**Seattle Weather Project**

**Introduction**

One of the nicknames for Seattle, Washington is "Rainy City". This project seeks to investigate and determine whether this popular perception holds true when comparing Seattle's precipitation levels to those of another US city, Grand Rapids, Michigan.

The core question and hypothesis we sought to answer is whether Seattle receives more precipitation, on average, than Grand Rapids?

We hypothesized that Grand Rapids receives an equal or greater amount of total precipitation than Seattle. Our analysis uses historical daily weather data to provide a data-driven conclusion, free from local bias or reputation.

**Data Used**

The data for this analysis consists of daily precipitation measurements (recorded in inches) sourced from the National Oceanic and Atmospheric Administration (NOAA) downloaded from this location: https://www.ncei.noaa.gov/cdo-web/search?datasetid=GHCND. We gathered records for weather stations near Seattle, WA, and Grand Rapids, MI, covering a five-year period from January 1, 2018, through December 31, 2022.

Initially, the raw datasets contained numerous columns detailing various weather metrics (such as snow depth and maximum daily precipitation). For a focused comparison, we isolated only the date and the daily liquid precipitation (rain, or rain equivalent from frozen precipitation).

The raw Seattle data contained 190 missing daily entries, which could be due to temporary station outages or measurement errors during that period. To ensure the fairest comparison, these missing values were carefully handled: we imputed the data by calculating the average precipitation recorded for that specific day of the year across all other available years in the Seattle dataset. This method preserves the seasonal patterns of precipitation while filling in gaps.

**Analysis Methods and Results**

To compare the two cities effectively, we first organized the data into a single, comprehensive table, or "tidy dataset." This allowed us to calculate and compare key metrics and visualize seasonal trends.

**1. Overall Average Daily Precipitation**

We calculated the mean daily precipitation across the entire five-year period (2018-2022).

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| --- | --- |
| **City** | **Average Daily Precipitation (inches)** |
| Grand Rapids (GRR) | 0.1184 |
| Seattle (SEA) | 0.1133 |

A graph showing a comparison of average precipitation

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Figure 1. Average Daily Precipitation

Result: On a daily average, Grand Rapids received more precipitation (0.1184 inches) than Seattle (0.1133 inches). This difference means Grand Rapids, on average, received about more daily precipitation than Seattle over the five-year period. Whether this is a general trend is difficult to assess given the limited time frame of analysis, but this small point in time generally shows a general trend toward Grand Rapids being more of a “rainy city” than Seattle.

**2. Seasonal and Monthly Precipitation Trends**

While the overall average addresses the initial question, examining monthly totals provides crucial insight into seasonal differences, which often drive the "rainy" perception.

The line chart below illustrates the total monthly precipitation in both cities over the five-year period.

A clearer view of the typical annual pattern is shown in the grouped bar chart below, which displays the average total precipitation for each month.

This monthly breakdown reveals a significant pattern:

A graph of a number of months

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Figure 2. Average Monthly Precipitaion

* Seattle sees its highest precipitation during the winter months (November through January) and a marked reduction in summer.
* Grand Rapids maintains a more consistent precipitation level throughout the year, with no dramatic "dry" season. Although more recent years indicate strong empirical data to indicate that this trend is changing. A useful exercise would be to continue this analysis in the most recent three years.

The perception of Seattle as rainier may stem from the concentration of its precipitation in the winter, which often manifests as persistent, light drizzle over many days. Grand Rapids, conversely, distributes its slightly higher total precipitation more evenly throughout the year, at least during this period of time.

**Conclusion**

Based on the analysis of daily precipitation data from 2018 through 2022, the hypothesis that Grand Rapids, Michigan, receives as much or more rain than Seattle, Washington, is supported.

Grand Rapids (GRR) received an average of 0.1184 inches of precipitation per day, compared to 0.1133 inches per day in Seattle (SEA).

Therefore, when considering the total volume of liquid precipitation, Grand Rapids is, on average, technically the "rainier" city in this comparison.

This finding suggests that Seattle's reputation as the "Rainy City" is likely influenced less by the total volume of rain and more by the type and frequency of its rainfall**,** particularly the persistent, low-intensity winter weather, as opposed to the more common, higher-intensity rainfall events typical of Midwestern climates like Grand Rapids.