

# **Visualizing Global Temperature Trends - 07**

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Section 1

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# 1. Abstract

The internship project “Visualizing Global Temperature Trends” focuses on analyzing and visualizing global temperature data to identify trends like warming, cooling, etc. using Python. Using the data file provided, the project first imports and installs the necessary Python packages, plots the required graph, smoothens the data to visualize the peaks and falls in temperature trends, plots heatmaps and then draws the conclusion that there is an upward rise in global temperature trends. A second dataset titled “Microsoft Stock – Time Series Analysis” is used to plot the raw graph, smoothened graph, color scatter plot and come to the conclusion that there is a clear upward rise in stock prices from 2015 to early 2021. The analysis is conducted using Python in the Google Colab environment, utilizing libraries NumPy, Pandas, Matplotlib, Plotly and Seaborn.

## 2. Introduction

This project, “Visualizing Global Temperature Trends” addresses the critical issue of climate change by providing a comprehensive analysis and visualization of historical global temperature data from 1880 to 2016. Increasing global temperature has many devastating consequences like rise in sea levels, rapid melting of glaciers, habitat loss, breakdown of the ecosystem, change in migratory patterns, vulnerability of a larger population to heatstroke, etc. to name a few. These changes highlight the need for a simple plot to visually analyze the trends in global temperature. This project does the same by converting the large dataset to simplified time series 12 month moving average and 60 month moving average plots to better read and analyze the global temperature trends.

The project uses Python as its language of choice, in Google Colab, a cloud based online integrated development environment (IDE) for Python that requires no setup. Python is known for its extensive collection of libraries, which are well utilized in the project. The libraries used are as follows:

- Pandas – To analyze, clean, explore and manipulate the dataset provided.
- NumPy – To convert the large data stored in Python list into array for faster computation.
- Matplotlib – To integrate with Seaborn to plot graphs. It is a low-level graph plotting library on its own.
- Plotly – To create the graphs, line charts, heatmaps and scatter plot.
- Seaborn – To work with Matplotlib to visualize the random distribution plot graphs.

A standard data science procedure was followed to complete this project – data collection from a reliable source, raw data plotting, cleaning (or smoothening) the data to handle missing values and inconsistencies, exploratory data analysis using different types of graphs and charts, and finally, drawing a credible conclusion from the different plots present. The primary purpose of this project was to map the change in global temperature

over the last 200 years and to visualize the upward rise of Microsoft Stock prices from 2015 – 2021.

This project required extensive reading and understanding of time-series datasets [3][4], moving averages – its types and functions, especially in meteorology and finance [1], global temperature trends, stock price fluctuations, basic data science processes – data collection, data cleaning, data visualization, and knowledge of Python – the language and its libraries [4][5][6][7][8][9]. The first two weeks of the internship were crucial for understanding and working with the Python language in an IDE (Google Colab). The topics learnt during training are as follows:

#### Week 1

Sl. No.	Date	Day	Topic
1.	25.08.2025	Monday	Introduction - Welcome Note - What to expect from this internship
2.	26.08.2025	Tuesday	Python Basics - 1 (Data, Variable, Lists, Loop)
3.	27.08.2025	Wednesday	Python Basics - 2 (Data Structures)
4.	28.08.2025	Thursday	Python Basics - 3 (Class, Functions, OOPS)
5.	30.08.2025	Saturday	Python Basics - 4 (NumPy, Pandas)

#### Week 2

Sl. No.	Date	Day	Topic
1.	01.09.2025	Monday	Machine Learning Overview
2.	02.09.2025	Tuesday	Regression Lab
3.	03.09.2025	Wednesday	Classification Lab
4.	04.09.2025	Thursday	LLM Fundamentals
5.	06.09.2025	Saturday	Communication Skills

## 3. Project Objective

The project contains two datasets – “Visualizing Global Temperature Trends” and “Microsoft Stock Prices – Time Series Analysis”. The main objective of this is:

- Cleaning – The large datasets are to be processed and converted to clean data.
- Graphing – The datasets are to be visualized in the form of graphs. Graphs for both raw and smooth data are to be plotted to compare the difference in ease of analysis between the two.
- Colour Mapping – The datasets are to be showcased using coloured maps for a better understanding of the trends. These maps are to be redrawn in some other format barring graphs.
- Concluding – The trends in the datasets are to be analyzed and a conclusion is to be drawn.

This project exclusively utilizes pre-existing datasets that have been either provided by the institute or downloaded from a public domain. Therefore, no survey is intended. The focus remains on the rigorous analysis and visualization of established scientific data.

## 4. Methodology

The methodology of the project, as previously stated, followed a structured data science pipeline, encompassing data collection, cleaning, preprocessing, smoothening, exploratory analysis, and visualization. The conclusion was drawn after all the steps were completed. This project exclusively utilizes existing data and does not involve the collection and surveying of on-site data; hence no questionnaire or surveying methodology is included.

### Dataset 1 – Visualizing Global Temperature Trends

- a. Data Collection – Data was provided by the institute before the start of the project.
- b. Data Plotting – The given dataset was plotted without any changes.
- c. Data Cleaning – The data was smoothened twice, once as a 12-month moving average and once as a 60-month moving average to handle any inconsistencies in the data and to get clearer peaks and falls in the data.
- d. Graphs – The graphs for the smoothed-out data were plotted.
- e. Heatmaps – Two heatmaps, one for the last 50 years and another for the last 20 years was plotted. The first heatmap was revisualized as a line chart.
- f. Conclusion – The graphs and heatmaps helped to infer that there has been a rise in global temperature over the last 200 years.

### Dataset 2 – Microsoft Stock – Time Series Analysis

- a. Data Collection – The data was collected from Kaggle. [2]
- b. Data Plotting – The given dataset was plotted without any changes.
- c. Data Cleaning – The dataset was smoothed once over a 30-day moving average.
- d. Graphs – The graph for the smoothed-out data was plotted.
- e. Scatter Plot – A scatter plot to visualize the closing trend of the stock prices was drawn. This was remade as a line chart.
- f. Conclusion – The graphs and scatter plot helped to infer that despite fluctuations in market, the Microsoft Stock Prices has seen a general rise from 2015-2021.

## 5. Data Analysis and Results

This section will present all the graphs, plots and maps used in the project. All analyses were done in Google Colab using Python and its libraries.

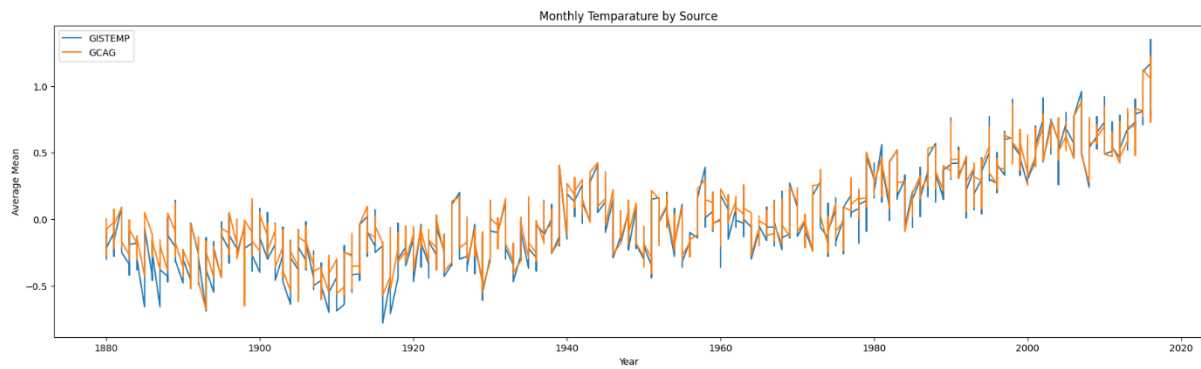


Figure 1. Raw graph of global temperature dataset

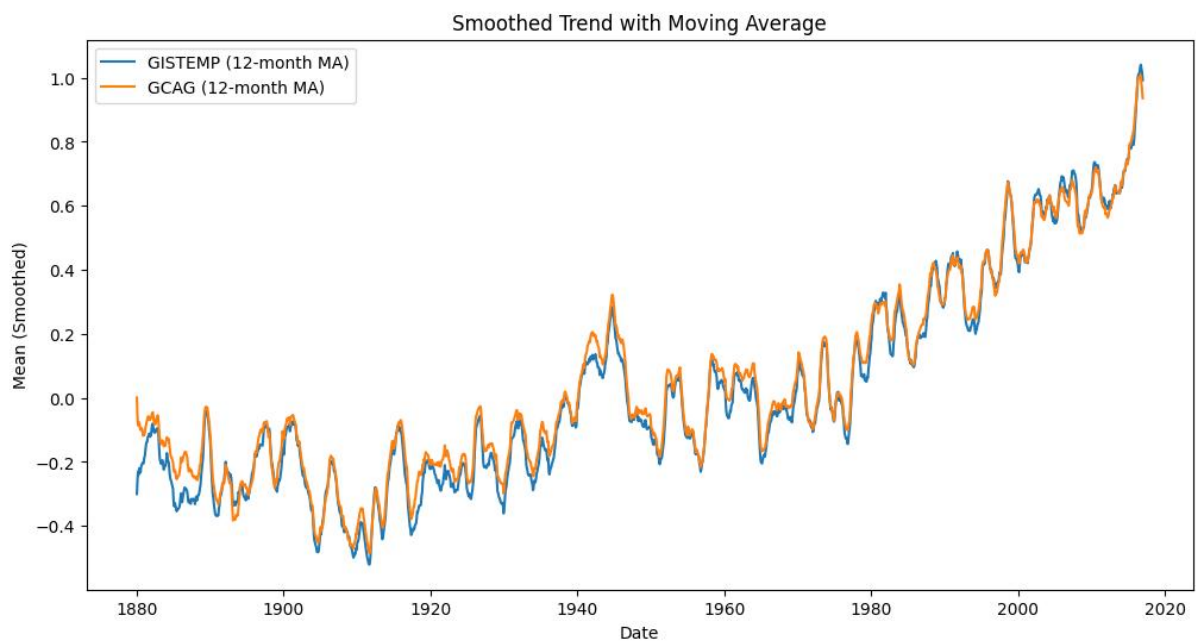


Figure 2. 30-day moving average graph

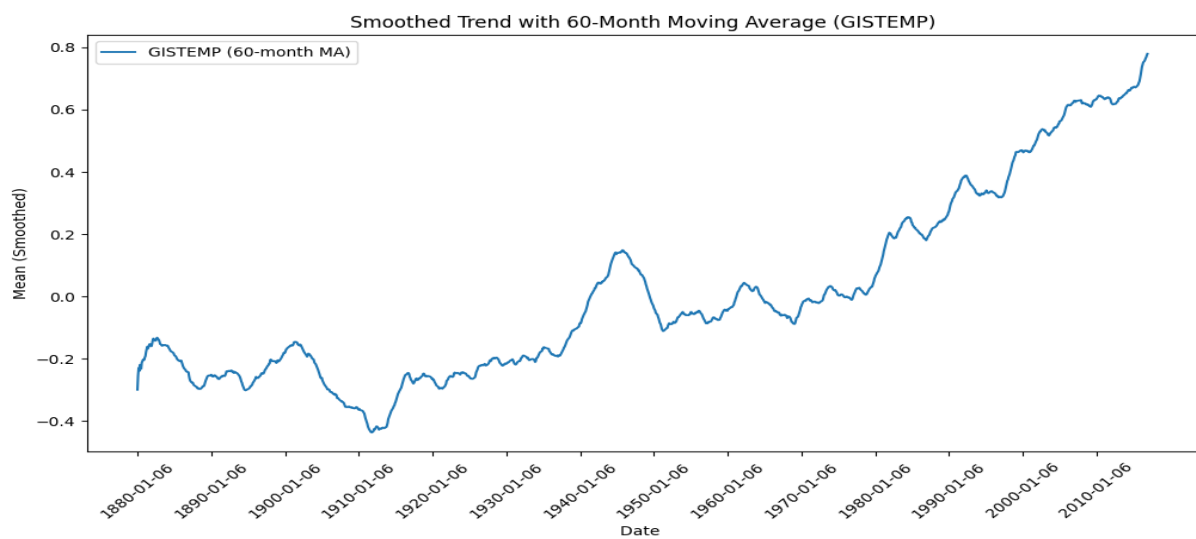
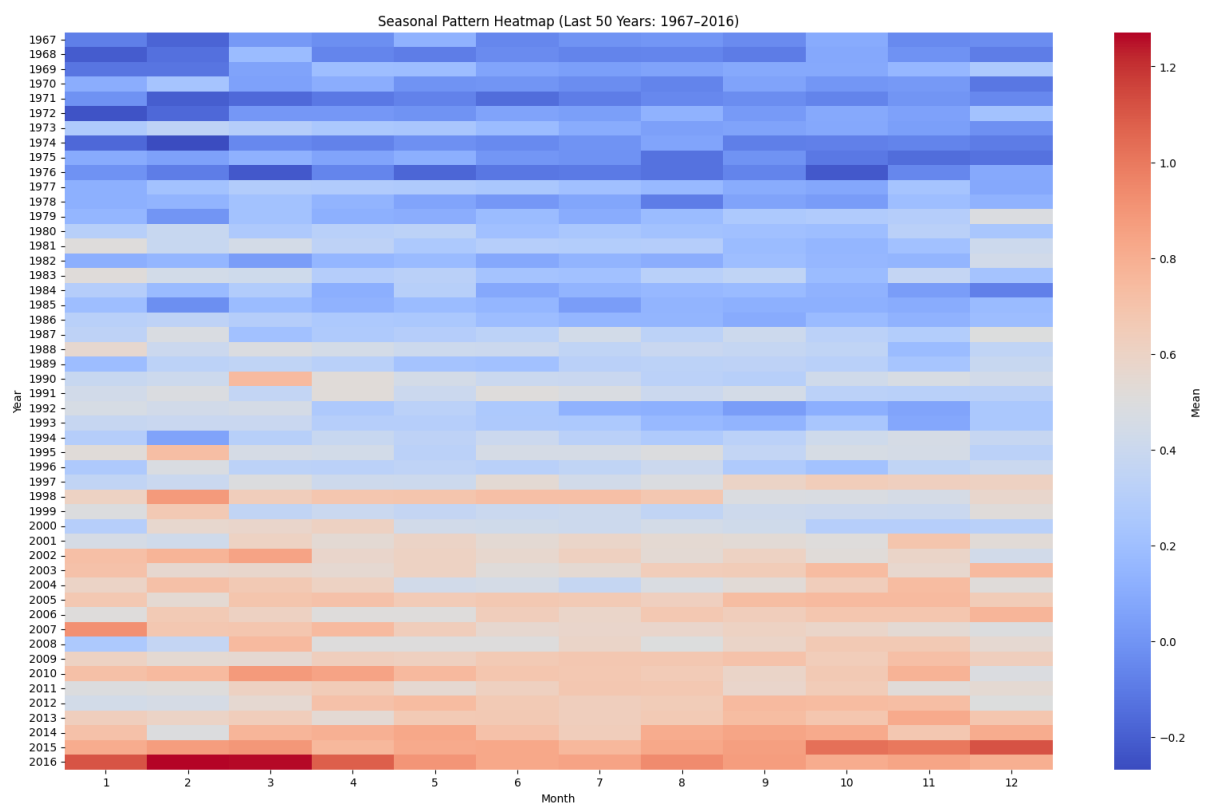
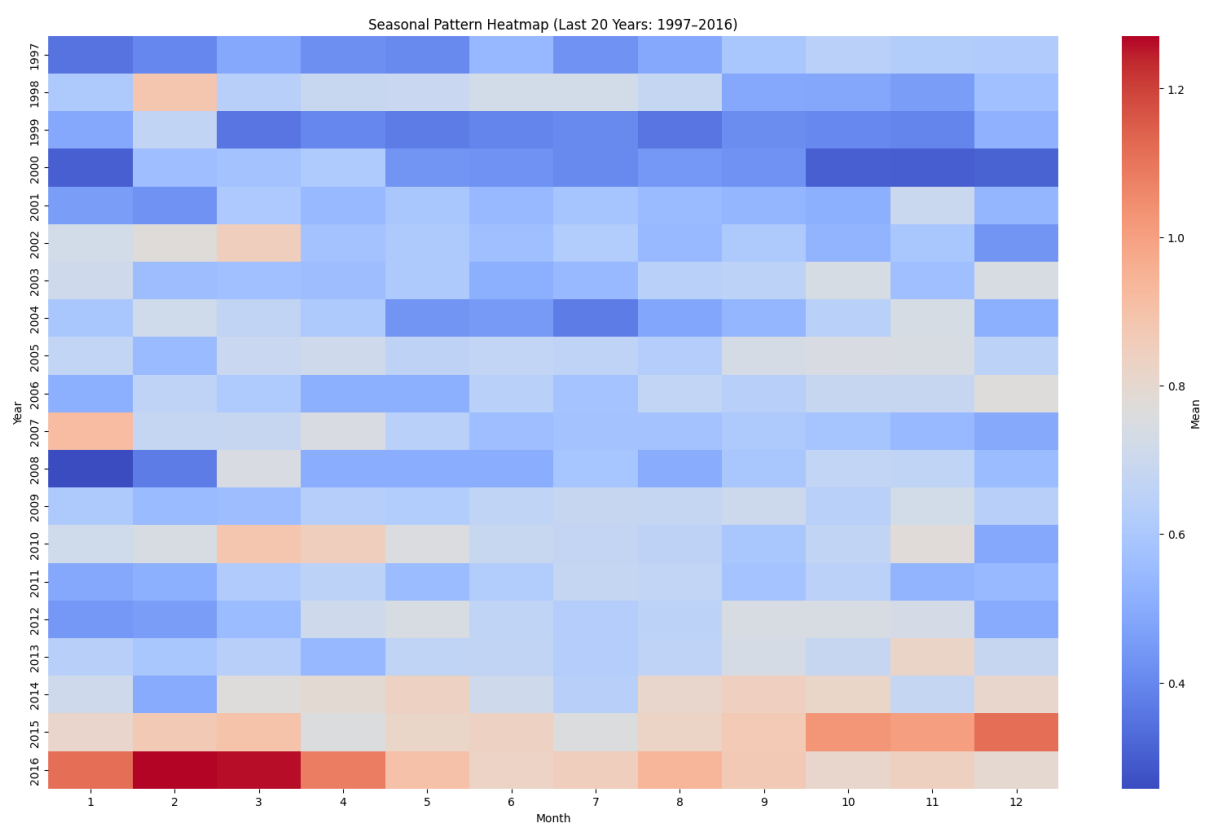


Figure 3. 60-day moving average graph



*Figure 4. 1967-2016 Heatmap*



*Figure 5. 1997-2016 Heatmap*

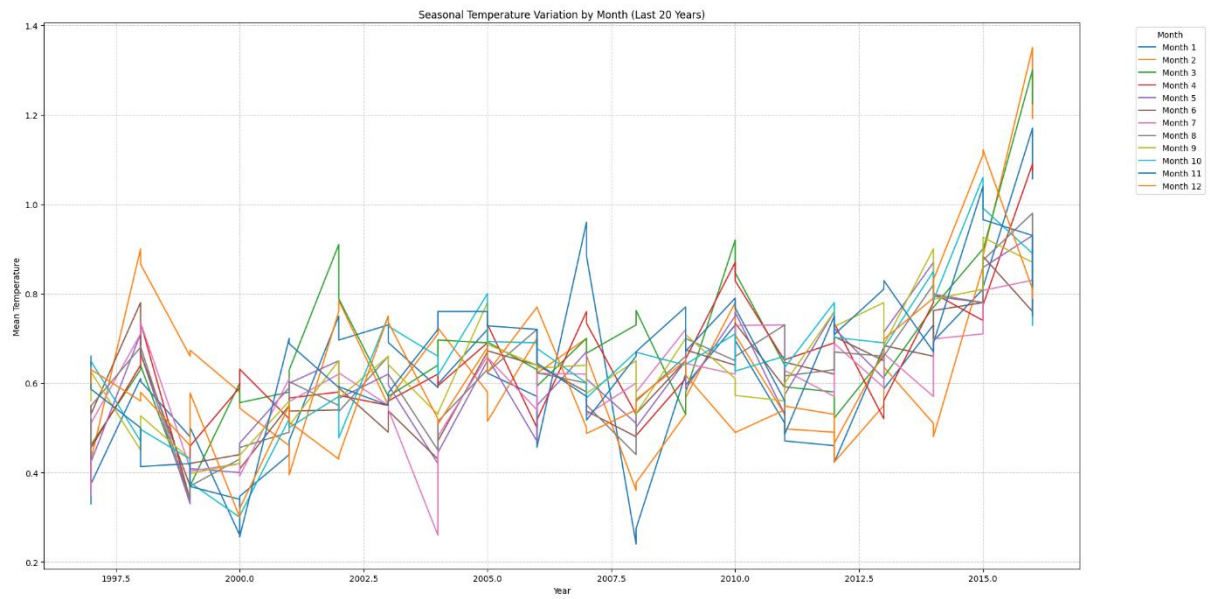


Figure 6. Line Plot of 20-year heatmap

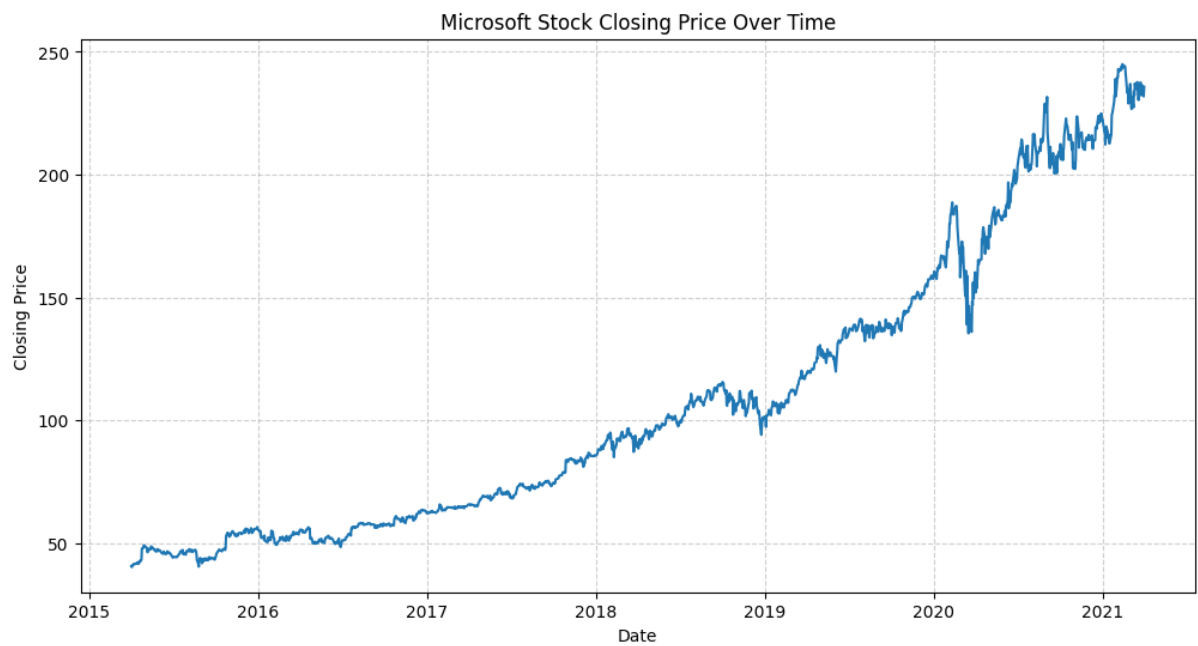


Figure 7. Raw graph of closing stock price dataset

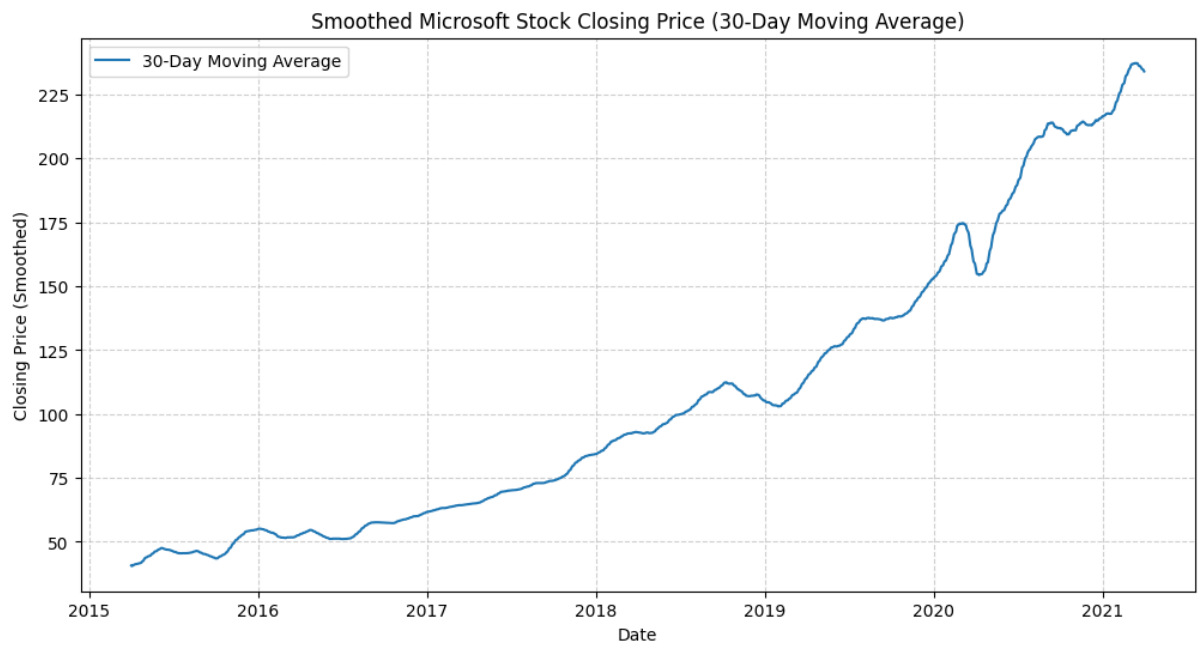


Figure 8. 30-day moving average graph

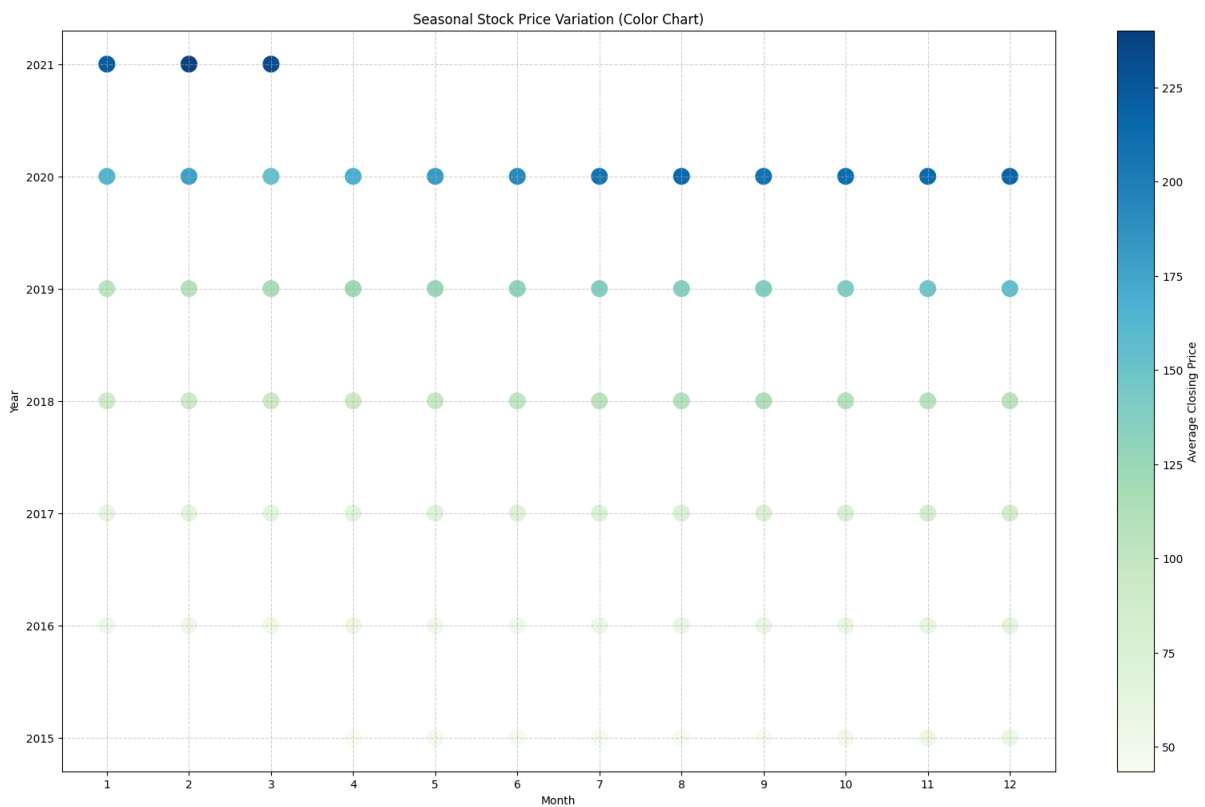


Figure 9. Closing Stock Price scatter plot



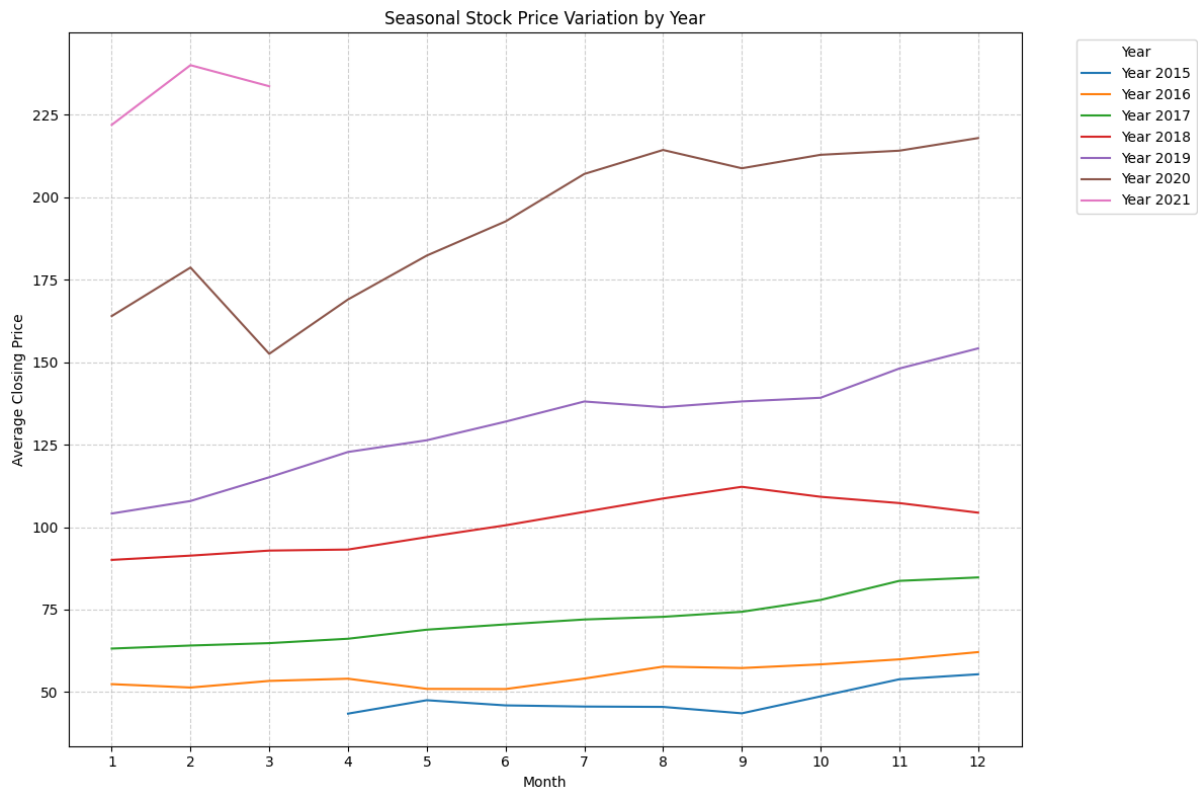


Figure 10. Line chart of scatter plot

## 6. Conclusion

The project achieved its objective of performing comprehensive analysis and intuitive visualization using Python to capture trends in historical global data and Microsoft Stock prices. The findings of the project adhere to the well-known facts – global temperatures are increasing and Microsoft Stock prices have seen an upward shift in closing prices, that have been already stated by scientists and analysts previously. Thus, this project can be considered successful.

## 7. Appendices

### A. References

1. <https://www.investopedia.com/terms/m/movingaverage.asp>
2. <https://www.kaggle.com/datasets/vijayvvenkitesh/microsoft-stock-time-series-analysis>
3. [https://en.wikipedia.org/wiki/Time\\_series](https://en.wikipedia.org/wiki/Time_series)

4. <https://www.tigerdata.com/blog/how-to-work-with-time-series-in-python>
5. [https://www.w3schools.com/python/pandas/pandas\\_intro.asp](https://www.w3schools.com/python/pandas/pandas_intro.asp)
6. [https://www.w3schools.com/python/numpy/numpy\\_intro.asp](https://www.w3schools.com/python/numpy/numpy_intro.asp)
7. <https://www.geeksforgeeks.org/python/python-plotly-tutorial/>
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9. [https://www.w3schools.com/python/numpy/numpy\\_random\\_seaborn.asp](https://www.w3schools.com/python/numpy/numpy_random_seaborn.asp)

#### B. GitHub Link of Code

1. [https://github.com/bosonofmyeye/IDEAS---TIH---07/blob/main/Koneenica\\_Majumder\\_07\\_Visualizing\\_Global\\_Temperature\\_Trends.ipynb](https://github.com/bosonofmyeye/IDEAS---TIH---07/blob/main/Koneenica_Majumder_07_Visualizing_Global_Temperature_Trends.ipynb)