In this project, we want to answer a simple but also could be more complicated than you think: which city rains more, Seattle or Miami? Seattle is known for its cloudy and wet days, while Miami is famous for its sudden tropical downpours. To find out which city rains more, I analyzed daily precipitation data for both cities and compared the mean precipitation by months, and the proportion of days with any measurable rain.

The data used for this project includes daily weather recodes from 2018 to 2023 for Seattle and Miami. Each entry lists the date, the city, the station, amount of precipitation, and other weather details such as snow depth. Before analyzing the data, missing or incorrect values were removed, and the dates were checked to make sure they were in the right format. After cleaning, the data gave a clear picture of rainfall patterns in both cities over the time period.

The goal was to understand how much rain each city receives and how often it rains. Daily precipitation data shows day-to-day variable, while the monthly mean precipitation shows seasonal differences between the two cities. The proportion of rainy days, the number of days with any measurable precipitation shows how often each city experience rain. All three measurements give us a complete understanding of the rainfall patterns of the two cities.

Using cleaned weather data, I first compared the daily precipitation from 2018 to 2023 between Seattle and Miami to visualize how rainfall varies from day to day. I then calculated the mean precipitation for each month to find out the seasonal patterns. Next, I calculated the proportion of rainy days to determine how often each city experiences precipitation. Lastly, I examined whether the differences in mean monthly precipitation between the two cities were statistically significant. A difference is statistically significant when it's unlikely to have occurred by chance.

Figure 1 shows clear differences in rainfall behavior. When Miami experiences heavy rainfall, it often results in significant spikes on the graph, frequently reaching three to four inches and even seven inches in a single day, indicating heavy downpours that occur less frequently. In contrast, Seattle's daily rainfall remains consistently low but more frequently. **Figure 2** compares the mean monthly precipitation, showing that Miami mostly rains in the summer months, consistent with its tropical climate, while Seattle has moderate rainfall spread more evenly across the fall, winter, and spring. **Figure 3** shows the proportion of days with any precipitation, demonstrates that Seattle experiences rain way more often compared to Miami, confirming Seattle's reputation for persistent drizzle. **Figure 4** also shows the mean monthly precipitation for both cities, but it also marks whether the differences in monthly precipitation are statistically significant. It shows that Miami's rainfall is significantly higher than Seattle's during the summer months, while Seattle's differences in the winter months are smaller and not statistically significant.

These results show that the answer to "which city rains more" depends on how we define "more". If we mean total rainfall, then Miami is the obvious answer. However, if we mean how often it rains, then Seattle experiences far more rainy days. Overall, the data show that while Seattle experiences rain more frequently, Miami receives a far greater total amount of rainfall. The differences in monthly averages are statistically significant during Miami's summer season, confirming that Miami's storms contribute much larger amounts of rain. Therefore, if we go by the surface meaning of the phrase "rains more," the clear answer is Miami.

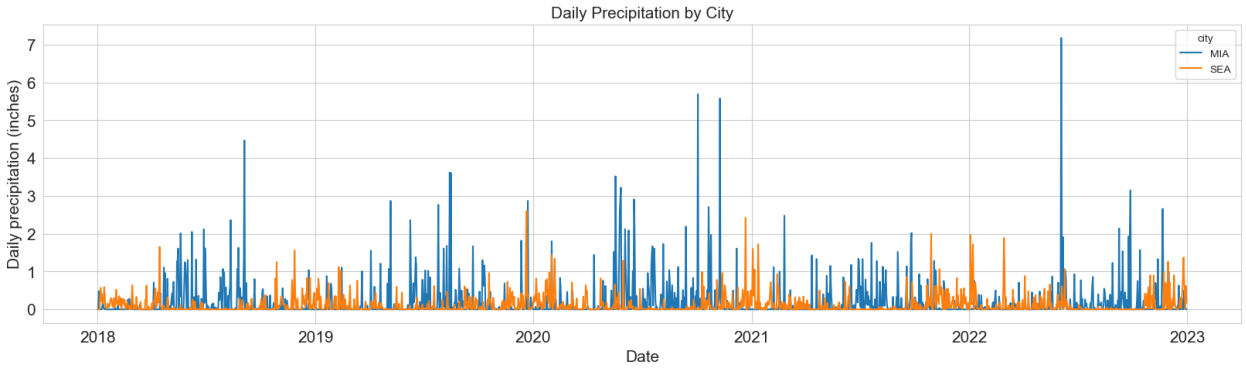

Figure 1. Daily precipitation for Seattle and Miami from 2018 to 2023.

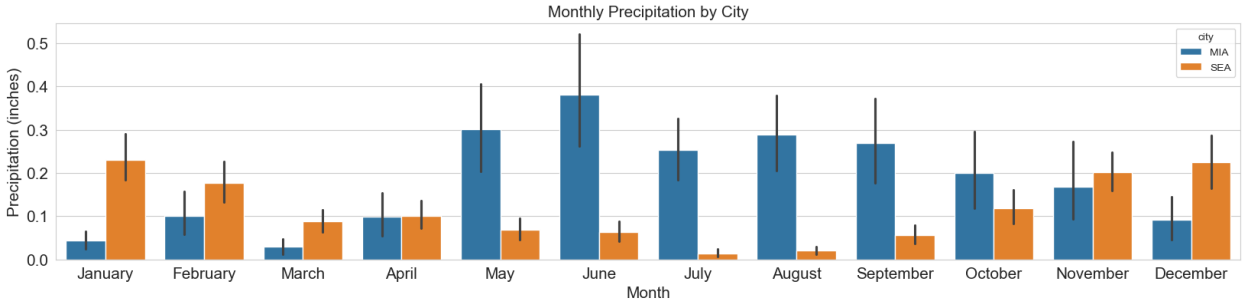

Figure 2. Average monthly precipitation between Seattle and Miami from 2018 to 2023.

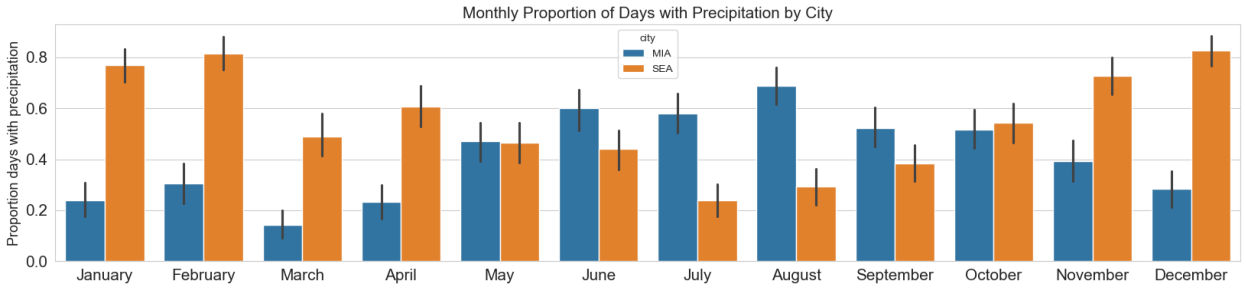

Figure 3. Average monthly proportion of days with measurable precipitation from 2018 to 2023.

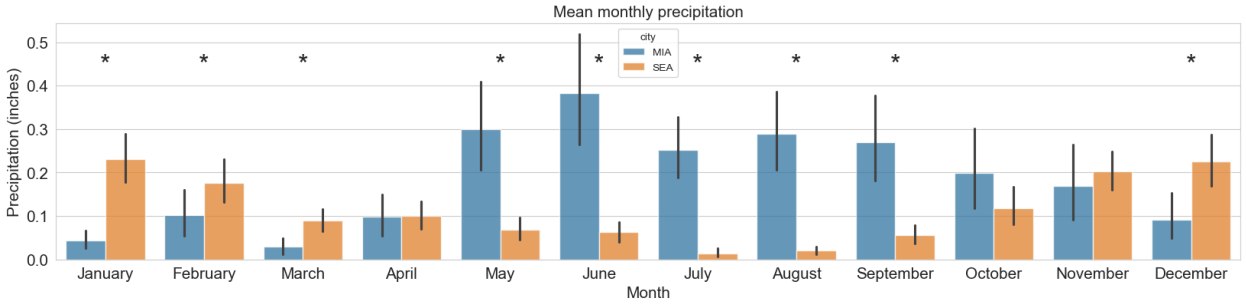

Figure 4. Average monthly precipitation in Seattle and Miami from 2018 to 2023, with statistically significant differences indicated.