Analyzing and Visualizing of Global Air Temperatures and Precipitation Patterns

Presented By

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Introduction

Overview of the project and its goals:

This project analyzes the correlation between global air temperatures and precipitation patterns over extended periods. Specifically, it examines the trends and changes in global air temperatures from 1922 to 2021 and investigates the variations in global precipitation from 1951 to 2021. The primary goals are to identify significant long-term trends and anomalies in both air temperatures and precipitation patterns, explore their interrelationships, and understand how these elements influence each other. By evaluating the potential impact of temperature changes on global precipitation, the study seeks to contribute to the broader understanding of climate change.

Data Sources

Data source 1: Climate_environment

- Data Type: txt
- this dataset identifies monthly global air temperature anomalies from the period of 1922 through 2021.

Data source 2: Climate_environment

- Data Type: txt
- The source data includes monthly precipitation for the years between 1951 and 2021.

Project Plan

- **Data Collection and Preprocessing**: Collecting and preprocessing the global air temperatures and precipitation data .
- **Feature Engineering**: Creating relevant features from the data to enhance analysis.
- **Interpretation and Insights**: Analyzing the results and extracting meaningful insights.
- **Reporting on Findings**: Presenting the findings and recommendations.

Data Collection and Pre-processing

- ✓Retrieve data from the provided data sources.
- ✓ Perform data cleaning and preprocessing.
- ✓ Handle missing values and data inconsistencies.

Global Temperature Pattern from 1922 to 2021

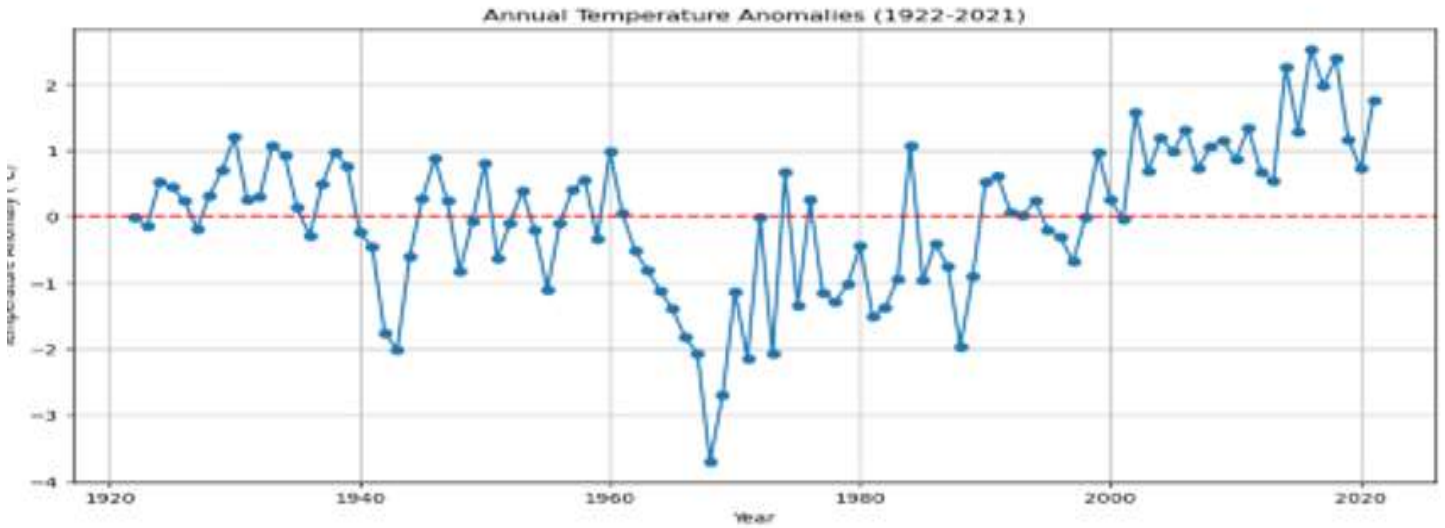


Figure 1:Yearly Global Air Temperature Fluctuation

We can see the global temperature pattern in Figure 1 .The average temperature is increasing.

Monthly Temperature

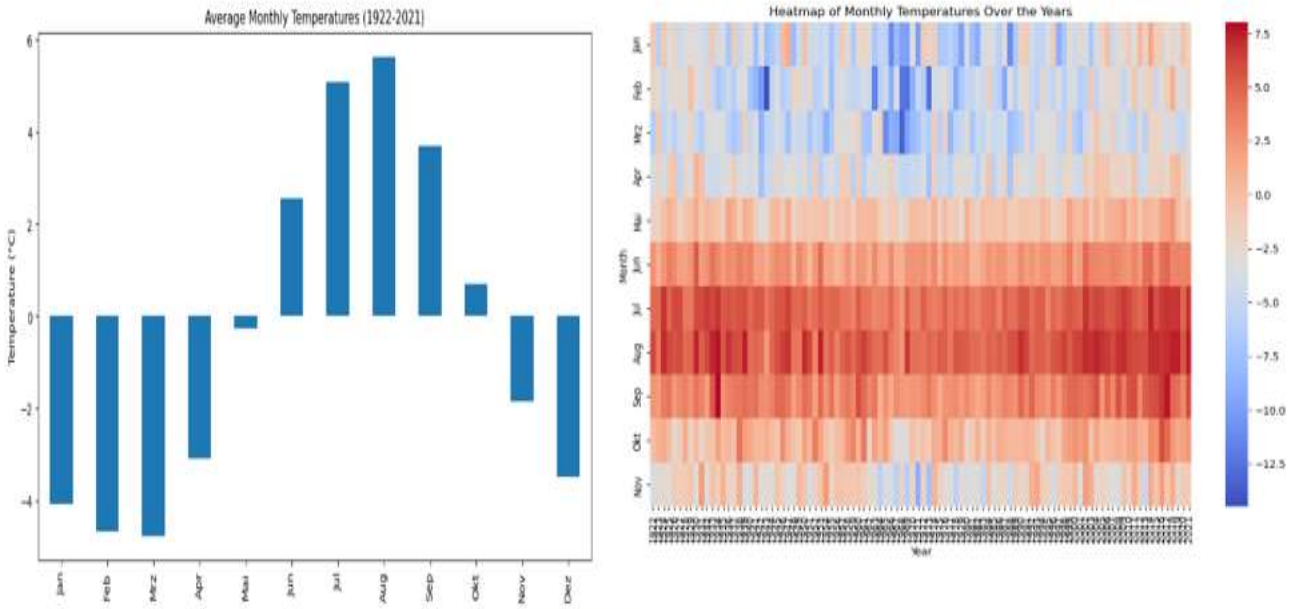


Figure 2: Monthly Temperature

Figure 2 displays a bar graph titled "Average Monthly Temperatures (1922-2021)," highlighting seasonal temperature variations with cold winters and warm summers. December, January, and February exhibit negative temperatures, while July and August peak at 5-6°C, indicating the warmest period. A long-term warming trend is evident, with recent years showing consistently higher temperatures, especially during summer months.

Precipitation Trend

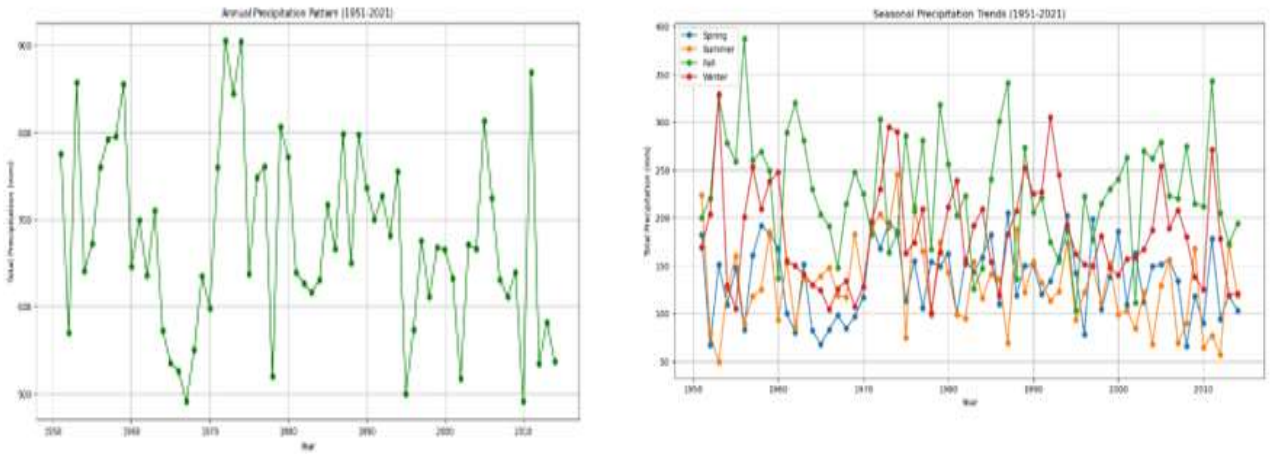
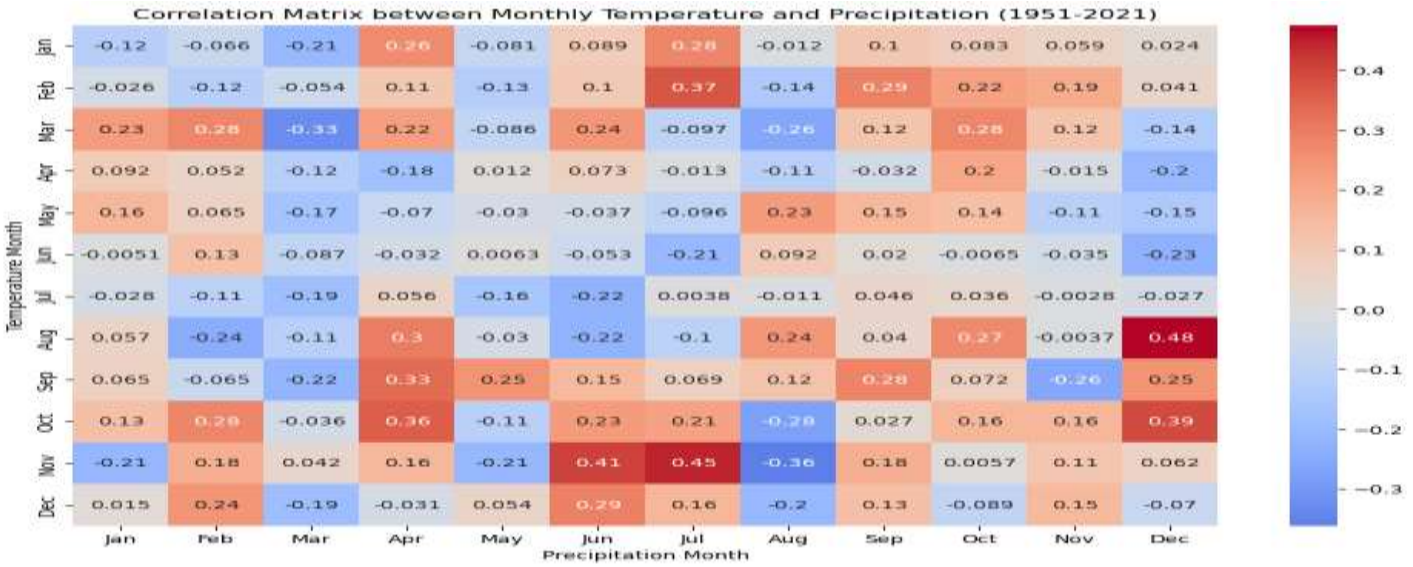


Figure 4: Precipitation variability

Figure 4 illustrates the variability and long-term trends of precipitation both annually and seasonally. Annual precipitation patterns exhibit significant fluctuations with notable peaks and troughs. Seasonally, summer precipitation tends to be lower and more variable, while winter often has high peaks indicating substantial precipitation, though variability is also present. Fall and spring also show considerable variability, with fall occasionally experiencing substantial precipitation.

Correlation between Global Air Temperatures and Precipitation



Correlation coefficients show the relationship between global air temperatures and precipitation, with values ranging from -1 to 1. Positive correlations indicate direct relationships, such as warmer January temperatures correlating with higher March and September precipitation, while negative correlations indicate inverse relationships, like August temperatures negatively correlating with April and May precipitation. Notable findings include strong positive correlations between August temperatures and October precipitation (0.48) and February temperatures with August precipitation (0.37).

Limitations

- The correlation between air temperature and precipitation has notable limitations. These correlations do not account for all influencing factors, such as atmospheric pressure, wind patterns, and geographic variations, which can significantly impact precipitation. Consequently, the observed relationships may not fully represent the complexities of climate interactions, and additional variables should be considered for a more comprehensive understanding.

Future work

- Expand datasets to include recent years and improve spatial resolution
- Incorporate additional meteorological variables (e.g., atmospheric circulation, oceanic indices)
- Study regional variations in temperature-precipitation correlations
- Apply advanced statistical techniques and climate models


thank you