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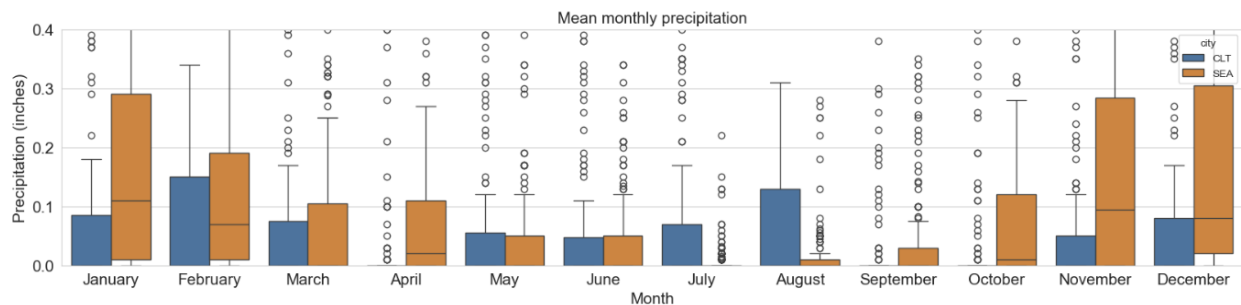
DATA 5100

Weather Project Report

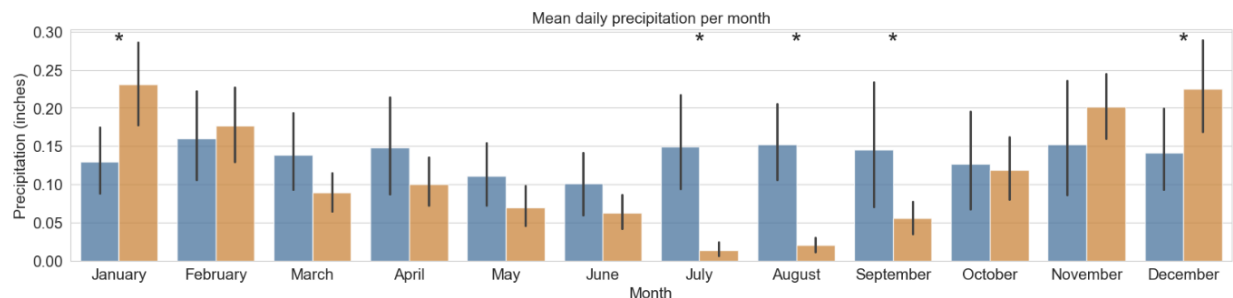
October 9, 2025

This report compares precipitation patterns in Seattle, WA and Charlotte, NC to answer the question “Which city rains more?” using daily weather data from 2018 through 2022. The dataset for Seattle was provided in class, while the dataset for Charlotte was obtained from the National Oceanic and Atmospheric Administration (NOAA). Please note that any missing daily precipitation values were replaced with the mean daily precipitation of all years for the corresponding calendar day. The idea of “rainy” can be understood either from the perspective of (1) total volume of precipitation or (2) the total number of days with precipitation.

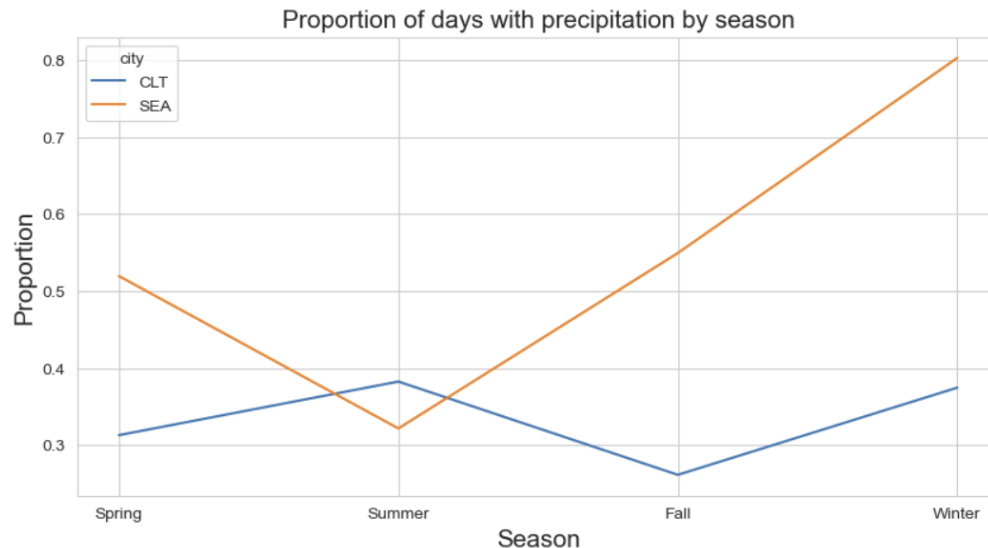
According to the Mean Daily Precipitation graph, Charlotte (CLT) receives more rainfall per day on average than Seattle (SEA). From this, we can infer two things: (1) When it rains in Charlotte, precipitation tends to be more intense and concentrated within a shorter time, and (2) although it rains frequently in Seattle, the average daily precipitation is lower. To confirm these observations, we need to examine several additional graphs.



The above graph, the Mean Monthly Precipitation Boxplot, clearly shows seasonal differences between the two cities. In the winter months (November through January), Seattle’s (SEA) median precipitation is much higher than Charlotte’s (CLT), with a wider quartile range. This indicates that Seattle experiences more frequent and varied amounts of precipitation in winter. In contrast, during the summer months (especially in July and August), Charlotte’s median is higher, while Seattle’s boxplot is almost absent, suggesting that Charlotte receives heavier and concentrated rainfall in this season.



The second graph, Monthly Mean Precipitation, used t-test and it presents monthly mean precipitation as bar plots. Note that \* symbol indicates months where the differences between the two cities are statistically significant. The graph shows that Seattle records significantly more rainfall than Charlotte in January and December. While in July, August, and September, Charlotte records significantly more. This clearly demonstrates a seasonal pattern: Seattle rains more in the winter, while Charlotte rains more in the summer. The Monthly Proportion of Days with Precipitation graph also shows that the gaps between two cities are particularly large in winter and summer.



The above graph compares the proportion of rainy days by season. Seattle maintains a precipitation proportion above .5 (50%) in spring, fall, and winter, with fall and winter showing more than twice the proportion observed in summer. In contrast, Charlotte shows a sharp hike in the proportion during summer but remains relatively low in other seasons (typically between .3 and .4). The last two graphs show the average and total precipitation from 2018 to 2022. Charlotte recorded higher total and average precipitation than Seattle between 2018 and 2020, but from 2021 the number dropped sharply, converging to nearly the same level as Seattle. By contrast, Seattle's annual precipitation remained relatively stable over the same period in both.

In summary, the answer to the question "Which city rains more?" depends on the criteria used. If we measure by total volume (mean/sum precipitation), Charlotte records higher rainfall and particularly in summer. However, if we measure by frequency (proportion), Seattle is clearly the city where it rains more often. Based on data and graphs, we can conclude that Seattle rains frequently in all seasons except summer, while Charlotte is characterized by heavier summer rain. Based on this trend, it appears that in the future, Seattle may surpass Charlotte in both precipitation volume and frequency. However, the last two graphs suggest that in the future Seattle's average and total precipitation could surpass Charlotte's, given that Charlotte's dataset contained no missing values.