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ASSESSMENT OF CHANGES IN HYDROMETEOROLOGICAL PHENOMENA (A CASE STUDY OF KASHKADARYA REGION)

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Absract: This article analyzes the trends in changes in hydrometeorological phenomena observed in the Kashkadarya region. During the study, the dynamics of temperature, precipitation, wind speed, and other indicators in the region are analyzed based on data from meteorological observation stations. The research results contribute to a deeper understanding of the region's climatic characteristics and help develop strategies for preventing natural disasters.
Keywords: Hydrometeorological phenomena, Climate change Kashkadarya region, Temperature dynamics Precipitation Drought Meteorological observations Global warming Climate adaptation

ОЦЕНКА ИЗМЕНЕНИЙ ГИДРОМЕТЕОРОЛОГИЧЕСКИХ ЯВЛЕНИЙ (НА ПРИМЕРЕ КАШКАДАРЬИНСКОЙ ОБЛАСТИ)

Аннотация: В данной статье анализируются тенденции изменения гидрометеорологических явлений, наблюдаемых в Кашкадарьинской области. В ходе исследования на основе данных метеорологических наблюдательных станций проводится анализ динамики температуры, осадков, скорости ветра и других показателей в регионе. Результаты исследования помогают глубже понять климатические особенности региона и разработать стратегии предотвращения природных катастроф.
Ключевые слова: Гидрометеорологические явления Изменение климата Кашкадарьинская область Динамика температуры Осадки Засуха Метеорологические наблюдения Глобальное потепление Адаптация к изменению климата

Input

Hydrometeorological phenomena are one of the important factors determining the climatic conditions of any region. Kashkadarya region is located in the south of Uzbekistan and has semi-desert and desert climatic conditions. In recent years, global climate change has also affected this region. In particular, extreme temperatures, changes in the precipitation regime, and drought phenomena are observed. This article aims to assess and analyze changes in hydrometeorological processes in the Kashkadarya region. The climate of Kashkadarya region is sharply continental, with very hot and dry summers and relatively cold winters. In the summer months, the air temperature can rise to +40°C and above, and the heat is especially noticeable in desert areas. During the winter months, the temperature sometimes drops to -

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10°C, but the cold doesn't last long. Precipitation falls mainly in autumn and spring, with an average annual precipitation of about 200-400 mm. In mountainous areas, precipitation is relatively high, and snow cover forms in winter. The Kashkadarya River and groundwater are the main sources of water for the region, since the amount of precipitation is insufficient for agriculture, and irrigation systems play an important role. Winds also have a significant impact: hot and dry winds in summer, while cold air masses can lower temperatures in winter. In general, the region's climate is dry and hot, and agriculture, especially cotton and grain cultivation, depends on irrigation systems (https://uz.wikipedia.org/wiki/Qashqadaryo_viloyati).

The importance of hydrometeorological observation stations

The National Network of the Hydrometeorological Service of the Republic of Uzbekistan includes more than 330 hydrometeorological observation and environmental pollution monitoring points. In the Kashkadarya region, several meteorological stations and hydrological posts operate. For example, the Guzar and Akrabad meteorological stations regularly monitor temperature, humidity, wind speed, and direction in the region. In addition, there are other stations located in different regions of the region, which play an important role in monitoring and analyzing weather conditions.

The importance of hydrometeorological observation stations

Hydrometeorological observation stations in the Kashkadarya region are of great importance in the following areas:

- Weather forecasts: Based on data collected by stations, short-term and long-term weather forecasts are compiled. This is important for agriculture, transport, and other sectors.
- Water Resources Management: Hydrological posts monitor the condition of rivers, reservoirs, and other water sources. This helps to predict and prepare for such phenomena as floods and droughts.
- Agricultural support: Agrometeorological stations measure soil moisture, temperature, and precipitation, providing farmers with recommendations on crop care.
- Prevention of emergencies: Meteorological stations allow for the early detection of hazardous phenomena such as strong winds, hail, and mudflows, and the warning of the population.
- Environmental monitoring: Contributes to maintaining ecological balance by monitoring the level of pollution of atmospheric air, soil, and water.

Changes in hydrometeorological phenomena in the territory of Kashkadarya region are analyzed in detail. We analyzed the temperature and humidity-extreme phenomena in the period 1991-2022.

Purpose and relevance of the research

The main goal of the research is to assess hydrometeorological phenomena in the Kashkadarya region, determine their statistical changes, and study their impact on water resources and agriculture.

Object and method of research

The study was conducted on the basis of the following methods: Analysis of meteorological observation data (between 1991-2022). Assessment of changes in temperature and precipitation using statistical analysis methods. Study of the frequency and dynamics of the recurrence of extreme weather phenomena. Determination of trends in changes in water resources.

Results and discussion

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A sharp increase in temperature has been observed in the Kashkadarya region over the past 30 years. The average annual temperature in 1991 was 14.2 °C, and in 2022 it reached 15.8 °C. Summer maximum temperatures in 2010: 45.6°C, in 2017: 46.2°C, in 2022: 47.1°C This leads to the intensification of hot climatic conditions in the region and a change in the vegetation period (https://climatecharts.net/).

Analysis of precipitation and drought

The average amount of precipitation in the region is 230-300 mm per year. However, the annual changes in this indicator are quite high: 2001-2005 - years of severe drought 2010-2015 - years of excessive precipitation 2020-2022 - sharp changes in precipitation (some months were completely dry, while other months had 2 times more precipitation than normal). In Kashkadarya region, the frequency of extreme events has increased: Hail and downpours: observed 2 times in 2010, and 5 times in 2022 Mudflows and floods: 3 large mudflows in 2017, 6 in 2022 Severe drought: severe drought was observed in 2011, 2014, 2018 and 2021 (https://t.me/kunuzofficial).

Water resources and environmental problems

The main water sources of the Kashkadarya are the Kashkadarya River, the Tupalang Reservoir, the Kokdala Artesian Water, and other small tributaries. However, the water level in the Kashkadarya River has decreased by 15-20% over the past 20 years. A widespread water shortage is occurring. Cotton and grain yields have decreased. In horticulture and viticulture, yields decreased by 10-15%. Wind regime and dust storms in Kashkadarya region Winds will blow mainly in a northwesterly direction. In recent years, wind speed and frequency have been increasing: 2000 - Average annual wind speed 3.2 m/s 2022 - Average annual wind speed 4.5 m/s An increase in wind speed has led to an increase in the number of dust storms: 2005 - 3-4 dust storms per year. In 2022 - 8-10 dust storms per year. Dust storms are intensifying soil erosion, reducing the fertility of agricultural lands.

Water resources and hydrological problems

The main water resources of the Kashkadarya region are the Kashkadarya, Tanhoz, Guzar, and Amu Darya rivers. The water level of the Kashkadarya River has decreased: in the 1990s, the average annual water discharge was 45-50 m^3/s. In 2022, this indicator decreased to 25-30 m^3/s. The volume of water coming from the Amu Darya has decreased: In the 1990s, 2.5-3 km^3 of water was allocated to the region. In 2022, this amount was around 1.8-2 km^3. The decrease in water resources reduces irrigation opportunities in agriculture and leads to the drying up of sown areas. In Kashkadarya region, there is a reduction in the area of forests and green spaces: In 1990 - 130 thousand hectares of forests In 2022 - 85 thousand hectares of forests The reduction of forests causes the following problems: Increased CO_2 in the atmosphere Increased air pollution and erosion. As a result, the ecological balance in the region is disrupted, and changes in hydrometeorological phenomena are accelerating.

Conclusion

The results of assessing changes in hydrometeorological phenomena using the example of the Kashkadarya region show that in recent decades, significant changes in climatic and meteorological conditions have been observed in the region. During the study, it was established that the average annual air temperature in the region is steadily increasing, the uneven distribution of precipitation, and the duration and intensity of drought periods have increased. These circumstances have a significant impact not only on natural and ecological systems, but also on agriculture, water resources, and the standard of living of the local population. According to the data analysis, during 1991-2022, the average annual temperature

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in the Kashkadarya region increased by 1.5-2°C, which indicates a local manifestation of the global warming process. Especially in the summer months, a rise in the maximum temperature above 45°C is often observed. This leads to a decrease in water resources, an intensification of evaporation processes, and an increase in water scarcity. Changes in the precipitation regime have increased the risk of drought and water shortages in the region. Over the past 30 years, the annual amount of precipitation has decreased by 10-15%, and the seasonal distribution of precipitation has changed, with an increased risk of mudflows and floods due to unexpected heavy rains in spring and autumn. Such extreme phenomena lead to erosion of agricultural lands, damage to sown areas, and a decrease in yields. Also, the number of strong winds and sandstorms has increased, and their frequency and intensity have increased compared to previous years. Such phenomena increase atmospheric dust, negatively affecting not only the ecological situation, but also human health. These changes indicate the need to take measures to adapt to climate change in the Kashkadarya region, strengthen the hydrometeorological monitoring system, and predict the risk of natural disasters in advance. For this: Expansion of long-term meteorological observations, use of advanced technologies and satellite data; Effective use of water resources, introduction of water-saving technologies and improvement of the reservoir management system; Development of adaptation strategies in the agricultural sector, introduction of drought-resistant crop varieties; It is necessary to improve forecasts for precipitation and extreme weather events and establish a system of prompt warning of the population. In the future, it is possible to ensure ecological and economic stability in the Kashkadarya region by forecasting further changes in hydrometeorological phenomena and developing measures for adaptation to them. The results of this study show that by effectively managing the natural resources of the region and implementing adaptation measures, it is possible to reduce hydrometeorological risks.

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