



AIR TEMPERATURE ANALYSIS BASED ON DATA FROM METEOROLOGICAL STATIONS IN THE KASHKADARYA REGION

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Annotation

Global climate change is affecting the water cycle on Earth, further intensifying the uneven distribution of water resources across time and regions. In this regard, the World Meteorological Organization states that "by 2050, nearly 5 billion people will not have adequate access to water for at least one month a year. Overall, global warming is amplifying the Earth's water cycle, with flood-related disasters increasing by 134 percent since 2000, while the number and duration of droughts have increased by 29 percent during the same period." This situation necessitates conducting research aimed at monitoring water resources and utilizing innovative technologies for their optimal management, as well as forecasting river flow..

Climate policies

Global climate change is one of the most urgent and serious problems of our time, affecting countries worldwide and becoming a significant obstacle to sustainable development. The inability to predict exactly how the threat will manifest, its consequences, and its impact on natural resources, ecology and environment, human health, and water resources makes it particularly challenging. The observed warming is causing extreme natural phenomena globally, such as droughts, storms, debilitating heat waves, fires, and floods. Central Asia, including Uzbekistan, is among the countries most vulnerable to environmental disasters. As the President of the Republic, Shavkat Mirziyoyev, emphasized: "Today, every country is experiencing the devastating consequences of climate change, and these negative impacts pose a direct threat to the sustainable development of the Central Asian region.". According to World Bank research, if the current rate of global temperature increase continues, by the end of the 21st century, the world's average temperature will rise by 4 degrees Celsius, which will be further exacerbated by local climate



changes. Over the past 60 years, global climate change has led to a reduction in the region's glacier area by approximately 30%. Research results predict that by 2050, water resources will decrease by up to 5% in the Syr Darya basin and up to 15% in the Amu Darya basin. Consequently, the resulting freshwater shortage in the region may affect all sectors and potentially lead to an 11% decrease in gross domestic product..

1. General characteristics of the territory

In terms of natural conditions, the Kashkadarya region is divided into two parts: the western part is plain, and the eastern part is mountainous. The Karshi Desert (with an altitude of 20-400 meters above sea level) occupies a large area of the plain. To the north of the Karshi Steppe is the Jom Steppe, which consists of a wavy plain, and to the south it adjoins the Nishan Steppe. Administratively and territorially, Kashkadarya Region borders Bukhara Region to the northwest, Samarkand and Navoi Region to the north, and Surkhandarya Region to the south and southeast.

2. Source of data. Methods and techniques used

The article analyzes characteristic air temperature data from two meteorological stations located in the Kashkadarya region for the entire observation period. Methods of comparison, mathematical statistics, and analysis of time trends were used. The analyzed data was obtained from pogodaiklimat.ru. This database is the official website of the Russian Federation and receives available information from the Uzhydromet Center. Incomplete data rows were removed when the tracking data was moved. Data on the location of weather stations, elevation above sea level, duration of observation years, and geographical coordinates are presented in Table 1.

Table 1. Weather station information

№	Station location	Station name	Station coordinates	Height above sea level, m	Observation years duration
1	Kashkadarya region	Opposite	38.80 north latitude, 65.72 east longitude	376 м.	1951-2023, 72 years
2	Kashkadarya region	Шахрисабз	39.05 north latitude 66.83 east longitude	622 м.	1929-2023, 94 years

3. Analysis of characteristic air temperatures (average, maximum, and minimum)

Graphs and histograms of average, maximum, and minimum air temperatures were drawn based on data from each weather station for the observation period. Figure 2 below shows a graph of air temperature changes at the Karshi meteorological station. The graph shows that the air temperature trend is increasing. After 1984, the minimum temperature values did not fall below 15 °C. Thus, the dispersion (scattered arrangement of points relative to the mean) is significantly reduced.

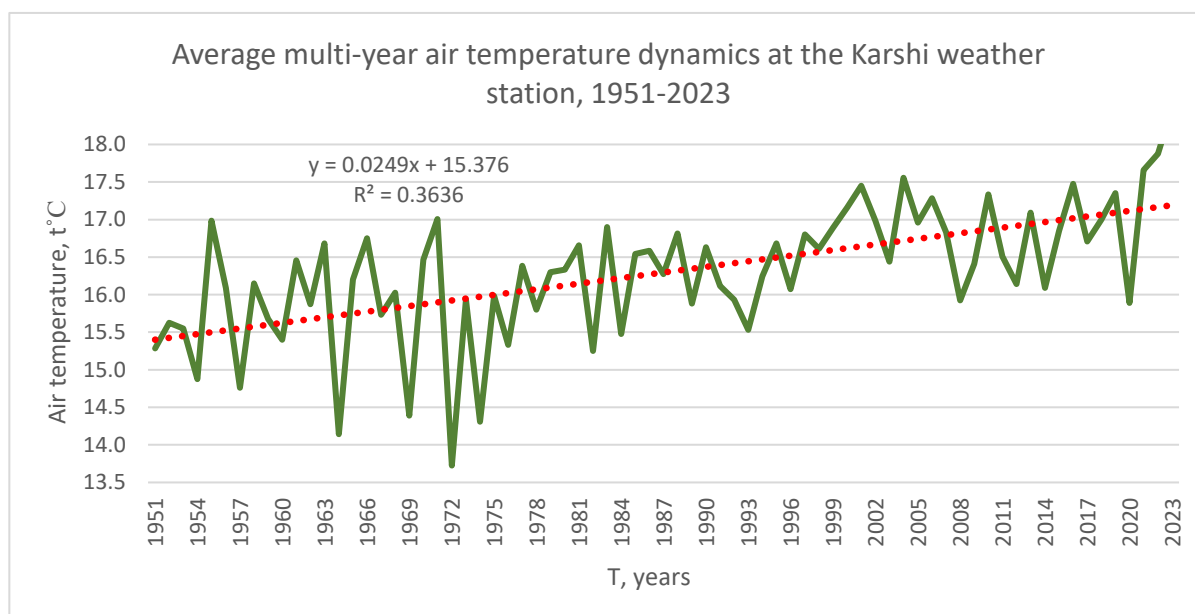


Figure 1. Average multi-year air temperature dynamics at the Karshi weather station, 1951-2023.

This shows that since the 1980s, the decline in negative air temperature indicators has sharply decreased, and the rise in positive values has increased, especially in the 2020s. The same situation was maintained for the maximum values for the observation period.

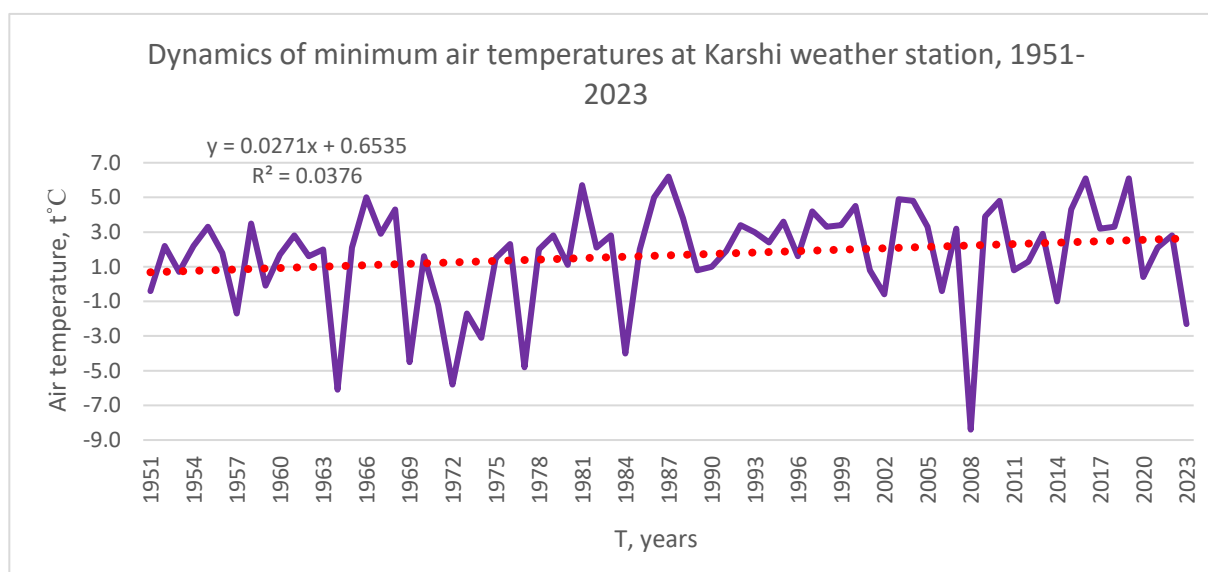


Figure 2. Dynamics of average minimum air temperatures at the Karshi meteorological station, 1951-2023.

Figure 2 shows a graph of the change in minimum air temperature at the Karshi meteorological station. The trend is insignificant for the observation period. Since the correlation coefficient - R^2 is 0.03. This leads to the conclusion that at minimum air temperature values, the increase is very small. Also, the minimum value in the observed period corresponds to 2008 (-8.4°C). If we analyze the change in air temperature by month, it can be seen that there was no change for the 1976-2000 group only in March (Fig. 3).

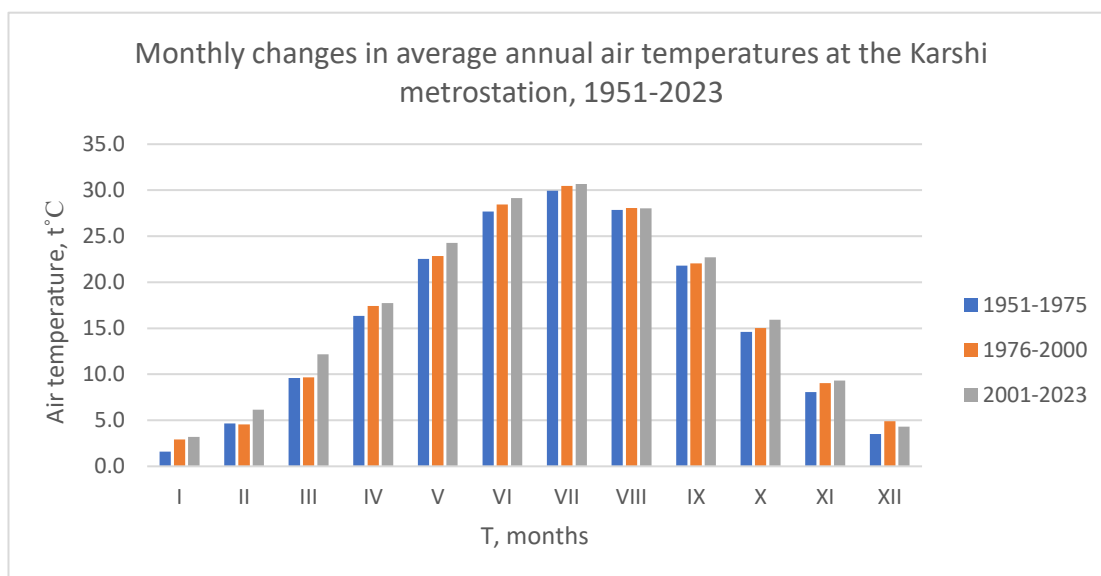


Figure 3. Histogram of the monthly distribution of average air temperatures at the Karshi meteorological station, 1951-2023.

In the group of 2001-2023, average air temperatures are rising in all months of the year, especially in November-December and January. Therefore, the temperature in the winter months has significantly increased. This, in turn, leads to less heavy precipitation and warmer winters.

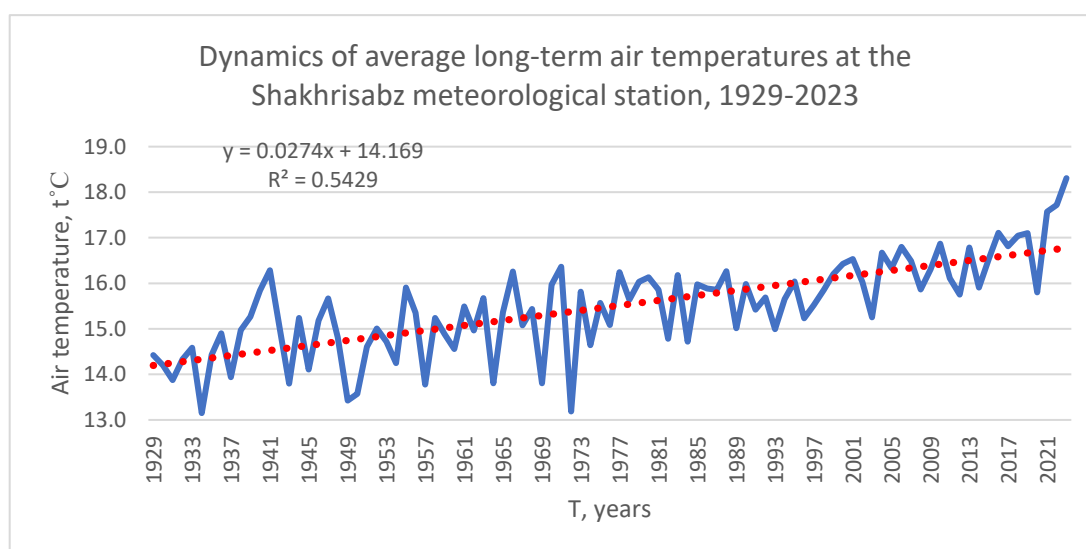


Figure 4. Dynamics of average air temperatures at the Shakhrisabz meteorological station, 1929-2023.

The graph of average multi-year air temperatures at the Shakhrisabz meteorological station showed a trend of rapid growth. The air temperature schedule for the observation period can be conditionally divided into three stages: the first stage is 1929-1973, when the dispersion was high and there was a sharp decrease in temperature, the second stage is 1974-2003, when the dispersion decreased, and the average temperature increased from 16°C to 18°C from 2004-2023. Thus, the average air temperature has increased by 4°C since the 1920s. Especially after 2020, there are consecutive extremely hot temperatures. Analysis of the minimum and maximum air temperatures at the Shakhrisabz meteorological station yielded similar results to the results of the average multi-year values. For this reason, we will not dwell on this separately.

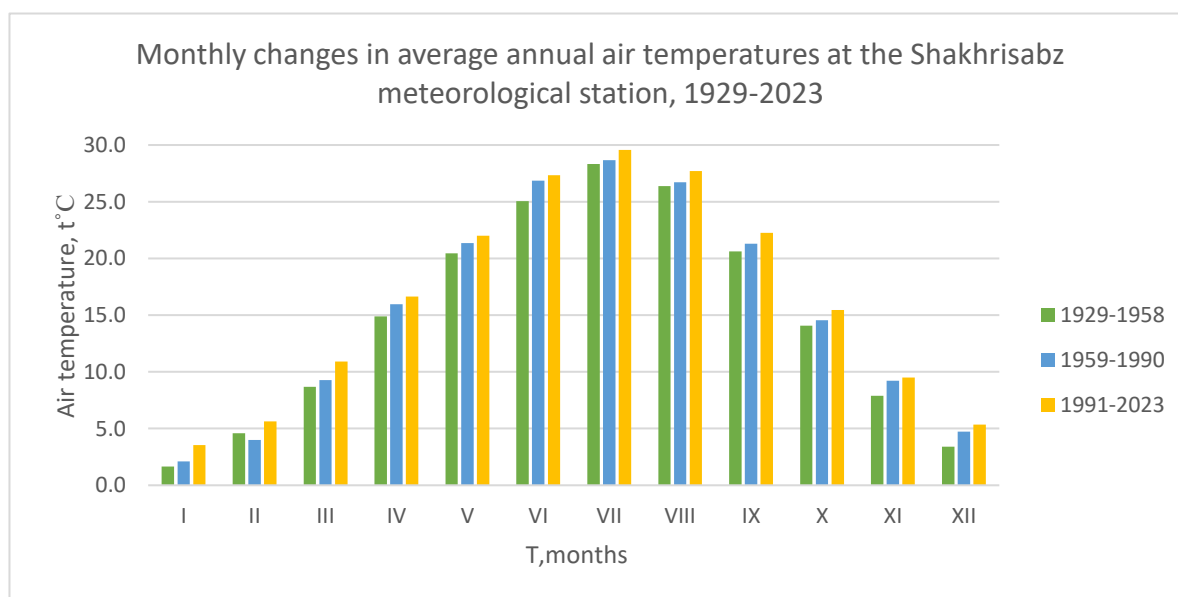


Figure 5. Histogram of the distribution of average air temperatures at the Shakhrisabz meteorological station by month, 1929-2023.

As the histogram shows, air temperatures have been increasing since the 1960s in June-December for the observed time. The group of 1991-2023 deserves special attention. Average air temperatures rose in almost all months of the year. Except for April-May.



4. Conclusion

As can be seen from the graphs, the air temperature trend is increasing. On all graphs after 1984, the temperature dispersion (diffuse arrangement of points relative to the mean) decreased significantly.

The temperature in the winter months has increased significantly. This, in turn, leads to less heavy precipitation and warmer winters. The graphs of minimum air temperatures clearly show a periodicity of 35-40 years (repetitive fluctuations). This periodicity was not observed in terms of average longevity and maximum air temperatures. This means that the air temperature in the Kashkadarya region is rising, especially in areas with glaciers.

5. List of literature

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