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Analysis of temperature data in Yili, Xinjiang in July and August of 2023 and 2022

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Abstract. Global climate change has a significant impact on ecosystems and human society, and studying its impact on temperature changes in specific regions is crucial to understanding and responding to climate change. Xinjiang is an important agricultural and animal husbandry base in China. Studying climate change and temperature changes in the region is of great significance to ensuring agricultural production and ecological security. The research investigates temperature changes in Yining City, Ili, Xinjiang, during July and August 2022 and 2023, focusing on the rising average temperatures, increased variance, and instability. Despite prior studies, there is still a lack of detailed, localized analysis over consecutive years. The study employs traditional data analysis methods, calculating average temperatures, variance, and standard deviation, and visualizing the results with line charts. The findings reveal significant temperature increases and greater variability, highlighting the potential risks to agriculture and local ecosystems. The discussion suggests measures to mitigate the effects of global warming and underscores the importance of harmonizing human activities with environmental sustainability.

Keywords: Yining City, temperature data, visualized analysis.

1. Introduction

Today, science and technology are developing rapidly, human productivity has been greatly improved, and agriculture, manufacturing, etc. are booming. The increase in factories and machinery that burns fossil fuels as a source of energy has led to a sharp increase in global carbon emissions. The percentage of greenhouse gases in the atmosphere increases, and more heat is reflected on the Earth. This has created a global problem - "global warming". A recent report published by The Lancet Public Health shows that global warming is having a serious impact on human health, not only leading to an increase in deaths but also promoting the spread of disease-carrying ticks and parasites in Europe [1]. This means that climate change is threatening public health in many ways, not only directly causing casualties in extreme weather events, but also exposing more people to health risks by changing disease transmission patterns. However, climate changes in corresponding regions are very complex, especially the variability of extreme climate events, their frequency and amplitude, which are more complex than average climate variability [2].

To better understand and respond to climate change, meteorological data analysis methods continue to evolve. Currently, traditional statistical methods and big data analysis methods are the two main

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meteorological data analysis methods. Traditional statistical methods rely on time analysis, etc., to discover meteorological regularities and trends.

Traditional statistical methods are based on basic mathematics and probability theory and have a rigorous scientific foundation. These methods have been proven and widely used for a long time, and are reliable and robust. Big data analysis technology is a technology that can analyze massive amounts of data. It refers to collecting, storing, and analyzing to discover the inherent patterns hidden in the data to help users make decisions [3].

The Ili River Valley is located between 80.15° and 84.93° east longitude and 42.23° and 44.83° north latitude. Its length from east to west is 360 kilometers, its widest point from north to south is 275 kilometers, and its total area is 56,400 square kilometers. It has a temperate continental climate [4]. The city's climate type is temperate continental. The temperate continental climate is one of the main climate types in China. Xinjiang is located inland and far away from the ocean, so this weather model is suitable for most parts of China. Moreover, there are not many studies on this area, and there is literature on daily temperature analysis of meteorological data. Through the analysis of meteorological data, extreme weather can be predicted, thereby enabling early intervention and protective measures. At the same time, crops that can bring the highest commercial value can be grown according to the climatic conditions of a specific period in an area.

This article takes Yining City, Ili, Xinjiang as an example, and uses traditional statistical methods to conduct daily temperature analysis of the region's meteorological data. This article aims to fill the gap in meteorological research on the city, provide new ideas and methods for meteorological data analysis in China, and provide a reference for agricultural production and climate prediction in related areas.

2. Method

2.1. Data sources

The data used in this article comes from "Wentian.com" and "Query.com". This website provides the temperature data of Yining City in previous years. Most websites can only provide meteorological data within the latest year, while the "Query Network" can provide data for one year and more than one year ago. "Wentian.com" is the only professional meteorological information product covering more than 2,000 counties and cities across the country and has China Mobile's full network operation qualification. It is also the only high-tech company authorized by the National Meteorological Center of the China Meteorological Administration to engage in meteorological information services and release. Therefore, through this website, this article can obtain more references, more accurate, and more research-worthy data. This makes it easy to find out the temperature change patterns and main characteristics of Yining City, Ili, and Xinjiang.

2.2. Data introduction

To comprehensively analyze the changes and patterns of summer temperatures in Yining City, this article selected the highest and lowest temperature data of Yining City from July to August in 2022 and 2023. Through a detailed comparison of temperature data for the same period between these two years, climate change trends can be predicted, such as the magnitude and rate of temperature rise caused by global warming. The temperature conditions for the growth of main crops in Yining City during this period can also be obtained to improve crop yields. This article can draw more scientific conclusions and improve credibility by studying temperatures in different annual periods.

2.3. Specific steps and methods

(1) Use Excel to organize the temperature data on different dates into a table, the format is as shown in Table 1.

(2) Select the date and temperature columns in the table and insert a line chart.

(3) Calculate the average temperature in different months.

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Table 1. Yining City's maximum and minimum temperature data in July 2023 (partial)

Date YYYY/MM/DD	The Lowest air temperature/℃	The Highest air temperature/℃
2023/7/1	15	29
2023/7/2	15	32
…	…	…
2023/7/31	11	25

Mean $\overline{T}$ calculation formula:

$$\overline{T} = \frac{\sum_{i=1}^{n} T_i}{n} \quad (1)$$

Among them, T represents the temperature on the day, n represents the number of days in the month. Calculate the variance and standard deviation of different months.

Variance introduction: The smaller the variance, the more stable the data is, and the larger the variance, the more unstable the data is. The variance can reflect the stability of a set of data, and this article uses this to judge the stability of temperature changes.

Variance s^2 calculation formula:

$$s^2 = \frac{(\overline{T}-x_1)^2+(\overline{T}-x_2)^2+(\overline{T}-x_3)^2+\ldots+(\overline{T}-x_n)^2}{n} \quad (2)$$

X is for each data of this group. Use Excel to redraw the calculated data into a table and line chart for visual comparison.

(4) Problems: Only two years of data are taken, which is slightly biased and there are too few valid data.

(5) Solutions: Conduct detailed comparisons to reduce chance and errors and improve data reliability.

3. Result

As shown in Figure 1, this picture is a line chart of temperature changes in Ili and Yining, Xinjiang from 2023/7/1 to 2023/8/31. The yellow line is the highest air temperature of the day. The blue line is the lowest air temperature of the day. The horizontal axis is the date, with YYYY/MM/DD as the standard. The vertical axis is air temperature in degrees Celsius. As time goes by, the overall temperature shows a downward trend. In mid-August 2023, there was a dramatic temperature drop. Temperature data on other dates are relatively regular and stable.

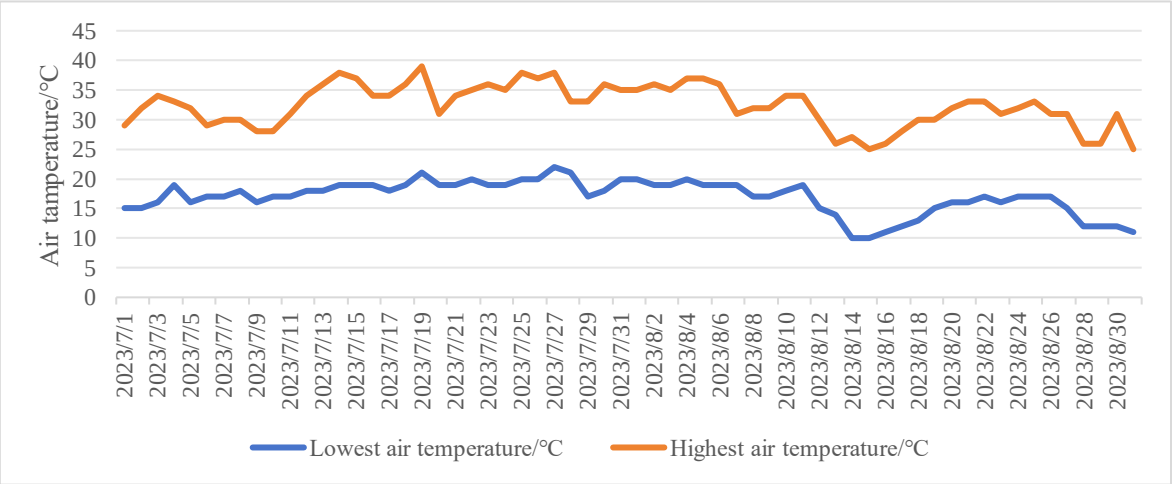

Figure 1. The line chart of air temperature in Yining City, Ili Kazak Autonomous Prefecture, Xinjiang 2023/7/1-2023/8/31 (Original)

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As shown in Table 2, this article calculated the average value, variance and standard deviation from 2023/7/1 to 2023/8/31. And the maximum temperature and minimum temperature of the day are calculated separately. All data retain three significant figures.

Table 2. Arithmetic results of temperature from 2023/7/1 to 2023/8/31

	Mean	Variance	Standard deviation
2023/7/1-2023/8/31The lowest air temperature	17.0	8.16	2.83
2023/7/1-2023/8/31The highest air temperature	32.4	12.8	3.55

As shown in Figure 2, this picture is a line chart of temperature changes in Ili and Yining, Xinjiang from 2022/7/1 to 2022/8/31. The yellow line is the highest temperature of the day. The blue line is the lowest temperature of the day. The horizontal axis is the date, with YYYY/MM/DD as the standard. The vertical axis is the air temperature in degrees Celsius. As time goes by, the overall temperature shows a downward trend. In mid-August 2022, there was a significant drop in temperature. Temperature data on other dates are relatively regular and stable.

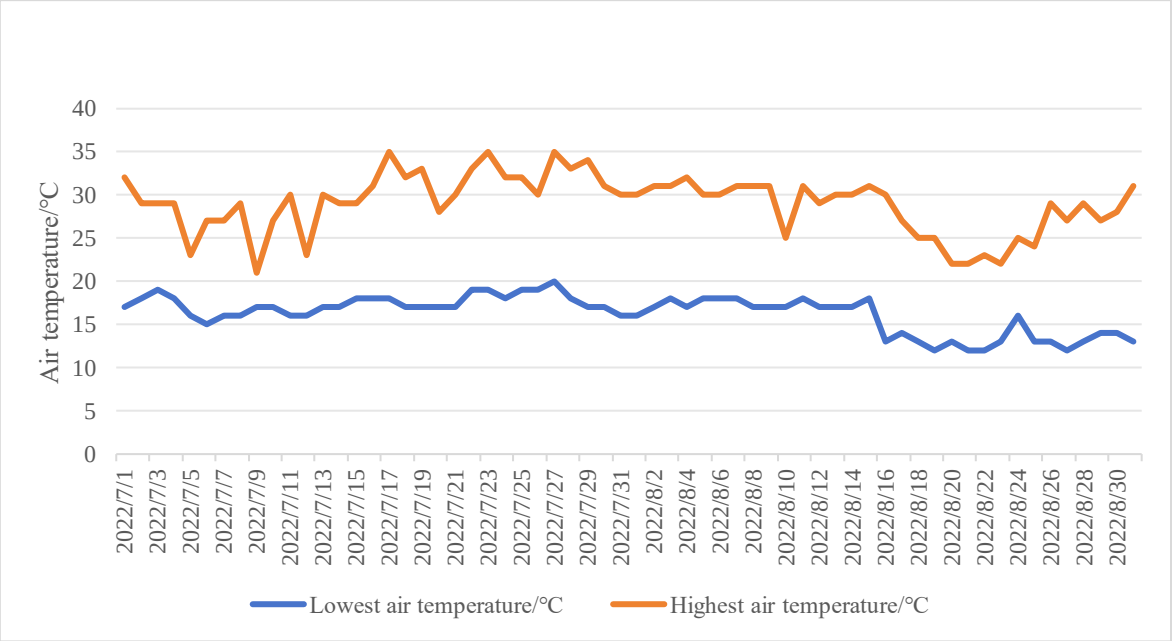

Figure 2. The line chart of air temperature in Yining City, Ili Kazak Autonomous Prefecture, Xinjiang 2022/7/1-2022/8/31 (Original)

As shown in Table 3, this article calculated the average value, variance and standard deviation from 2022/7/1 to 2022/8/31. The maximum temperature and minimum temperature of the day are calculated separately. All data retain three significant figures

Table 3. 2023/7/1-2023/8/31 temperature arithmetic results

	Mean	Variance	Standard deviation
2022/7/1-2022/8/31The lowest air temperature	16.3	4.53	2.11
2022/7/1-2022/8/31The highest air temperature	29.0	11.7	3.39

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4. Discussion

4.1. Mean

By comparing the temperature data from July to August in the two years, it can be seen that the average temperature has increased significantly, whether it is the maximum temperature or the minimum temperature. The temperature in Yining City has gradually increased since the mid-to-late 1970s. The highest annual average temperature (the first six years of the 21st century) was 2.24°C higher than the lowest annual temperature (the last nine years of the 1950s). It shows that the temperature increase in Yining City is obvious, which is consistent with the general background trend of temperature changes in the world, my country, and the northwest region, and is more sensitive to climate warming [5]. It can be seen that global warming is an important factor causing the temperature increase in Yining City. The region has been significantly affected by global warming. The temperature data in July and August in this article's study have significant changes. Changes in the average temperature are very likely to bring about negative impacts such as natural disasters, reduced crop harvests, and destruction of biological habitats. The Ili River Valley has also experienced frequent extreme weather and climate events in recent years, resulting in the frequent occurrence of meteorological disasters such as heavy rains and floods, thunderstorms, continuous rain, heavy snows, periodic droughts, hail, heavy fog, strong winds, heat waves, and hot and dry winds. Secondary disasters such as soil erosion, mudslides, landslides, collapses, land subsidence, forest and grassland fires, and agricultural, forestry, and grassland pests and diseases related to meteorological conditions also occur frequently [6]. Yining City is rich in flat peaches in July and August. Flat peaches like light, are drought-tolerant and afraid of waterlogging, salt-alkali, and repeated cropping. They are cold-resistant but not heat-resistant. They are suitable for planting in flat terrain, deep and fertile soil, and loose soil. However, after comparing the temperature conditions in July and August in the past two years, Yining City still has a continued warming trend, which will affect the production of flat peaches.

4.2. Standard deviation and variance

There are also significant upward changes in the standard deviation and variance. This data shows that temperature changes in July and August have become increasingly unstable. There are huge changes in temperature between two days, which creates extreme weather. The resulting series of natural disasters related to rising temperatures have also increased in frequency compared to the past, which has also increased the difficulty for people to deal with sudden and extreme natural disasters [7]. As a result, many crops have been adversely affected. According to data from China Changji Network, Yining City will experience large climate fluctuations and severe disaster impacts in 2023 [8]. Among them, the average summer temperature is 31℃, and the number of high-temperature days reaches a record high. High temperatures have affected northern and eastern Xinjiang, causing meteorological droughts of moderate intensity and above. The entire summer experienced five high-temperature processes, a drought process, and an extreme regional warming phenomenon [8]. These extreme climate events have had a significant impact on agriculture, the ecological environment, and residents' lives, especially posing severe challenges to water demand and crop growth. During this period, high-temperature weather occurred frequently, lasted for a long time, and was intense, further exacerbating the severity of the drought.

4.3. Suggestions

Global warming has brought climate change, and climate change has affected the most important agricultural development. To avoid further losses and injuries, people need to reduce emissions of "greenhouse gases". With the development of human industrial and agricultural activities, man-made greenhouse gas emissions, mainly carbon dioxide, are increasing year by year. Among them, carbon dioxide's contribution to the greenhouse effect far exceeds that of other man-made greenhouse gases [9]. The following are examples of excessive greenhouse gas emissions: excessive carbon dioxide emissions caused by excessive industrialization and deforestation, excessive methane emissions caused by

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overgrazing, etc. Xinjiang is a large grazing province with a developed animal husbandry industry, so more attention needs to be paid to this aspect. In the process of livestock breeding, greenhouse gas emissions from cattle sheds can be controlled through the following two methods: one is to improve the production methods and management models of livestock production to reduce the generation of greenhouse gases; the other is to use technical means to control greenhouse gases. These measures not only help reduce greenhouse gas emissions but also promote the sustainable development of animal husbandry [10]. In addition, tourism is also an important industry in Yili and Yining. For sustainable development, it need to have a longer-term vision and protect the environment. To create more value.

5. Conclusion

This article discusses the severity and harm of global warming. It uses traditional data analysis methods to compare the temperature changes in Yining City in July and August over the past two years by comparing data and calculating the average, variance, and standard deviation. Research has found the effects of climate change and global warming - rising temperatures and more dramatic changes. After the characteristics of temperature changes are obtained, future research can analyze the appropriate conditions required for local crop production. Controlling appropriate conditions can also improve production efficiency and bring more economic benefits. In this way, climate change trends can be predicted in the future, and measures to deal with natural disasters can be taken in advance to reduce economic losses caused by disasters. After two years of comparative research on temperature change data, it is recommended that people stop losses appropriately and do their best to reduce losses caused by global warming, climate change, and frequent extreme weather. It also hope that humans can achieve harmony between man and earth, and achieve coexistence and mutually beneficial relationships with nature. Only in this way can the future development of mankind achieve great improvement and progress.

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