

SECTION 8.

AGRICULTURAL SCIENCES AND FOODSTUFFS

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DYNAMICS OF TEMPERATURE CHANGES IN THE ZHYTOMYR REGION OVER THE PAST 75 YEARS: TRENDS AND CONSEQUENCES

Abstract. *The article investigates the dynamics of temperature changes in the Zhytomyr region during 1951-2024 based on data from the Zhytomyr meteorological station. The analysis showed a steady warming trend: the average annual temperature increased by 2,4°C, which is higher than the global average. The most noticeable increase occurred after 2000, which has had a significant impact on agriculture, water resources, and ecosystems in the region. Further temperature increases are predicted, which could lead to changes in the region's climate conditions.*

Keywords: *climate change, temperature regime, warming, Zhytomyr region.*

Climate change is one of the most pressing problems of modern science and society, characterized by a gradual increase in the average temperature of the Earth's surface. This process is the result of the interaction of natural and anthropogenic factors that lead to global warming and changes in all spheres of human activity. In recent decades, the attention of scientists and international organizations has been largely focused on analyzing the mechanisms of climate change, its long-term consequences, and adaptation strategies. Rising temperatures are not only a concern for ecologists and climatologists, but are also becoming one of the central topics in politics, economics, energy and food security [1,2].

The thermal regime is one of the main regulators of biogeophysical processes, determining the conditions for the formation of weather phenomena, vegetation

types, soil formation and the vital activity of the animal world. Changes in the temperature regime have a multifactorial impact on natural ecosystems, the agricultural sector, water resources, and human health. For example, an increase in average temperatures causes a change in vegetation periods, affects the spread of plant pests and diseases, and changes the water balance of regions. Rising global temperatures increase the likelihood of extreme weather events, such as droughts, hurricanes, floods, and abnormal temperature fluctuations [3,4].

The effects of rising temperatures are particularly acute in agriculture, which is critically dependent on climate parameters. Longer periods of drought lead to a loss of soil moisture and a decrease in the productivity of many crops, especially grains and pulses. At the same time, warmer winters lead to more active wintering pests, which can significantly affect yields in the next season. Of particular importance is the fact that rising temperatures reduce the effectiveness of traditional agricultural technologies, forcing farmers to adapt by introducing new approaches to farming, including the introduction of drought-resistant crop varieties and soil moisture conservation technologies [5].

Climate change also has a significant impact on public health. Abnormally high temperatures cause an increase in the number of cases of cardiovascular and heat stroke, as well as increase the risk of dehydration. In addition, an increase in the average annual temperature creates favorable conditions for the spread of infectious diseases, including those transmitted through water and insects (e.g., malaria and Lyme disease). At the same time, a decrease in the number of cold days in winter reduces mortality from hypothermia and respiratory infections, but promotes the spread of allergenic plants, which can increase the incidence of allergies and asthma [6,7].

Scientific studies show that over the past 75 years, the air temperature in Ukraine has increased by 1,5-2,0°C, which is higher than the global average. This indicates a more intense warming rate in Ukraine, which is due to both global climate change and the specifics of the regional climate balance. Such dynamics of temperature changes is accompanied by an increase in the frequency of extreme weather events, such as droughts, squalls, floods, and precipitation instability. In particular, shorter winter periods and reduced precipitation during critical phases of crop development lead to a significant decrease in yields and deterioration of soil quality [8,9].

Global warming is a complex interdisciplinary challenge that requires a comprehensive approach to studying it and developing adaptation strategies. To effectively mitigate the effects of climate change, it is necessary to implement a

policy of rational use of natural resources, transition to renewable energy sources, reduce greenhouse gas emissions and raise environmental awareness. Scientific activities aimed at developing new climate models, predicting future changes and developing adaptive measures for various sectors of the economy play an important role in this process [10-14].

Thus, the problem of climate change is one of the biggest environmental, social and economic threats of our time. Its consequences are long-term and complex, affecting all aspects of human life. Given the rapid pace of warming and increasing climate risks, it is necessary to take active measures to minimize the negative effects and develop effective adaptation strategies that will ensure sustainable development of society in the future.

The purpose of the study was to analyze the long-term dynamics of air temperature in Zhytomyr region during 1951-2024, according to the data of the Zhytomyr weather station (50.26°N 28.68°E).

Air temperature, as a key meteorological variable, determines the peculiarities and changes in weather and has a significant impact on various aspects of human activity.

Analyzing the average annual air temperature in the Zhytomyr region from 1951 to 2024, we can clearly see a general upward trend (Fig. 1).

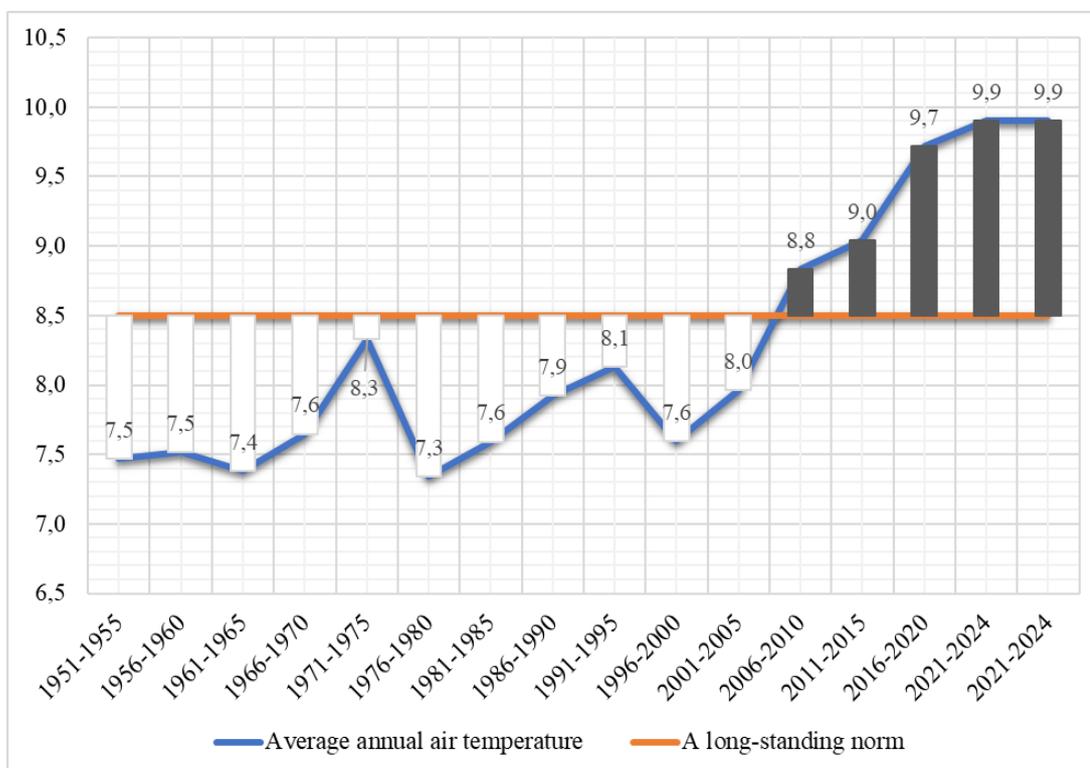


Fig. 1. Dynamics of changes in the average annual air temperature, 1951-2024

While at the beginning of the analyzed period (1951-1960) the average annual temperature was relatively stable at 7,4-7,5 °C, starting in the 1970s it began to rise, and this process became particularly pronounced after the 1990s.

A significant transition to a warming climate was observed in the 2000s, when the average annual temperature consistently exceeded 8°C, and in 2016-2020 it reached 9,7 °C for the first time. Meanwhile, the period of 2021-2024 records a new temperature maximum of 9,9 °C, which is the highest for the entire analyzed period.

Thus, in almost 75 years, the temperature in the region has increased by about 2,4 °C, which is a significant indicator that reflects a change in climate conditions towards warming.

It should be noted that the period 1951-1980 can be characterized as relatively stable. At that time, the average annual temperature in the Zhytomyr region was between 7,3-8,3 °C. The fluctuations were insignificant, and there were both periodic increases (for example, in 1971-1975 – 8,3 °C) and short-term decreases (in 1976-1980 – 7,3 °C). It is important to note that no sharp or prolonged heatwaves were recorded during this period, indicating that the climate was relatively stable until the late 1970s.

The period 1981-2000 is the beginning of a gradual warming. In the 1980s, there was a gradual increase in temperature: In 1981-1985, the average annual temperature rose to 7,6°C; in 1986-1990, it was already 7,9°C; and in 1991-1995, it was 8,1°C, which was the first clear evidence of climate change.

However, in the second half of the 1990s, the temperature unexpectedly returned to 7,6 °C. This could be due to temporary climate fluctuations, a decrease in solar activity, or other natural factors.

Starting from 2001 until now, it has been a period of rapid temperature growth. The beginning of the twenty-first century for Zhytomyr region demonstrated an increase in average annual temperatures. While in 2001-2005 it was 8,0°C, in 10 years (2011-2015) it was 9,0°C, which is 1°C higher.

The period of 2016-2020 was particularly significant, when the average annual temperature reached 9,7°C, which is 2.3°C higher than in 1951.

The last period of 2021-2024 recorded a new record of 9,9°C, which confirms a steady upward trend in temperature.

This temperature increase may indicate general climate change caused by both natural and anthropogenic factors (greenhouse gases, emissions, land use changes, etc.).

Obviously, warming has an impact on:

– agriculture: longer growing seasons, but at the same time an increased risk of

droughts;

– hydrological regime: reduction of snow cover, changes in groundwater levels;

– flora and fauna: shifting of natural zones, emergence of species atypical for the region.

It is worth noting that if the warming trend continues until 2030, the average annual temperature in Zhytomyr region may exceed 10 °C, and by the middle of the century (2050) it may reach 11 °C. This may indicate the region's transition to a warmer climate zone, similar to the current southern regions of Ukraine.

Conclusion. The analysis of average annual temperatures in Zhytomyr region over 1951-2024 showed a steady warming trend, which accelerated especially after 2000. An overall temperature increase of 2,4 °C contributes to significant climate change, which can have a significant impact on agriculture, water resources, ecosystems, and living conditions. A decrease in the number of cold winters, an increase in the average annual temperature, and a possible further increase of up to 11°C by 2050 indicate that the region is moving to a warmer climate zone. These changes require adaptation measures in the areas of agricultural production, forestry, and water balance to minimize risks and take advantage of the benefits of warming.

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