936 | Plain-mountainous part of the region |
| Almalik | 507 | 1979 йилдан | Ahangaran River valley |
| Oblik | 847 | 1925-1972 | Ahangaran River valley |
| Angren | 942 | from 1972 | Ahangaran River valley |
| Turk | 998 | 1953-1971 | Ahangaran River valley |
| Dukant | 2001 | from 1958 | The southern slope of the Chatkal Mountain Ridge |
| Қизилча | 2075 | 1957-1992 | The southern slope of the Chatkal Mountain Ridge |

| | | | |
|---|---|---|---|
| Kamchik | 2145 | from 1983 | The Qurama Range is the southeastern mountainous border of the region |
| Angren-plateau | 2289 | 1952-1964 | Upstream of The Ahangaran River |

The operating Angren station is located downstream of the  the Ahangaron Reservoir, in a low mountainous region, and therefore, its observation data cannot be used to study the distribution of meteorological parameters for whole of the basin area. Although the Dukant station is located in the middle mountainous region, it does not considered to be the catchment area of the Ahangaron River - Ertosh village.

**3. DISCUSSION:**

To describe the meteorological and hydrological regime of the basin in the current climatic period, where the water catchment area of the research object is 1110 km2, there is only one appropriate meteorological station observation data. This situation poses certain difficulties in studying the distribution of air temperature across the basin area, especially the amount of atmospheric precipitation. Numerous studies have shown that the air temperature in the Chirchik-Ahangaron basin has a fairly well-defined homogeneous distribution in latitude and longitude [4]. Therefore, we are limited to the observation data of the Kamchik Station when studying the air temperature regime of the basin. In contrast to air temperature, the distribution of atmospheric precipitation by latitude and altitude regions is not homogeneous. This situation requires a specific approach in studying the distribution of precipitation over the basin area. Such shifts in the composition of atmospheric precipitation, progressive and like a leapfrog exchanging of synoptic processes in Central Asia also temperature and humidity of air masses they bring to the region, additional dependence on the geographical type of these masses, are one of the issues of meteorology [5].

In the hydrological year (from 1st October to 30th of September) long-term distributions of the average monthly amounts of atmospheric precipitation observed at Angren and Kamchik stations are consistent, respectively. We considered changes in the amount of precipitation in the past (1990-2016) and current climatic periods. Both stations have two peaks, which are clearly expressed in the monthly distribution of precipitation during the year in the previous climatic period, in Angren they are December (84.4 mm) and March (92.0 mm), and in Kamchik they are November (83.1 mm) and April ( 94.4 mm) [6].

**4. RESULT:**

During the observed climatic period, there were significant changes in the composition of the monthly distribution of precipitation. In Angren there was a shift of the maximum to February (99.2 mm), and in Kamchik were three maximums (81.8, 92.4 and 93.5 mm, respectively) with values corresponding to November, February and April were observed [7].

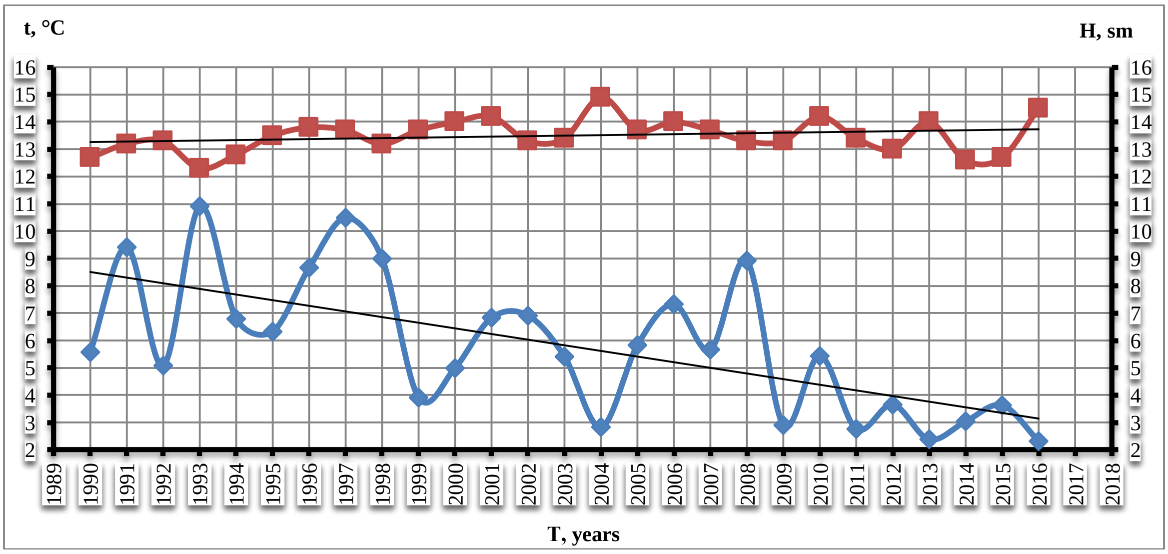


**Figure 1.** The average annual air temperature and the annual change in snow cover at the Angren meteorological station (1990-2016). (blue is snow cover and red is air temperature)

It is understandable that in the context of global climate change, some meteorological parameters are changing dramatically. From the graph above, we can see that the average annual air temperature observed at the Angren meteorological station has been slightly rising for years, and that the snow cover has been declining in recent years

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under the influence of the air temperature at first sight. However, if we analyze deeper the form of precipitation it is clear in the last few decades it shifts also, to form of liquid than snow. Noticeable, long-term annual amount is almost the same 680 mm, Kamchik station, 675 mm, and Angren station respectively.

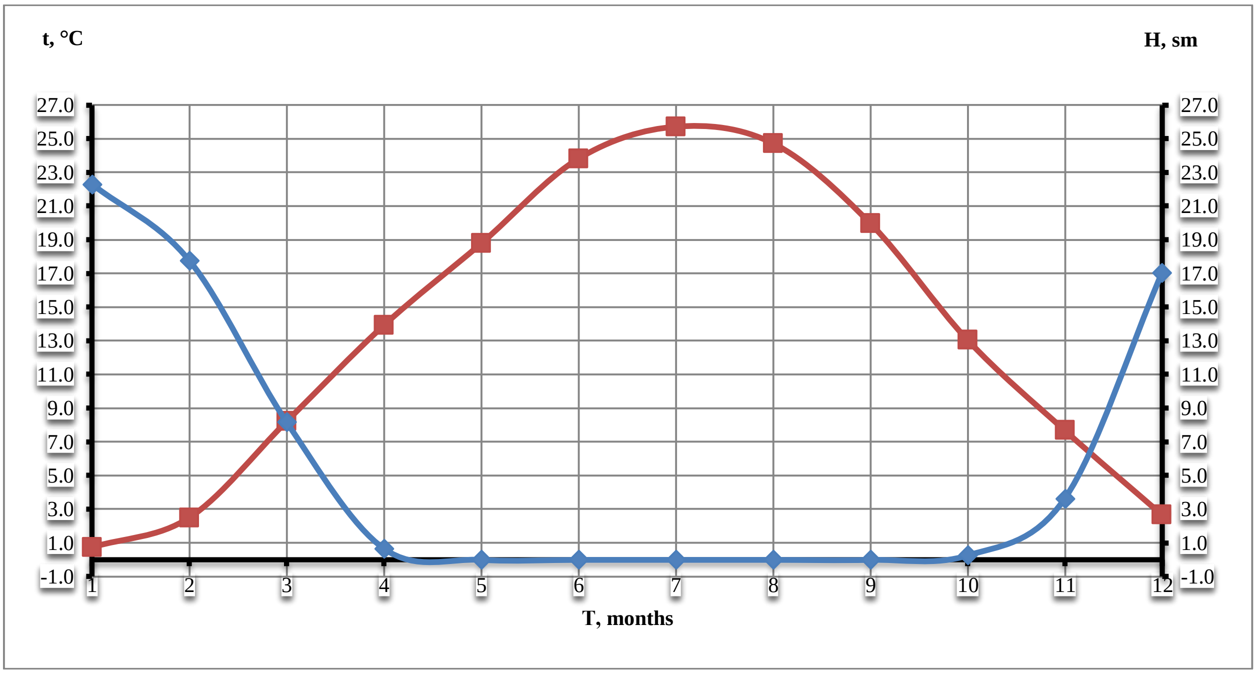


**Figure 2.** Graph of average annual air temperature and annual fluctuations of snow cover at Angren meteorological station.

The average monthly and annual air temperature observed at the Angren and Kamchik meteorological stations are analyzed. At the stations under consideration, an increase in the average annual temperature compared to the previous base climatic period. The rise in the average air temperature in the current period was 0.4 °C at Angren station, and 0.3 °C in Kamchik.

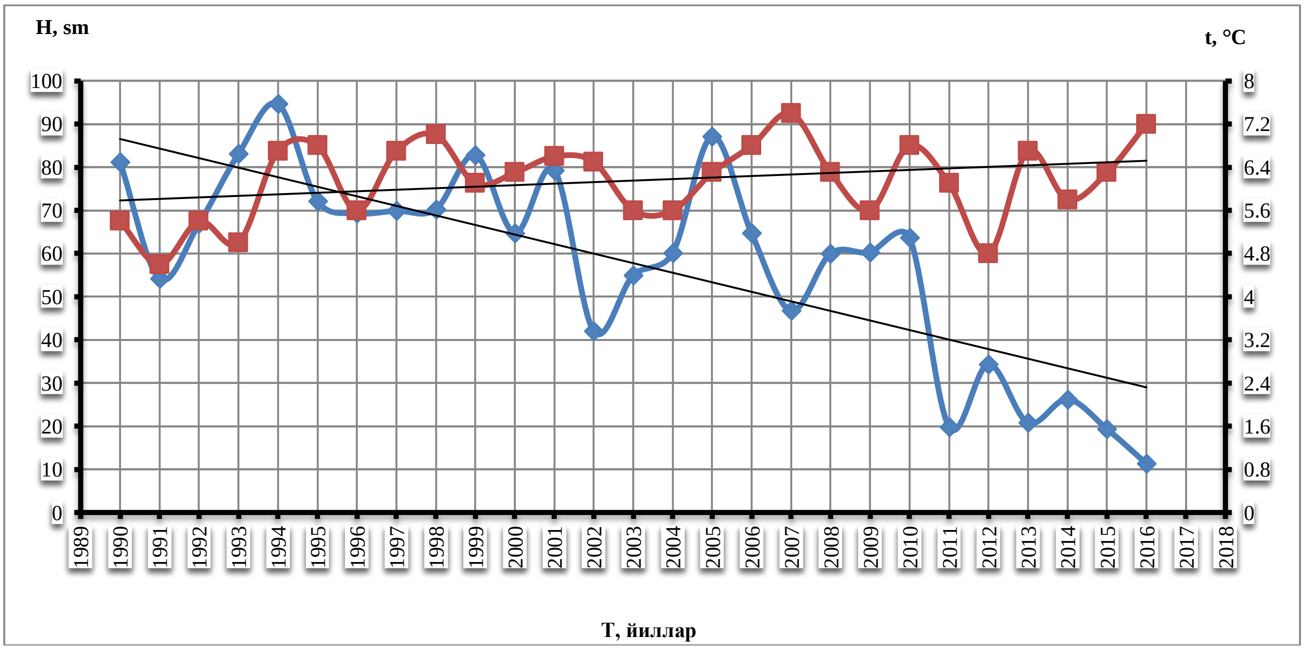


**Figure 3.** The average annual air temperature and perennial fluctuations of the snow layer observed at the Kamchik meteorological station (1990-2016).

We can see that the average annual air temperature observed at the Kamchik meteorological station has been rising over the years, but this increase is not statistically significant. Interestingly, in the last decades flashfloods due to spring heavy rainfalls occuring more frequently in the foothill small rivers of Uzbekistan [8].

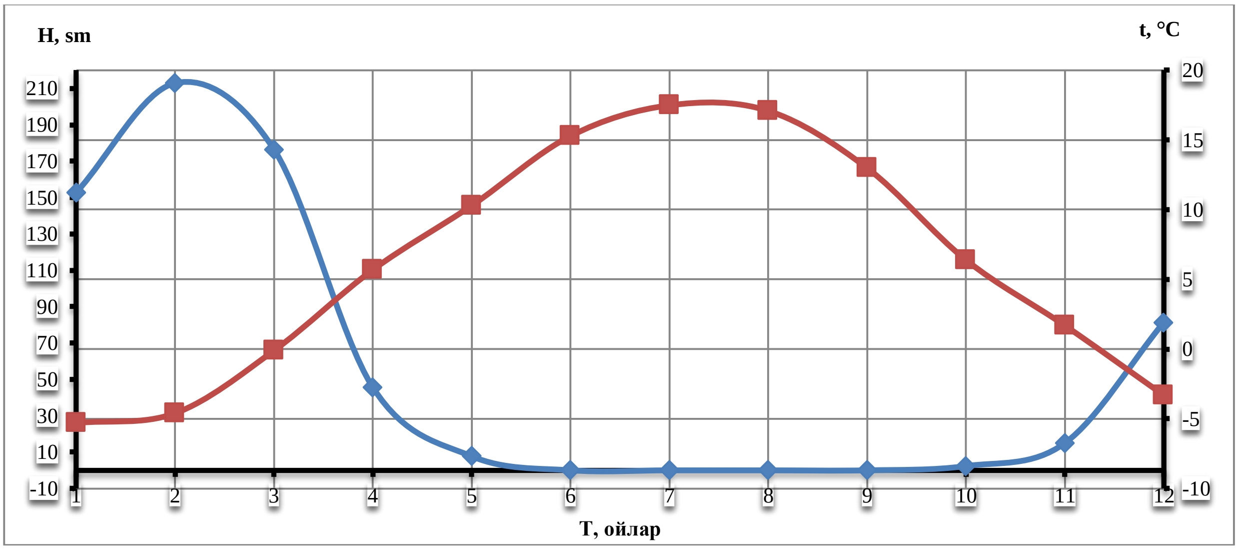


**Figure 4.** Graph of average annual air temperature and annual snow cover changes at Kamchik meteorological station.

## 5. CONCLUSION:

In the basin of the Ahangaron River valley, the average annual air temperature increased compared to the base climatic period. The increase in temperature was 0.4°C in Angren and 0.3°C in Kamchik. There have also been changes in the composition of precipitation indicators in the basin. Not the amount of precipitation, but the type began to change. This situation has led to a decrease in snow reserves. Hence, changes in temperature (rise) over the last 30 years are insignificant from a hydrometeorological point of view, but the transition of the precipitation type from crystalline to liquid form has led to a decrease in snow reserves. In addition, there was a significant change in the perennial average annual rainfall at both stations compared to the base period, as well as in the year-long distribution of maximum rainfall. The coldest month of the year at both stations is January, with an average temperature of 0.8 °C in Angren and -5.6 °C in Kamchik. The hottest month of the year is July, with average temperatures of 25.7°C and 17.5° C, respectively.

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