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# THE PECULIARITY OF SUSTAINABLE DEVELOPMENT IN CLIMATE CHANGE OF THE SYRDARYA REGION

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**Annotatsiya**:
Ushbu maqolada Sirdaryo viloyatida iqlim o‘zgarishining barqaror rivojlanishidagi muhim ahamiyati va ularni hudud tabiiy sharoitlari va atrof-muhitga ta’siri haqida fikrlar bildiriladi. Harorat va yog‘in-sochinlar ko‘p yillik ma’lumotlarini tahlili qilgan holda, iqlim o‘zgarishiga moslashish va atrof—muhitga ta’siri baholashga qaratilgan ilmiy tadqiqot natijalari keltirilgan.

**Kalit so‘zlar:** Sirdaryo viloyati, Mirzacho‘l, havoning harorati, iqlim mintaqasi, iqlim xususiyatlari, yog‘in, shamol.

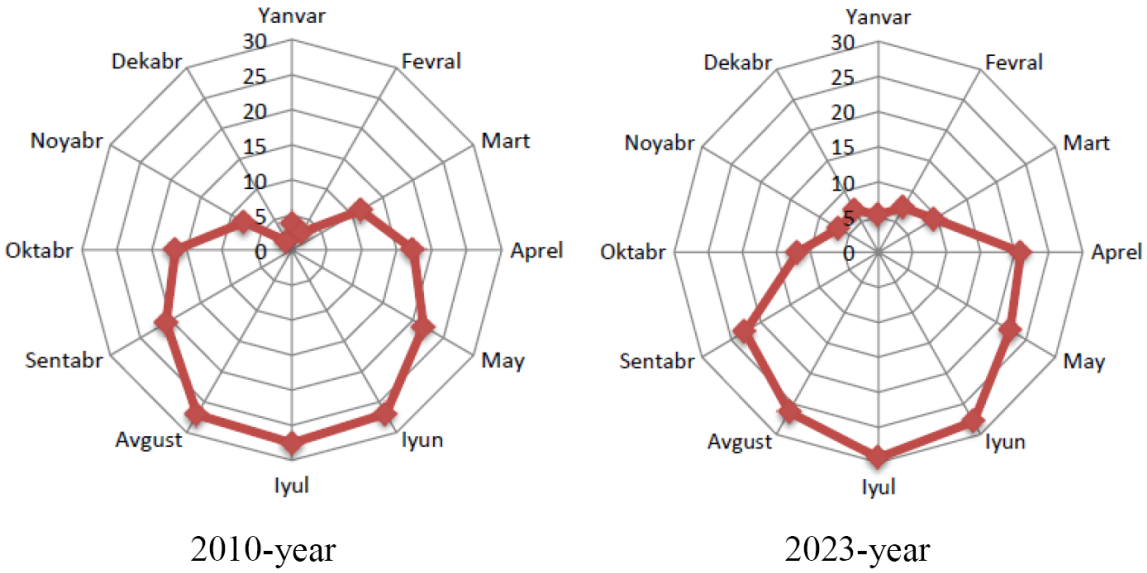
## Introduction

According to natural climatic conditions, Syrdarya region is located in the continental subtropical region. Also, the seasonal changes of tropical and temperate air masses and the preservation of stable hot and dry weather in summer and instability of winter indicate the existence of unique climatic conditions in the region.

Currently, it is urgent to carry out scientific research on the factors of climate change for the sustainable development of this region.

Object and styles of research. For research, climatic views of the Syrdarya region were selected and aimed at opening up specific aspects of sustainable development through changes over the long years. Studies were carried out on the basis of universally recognized methods and information related to the source.

Analysis and results. It is observed that the air temperature in Syrdarya region varies on average up to 12.2-14.5°C, it is lower in the east and north of the region, and the temperature rises slowly towards the south, that is, it reaches 14.5°C. . In the coldest period (winter), the average temperature varies from -0.8°C to -4.4°C, in the hottest period (summer) from +26.5°C to +29.9°C. stands The absolute minimum temperature in the territory of Syrdarya region varies from -28°C to -37°C according to the results of many years of observation.




Picture 1. Average monthly air temperature of Syrdarya region.

In the territory of Syrdarya region, spring frosts sometimes cause great damage to flowering fruit trees and vegetable crops. According to the average long-term data, spring frosts occur at the end of the first month of the spring season, only in the north-east and northern part of the Syrdarya region, in the first ten days of April. Relatively late arrival of spring frost corresponds to the regions where the Syr Darya riverbed is located. The first autumn frosts usually begin in the first ten days of October in the northern part of the Syrdarya region. As you go south, the onset of the first frost is much later. This shift of cold starts from the third ten days of October. The duration of cold-free days in Syrdarya region is from 175 to 230 days. The duration of days with a temperature above +5ºC is 245-260 days in the northern parts, and 265-272 days in the southern part. The length of days with a temperature above +10ºC is 203-212 days in the northern part, and 217-219 days in the southern part. Atmospheric precipitation. The amount of annual precipitation in Syrdarya region ranges from 175 to 400 millimeters. The lowest amount of annual precipitation is 200 mm in the northernmost part of Syrdarya region. The amount of precipitation increases from 220 to 300 mm in the central part adjacent to the Syrdarya river, and up to 400 mm in the southwestern part near the mountain. (Picture 1).

Precipitation is distributed according to seasons as follows: spring is the heaviest period of the year, and 40% of all precipitation in Syrdarya region is at this time; 25-34% of annual precipitation falls in winter, 15-20% in autumn, and 5-10% in summer. On average, the number of snow-covered days in winter is 30-34 days. The height of the snow cover is not high and is equal to 8-12 cm, in some cold winter years it may exceed this amount. Sometimes, in the years when the frost is severe and the snow cover is thin, the soil can freeze to a depth of 20-30 cm. (Picture 2).

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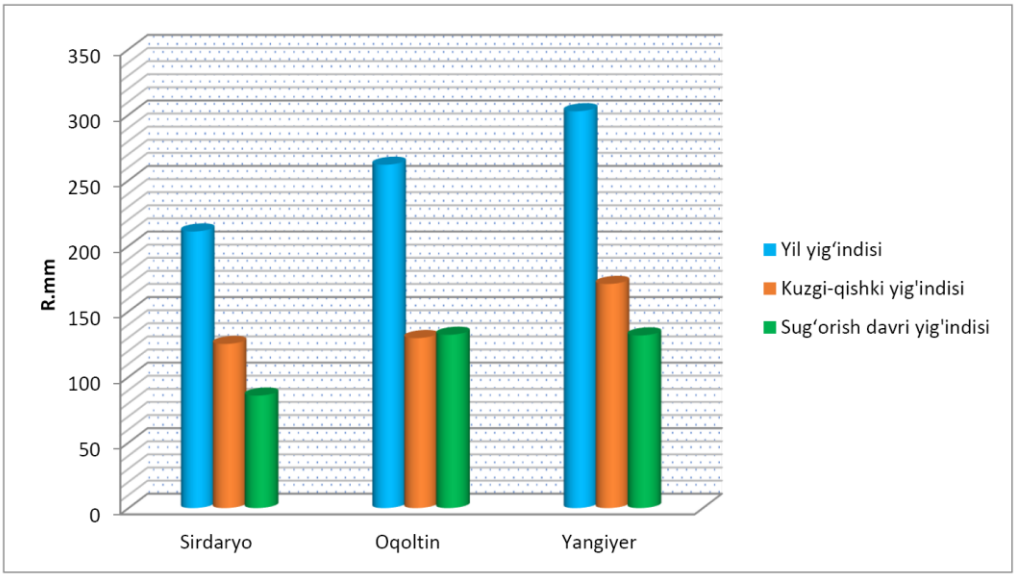
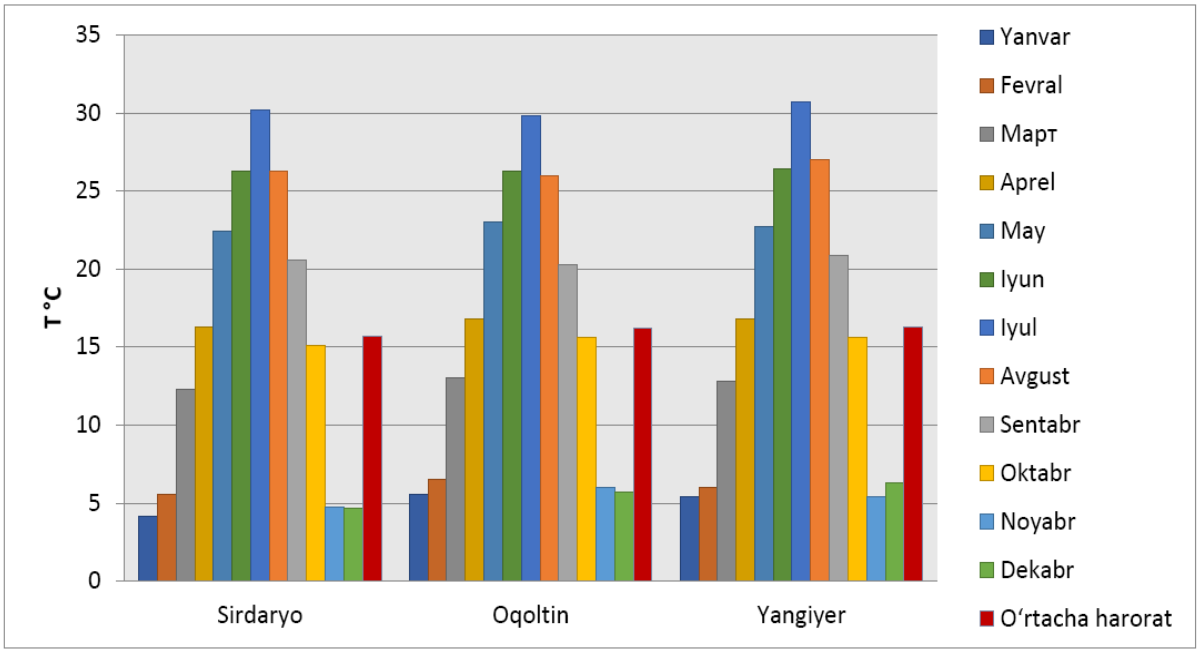


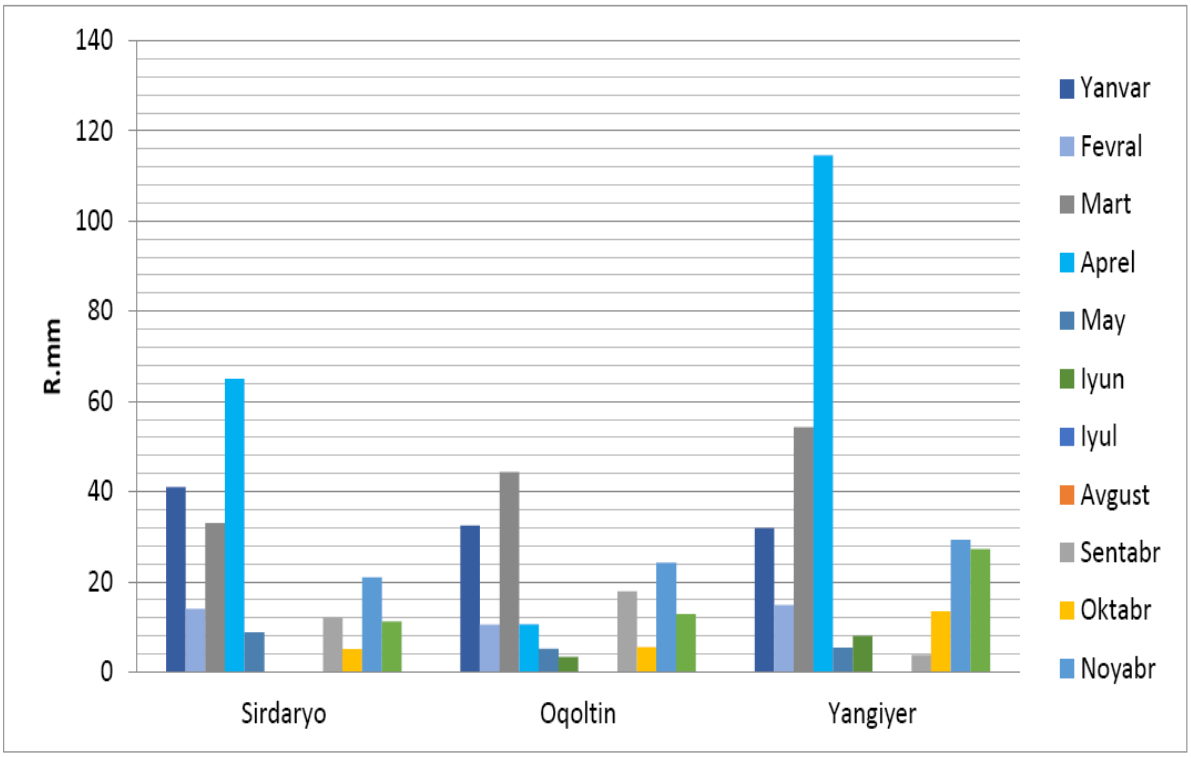

Picture 2. Meteorological average annual and seasonal precipitation indicators observed for many years in Syrdarya region

The most precipitation occurs in spring and winter, partly in the last months of autumn. Rainfall in the winter enriches the water reserves in the soil capillaries and causes a decrease in harmful and easily soluble salts in the soil. The average rainfall in 2018 was 295.2 millimeters, and in 2019 it was 258.5 millimeters, or if the amount of precipitation decreased by 36.7 millimeters, it was 378 millimeters in 2022 did In order to explain the different levels of changes in weather and climate, the data of meteorological stations of 3 regions: Syrdaryo, Akaltyn and Yangiyer were analyzed. (Picture 3).




Picture 3. Meterological average temperature indicators observed for many years in Syrdarya region

Analyzing the indicators of the Syrdarya city metrological station, located in the territory of the Syrdarya region, the annual average temperature is 14.9ºC in 2017, 14.8ºC in 2018, and 15.7ºC in 2012. The amount of annual precipitation is 341 mm in 2017, 287 mm in 2018, and 262 mm in 2012. The amount of annual precipitation is not evenly distributed over the months. (Picture 4).




Picture 4. Meterological average monthly precipitation indicators observed for many years in Syrdarya region

The temperature regime of the soils of the Syrdarya region is of great importance in agricultural production. Average annual soil temperature is around 16ºC. This indicates that the soil temperature is slightly higher than the air temperature by 2.0-2.5ºC. Throughout the year, the soil temperature is distributed like the air temperature: in the coldest period (winter) from -0.3ºC to -1.2ºC and in the hottest period (summer) it reaches +36.7ºC. In summer, the surface of the soil heats up strongly and in the hottest period of the year (July) it reaches an average of +62ºC. According to B.A. Eizenshtat, the highest temperature on the soil surface reached +70ºC at the "Syrdarya " meteorological station, +49ºC at a depth of 5 cm and +36ºC at a depth of 20 cm. The lowest temperature in the observations of these years was -31ºC on the soil surface, -5ºC at a depth of 5 cm, and -0.4ºC at 10 cm.

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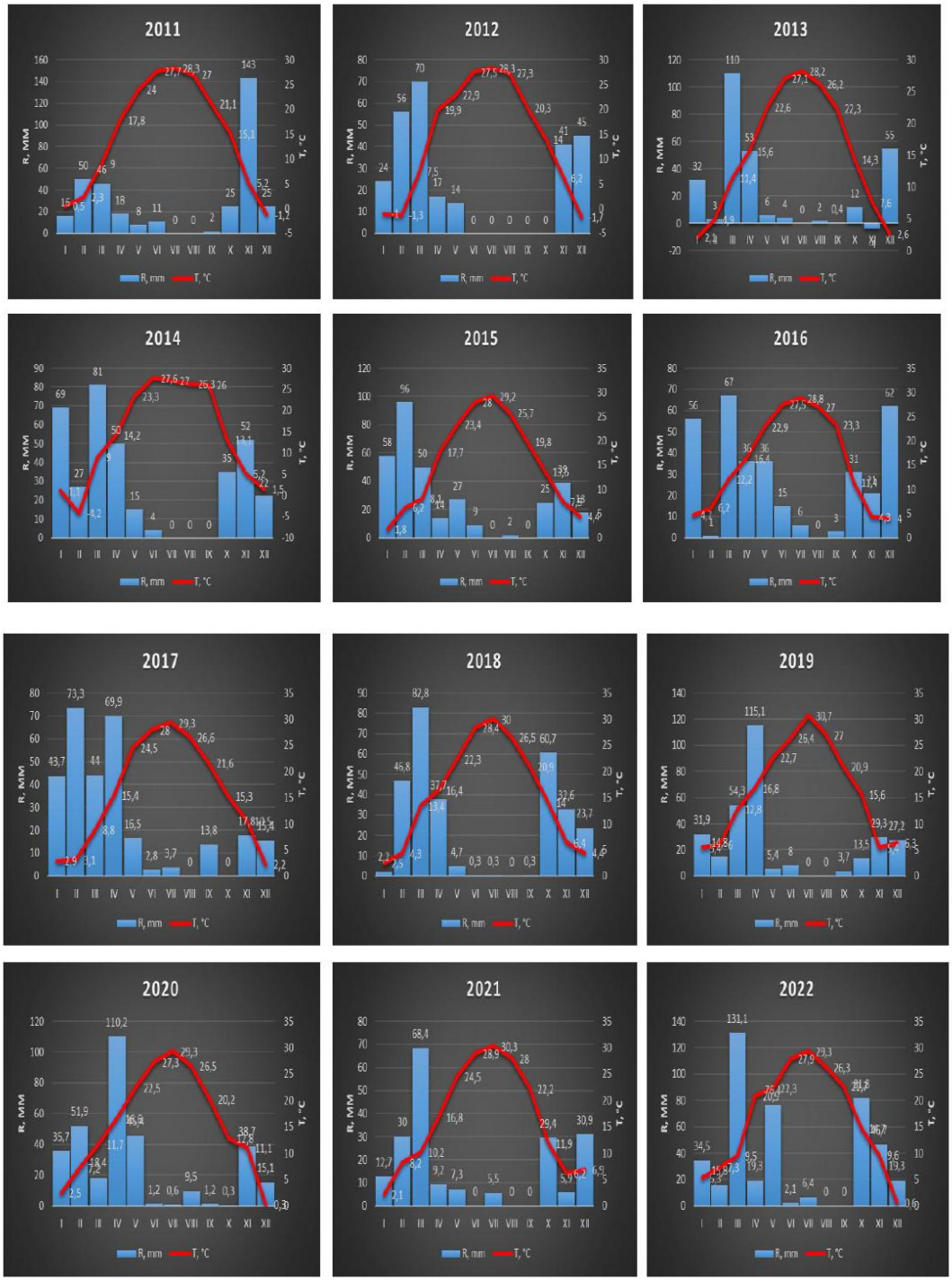



According to the data of the meteorological station "Gulistan" (Table 5), data on the average air in 1957, the temperature of the soil at a depth of 10 cm and the amount of precipitation by decade with the data in 2023 when compared, it can be seen that great changes have occurred in the climate. In April 1957, the average air temperature was 12.3ºC, and in 2023, the indicator was 16.5ºC. Also, the average soil temperature at a depth of 10 cm was 16.0ºC, and in 2023 this indicator was equal to 17.5ºC. In particular, it can be seen that there is a big

difference in the amount of atmospheric precipitation. In April 1957, the amount of precipitation was 6.0 millimeters, and in this month of 2023, this figure was 80.3 millimeters.

Table 5. Meteorological conditions of the research site

| month | dekade | Average monthly temperature | Soil temperature at a depth of 10 cm | Precipitation over a decade | month | dekade | Average monthly temperature | Soil temperature at a depth of 10 cm | Precipitation over a decade |
|---|---|---|---|---|---|---|---|---|---|
| 1957 year | | | | | 2023 year | | | | |
| april | I | 8,6 | 14 | 4 | april | I | 16,2 | 17,0 | 14,8 |
| | II | 16,0 | 18 | 2 | | II | 16,4 | 18,3 | 1,3 |
| | III | 12,4 | 16 | 0 | | III | 20,5 | 21,6 | 0 |
| may | I | 19,5 | 20 | 0 | may | I | 19,4 | 22,3 | 0 |
| | II | 18,2 | 20 | 0 | | II | 23,9 | 25,2 | 8,2 |
| | III | 23,4 | 24 | 9 | | III | 24,8 | 27,0 | 0 |
| june | I | 25,3 | 29 | 2 | june | I | 28,8 | 30,3 | 0 |
| | II | 25,0 | 28 | 10 | | II | 30,7 | 32,1 | 0 |
| | III | 26,4 | 32 | 0 | | III | 28,8 | 32,0 | 0 |
| july | I | 26,8 | 30 | 1 | july | I | 30,5 | 33,1 | 0 |
| | II | 25,6 | 31 | 1 | | II | 30,7 | 33,8 | 0 |
| | III | 25,0 | 30 | 0 | | III | 29,4 | 32,7 | 1,5 |
| august | I | 25,9 | 30 | 0 | august | I | 29,6 | 32,5 | 0,0 |
| | II | 23,2 | 28 | 0 | | II | 25,5 | 30,2 | 0 |
| | III | 22,0 | 27 | 0 | | III | 25,22 | 28,4 | 15,2 |
| september | I | 19,7 | 24 | 0 | september | I | 22,6 | 25,8 | 0 |
| | II | 18,6 | 23 | 0 | | II | 20,8 | 24,6 | 1,1 |
| | III | 17,7 | 22 | 0 | | III | 19,2 | 22,8 | 0 |
| oktober | I | 16,8 | 20 | 0 | oktober | I | 18,8 | 21,3 | 0,7 |
| | II | 7,6 | 12 | 46 | | II | 14,0 | 16,4 | 9,9 |
| | III | 8,2 | 10 | 5 | | III | 16,5 | 17,0 | 9,4 |
| november | I | 7,1 | 9 | 3 | november | I | 11,9 | 12,8 | 6,4 |
| | II | 6,4 | 8 | 29 | | II | 11,3 | 10,7 | 5,6 |
| | III | -4,8 | 1 | 16 | | III | 10,7 | 10,2 | 15,2 |

Source: compiled by the author based on the information of the hydrometeorological center of Syrdarya region.

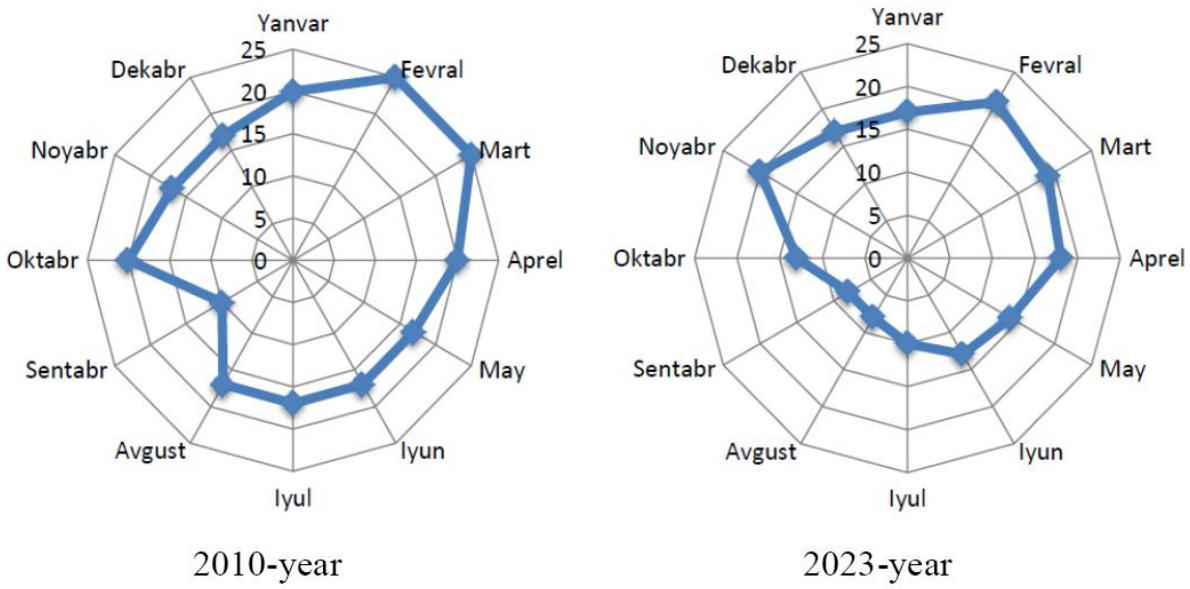
In general, if 3 data are compared on the growing season, it will have the following indicators. The average air temperature for 9 months of 1957 was 17.5ºC, and in 2023 it was 19.5ºC. The average soil temperature in a 10 cm layer was 21.1ºC in 1957, and 22.3ºC in 2023. The amount of precipitation for 9 months in 1957 was 128 millimeters, and in 2023 it was 185.4 millimeters.

If we pay attention to the data of Table 5, the highest soil temperature in both years corresponds to the month of July. It is directly related to the temperature of the atmospheric air and the amount of precipitation. It is important to know the temperature of the soil in the 10 cm layer of the soil. Information is the main indicator when determining the terms of planting agricultural crops. It can be observed that in the first decade of April 1957, the temperature in the 10 cm thick soil layer was 8.6ºC, compared to 2023, it was 4ºC higher. This indicator was repeated in November.

If we pay attention to the distribution of precipitation by months and decades, it can be seen that it is more evenly distributed in 2023. In 1957, the highest precipitation fell on the second decade of October and was 46 mm. According to long-term data, there is usually almost no precipitation in August. However, in the third decade of 2023, more than 10 millimeters of precipitation fell.

The relative humidity is not high, the air has the lowest humidity in June-August, and the annual average humidity is around 31-48%.

In the north-western part of Syrdarya, in the winter period, winds in the north direction prevail, while in the south-east region, winds in the south-east direction at a speed of 10-15 m/sec, and in the central part, in the south-east and south direction 4.0 Winds with a speed of -5.5 m/sec are observed.




Picture 6. The speed of constant blowing winds in the territory of Syrdarya region

In summer, winds blowing at a speed of 2.5-4.0 m/sec in the north-west direction are typical for the Syrdarya region. There is a strong south-eastern or easterly wind called Khavos wind, located at the exit from Mirzachol to Ferghana Valley, the wind speed is 25-28 m/sec, sometimes over 30 m/sec.. Such winds occur on average up to 52 times a year and are observed most of the time in winter days. The average evaporation of water in the Syrdarya oasis is 1200 millimeters, and there are years with high temperatures and strong winds. It can reach 1500-1600 millimeters.

The amount of evaporation can increase when the water level is high and after irrigation. According to the data obtained from the Syrdarya experimental station, the total annual evaporation is 969.5 millimeters, distributed according to seasons as follows: 296.4 millimeters in spring, 456.9 millimeters in summer, 144.7 millimeters in autumn, and 71.7 millimeters in winter. It was observed to be 5 millimeters. The microclimate of irrigated areas is much different than that of protected areas. In the irrigated areas, the temperature of the air is slightly lower in summer, and the humidity of the air is slightly higher. The decrease in temperature on the surface of the soil and in the air during the summer occurs as a result of the cover of green plants and artificial irrigation, as well as seepage water located near the surface of the earth. This is due to the formation of a unique climate of oases.

Irrigated hydromorphic soils differ from irrigated automorphic soils by low temperature variability, which is explained by the specific nature of their water regime and relatively rich in humus. Summer maximum temperatures here are 2-3ºC lower than other places, and winter minimum temperatures are higher by the same degree. Hydromorphic soils have a relatively high moisture content and keep the soil from overheating even on the hottest days due to constant water evaporation. Hydromorphic soils freeze less than automorphic soils due to heat coming from the lower layers through capillaries during cold winter days.

Conclusion. It became clear from our observations that dry air and frequent blowing of winds cause strong evaporation in the area, that is, evaporation reaches 1500 mm per year, which means that this indicator is 4-7 times more than the amount of precipitation. The average air temperature is +27.8°C in summer and -27°C in winter. The maximum hot temperature was observed up to +47°C. It can be observed that the climate change processes of the region have a direct impact on the environment, i.e. increasing environmental factors such as the rise of dust, soil degradation, desertification due to water shortage, and protection. . It is possible to increase the level of greenness through actions aimed at preventing these processes.

According to L. N. Babushkin, the southern part of Mirzachol is on par with the hottest regions of Uzbekistan in terms of summer temperature, and is only after the flat part of Surkhandarya. In the southern part of the region, frost-free days are 210-220 days, and the sum of effective temperatures reaches 4600-5000°C. Thus, the southern part of Syrdarya region differs from other parts. The sum of effective temperatures during the vegetation period is 2418°C in Gulistan, and 2197°C in the northern part of the region. The relative humidity is also reflected in the lack of precipitation in summer. These climatic indicators are one of the main reasons for the rise of salts in the soil. Therefore, it is necessary to develop measures to prevent agriculture in these areas from destroying the century-old salt reserve, and to drastically reduce evaporation.

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