Comparative Analysis of Precipitation – Seattle vs New York City

Introduction:

Seattle, Washington, and New York City, New York, represent two distinct climatic regions of the United States. Seattle is in the Pacific Northwest, near Puget Sound and the Cascade Mountain Range, which influences its temperate marine climate. The city is well known for its frequent light rain, with mild, wet winters and relatively dry summers. In contrast, New York City is situated on the northeastern Atlantic coast and has a humid subtropical climate. It experiences hot, humid summers and cold winters, with a wider range of temperatures and weather patterns throughout the year. Rainfall in New York City tends to occur as heavier and more intense downpours and thunderstorms. This analysis aims to determine whether Seattle truly receives more rainfall than New York City in terms of overall precipitation and frequency of days with rainfall. By comparing daily precipitation data from both locations, we will explore the differences in rainfall frequency and total precipitation amounts using data science methodologies.

Data Description:

Data source:

- Precipitation data was downloaded from NOAA's Climate Data Online Search tool for Seattle and NYC starting from dates 1st January 2018 through 31st December 2022.
- The Global Historical Climatology Network Daily (GHCND) dataset includes variables such as stations, date, precipitation, temperature, snowfall, snowdepth etc.
- For this analysis we have selected Stations for Seattle, WA: Seattle–Tacoma International Airport (Station ID: `USW00024233`) and New York City, NY: John F. Kennedy International Airport (Station ID: `USW00094789`).

Data processing:

- The data was processed to standardize date formats, remove unnecessary columns, and rename the remaining columns for clarity. The two city datasets were then combined into a single DataFrame, and missing values were handled with the mean across years of values on that day. This cleaned and consolidated dataset was used for the comparative rainfall analysis between Seattle and New York City.

Analysis Method:

I have adopted descriptive approach to describe data using summary statistics and visualizations. The exploratory data analysis (EDA) involved calculating mean of daily precipitation for both cities and visualizing it using bar plots. I then grouped the daily data into months to analyze variations across different months. An indicator variable was created to check if there was any precipitation occurred in each city which was plotted to visualize the proportion of days with any precipitation.

Further, I performed statistical tests to evaluate statistical significance of differences in precipitation levels and frequency of rainy days between the two cities.

Results

Figure 1.1 shows mean daily precipitation for both cities. Based on the graph, ***NYC has overall higher rainfall than Seattle.***
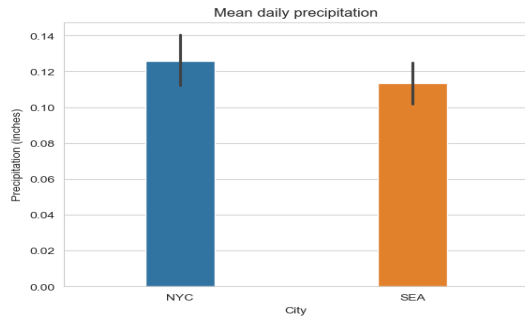
Figure 1.1

Figure 1.2 shows mean daily precipitation by month for each city. Seattle (orange bars) experiences slightly higher precipitation during winter months (November- February) whereas NYC (blue bars) has higher precipitation in summer months (June-September). **Overall NYC records higher precipitation across most months than Seattle.**
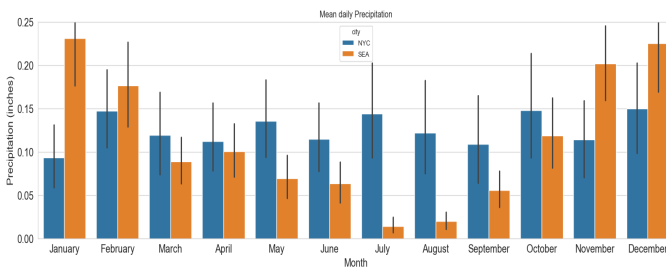

Figure 1.2

Figure 1.3 shows the proportion of days with any precipitation. **Seattle has overall higher proportion of days with rainfall than NYC.**

Figure 1.3

Figure 1.4 displays the proportion of days with any precipitation by month for each city.

Seattle (orange bars) shows a higher proportion of rainy days during most months, particularly between November and April. NYC's (blue bars) proportion of rainy days stays around 0.3 to 0.45 across the years. NYC shows more rainy days only in July and August. **This clearly indicates that Seattle has a greater number of rainy days across the year compared to NYC.**
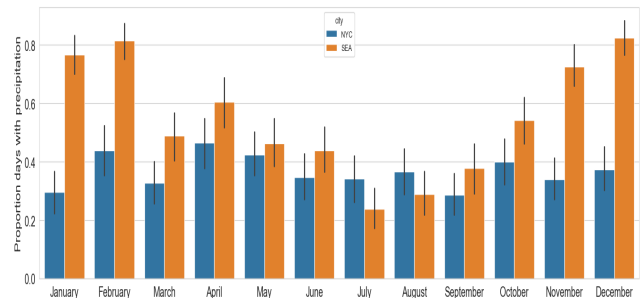

Figure 1.4

Finally, to determine whether the differences in precipitation levels and the frequency of rainy days between the two cities were statistically significant, I performed statistical tests. The results indicated that Seattle and NYC were significantly different in terms of both precipitation levels and the frequency of rainy days.

Conclusion

This analysis revealed clear differences in rainfall patterns between Seattle and New York City. Seattle experiences higher rainfall only during winter months compared to New York city. So, New York City experiences overall higher precipitation than Seattle. However, if we compare the proportion of days, Seattle has higher number of days with rainfall across the year. **These findings imply that while Seattle is rainier in terms of frequency, New York City often receives more total rainfall.**