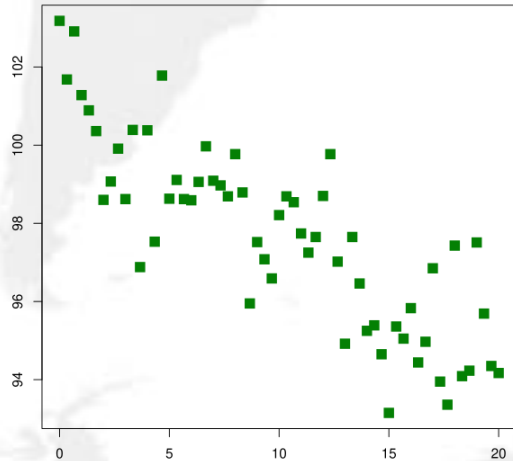
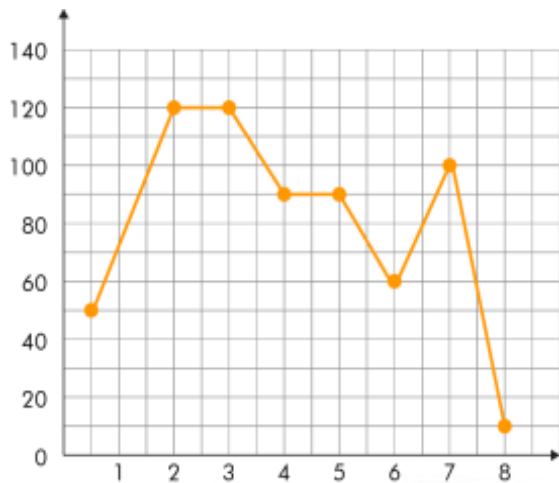


India's Climate & AQI Analysis

Trends, Impacts, and Insight



Why India's Climate and Air Quality Matter?

- Climate impacts ecosystems, human health, and global sustainability — making it crucial to monitor and understand.
- This presentation focuses on India, a country with rich geographic and climatic diversity.
- We analyze temperature, rainfall, and air quality (AQI) trends to understand how India's climate is changing over time.
- Our goal is to identify key patterns and contributing factors to support better resource management and environmental policy-making.

From Raw to Ready: Data Cleaning and Filtering Process

- All datasets were cleaned before analysis to ensure consistency and usability.
- CSV files from Kaggle were imported using `pd.read_csv()` and loaded into Pandas DataFrames.
- This restructuring simplified the dataset, enabling easier regional and temporal comparisons of rainfall trends.
- For India's rainfall data:

```
ReshapedData = InitialData.pivot_table(  
    index='YEAR',          #sets years as rows  
    columns='SUBDIVISION', #sets regions as columns  
    values='ANNUAL',       #values to populate the table  
)
```

Chronological Sorting for Trend Analysis

- Sorted rainfall data by '*Year*' after grouping monthly values.
- Calculated average annual temperatures and sorted by year
- Enabled consistent chronological trends across datasets
- Essential for merging rainfall and temperature data
- Ensured accurate alignment for scatter plot comparisons



Merging Datasets for Integrated Analysis

- Calculated annual averages for temperature and rainfall
- Merged datasets using *year* as a common key
- Enabled direct comparison of climate variables over time
- Air quality (2021 only) merged with temperature for year-specific insights
- Ensured aligned years for accurate correlation and visualization

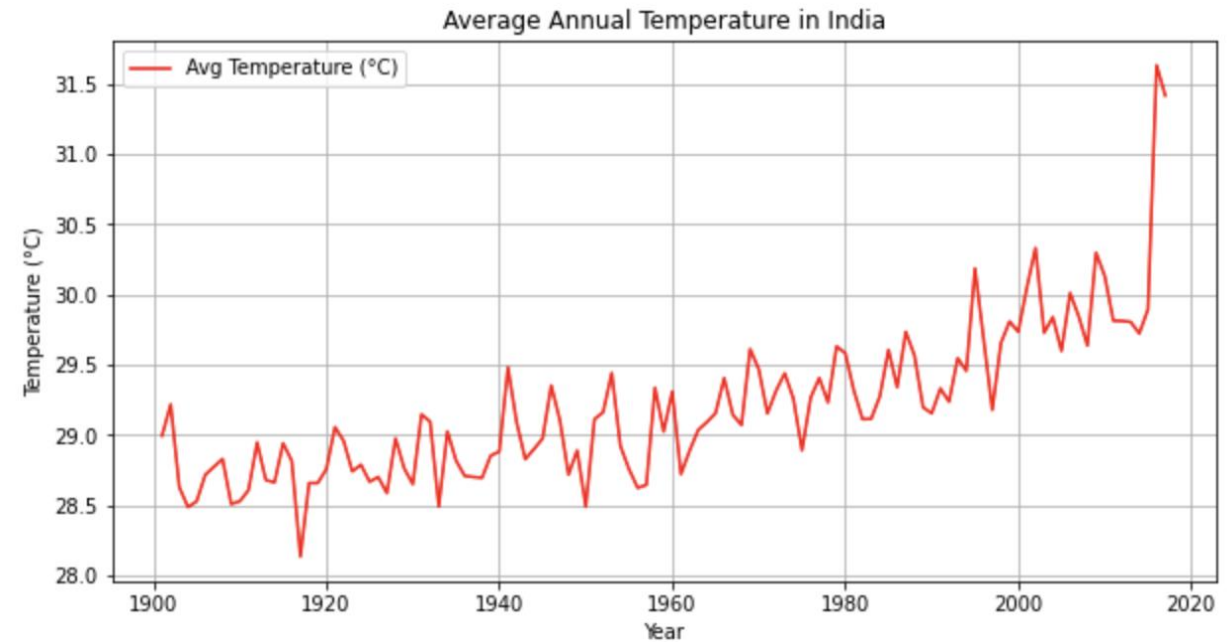
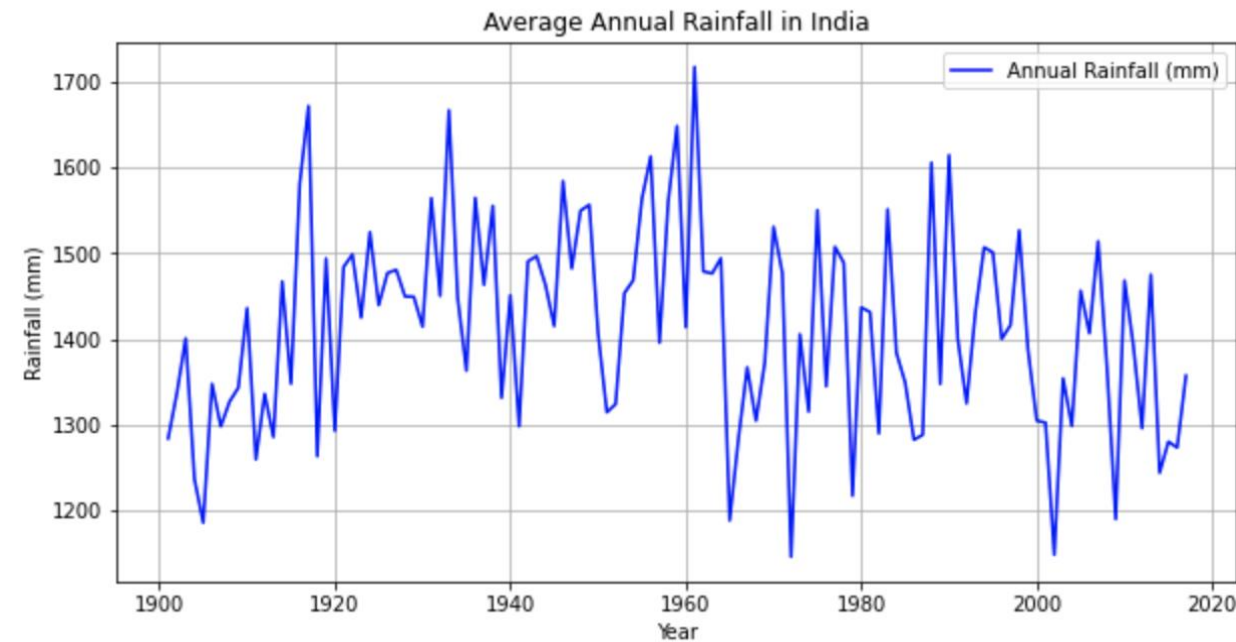
Temperature	
Year	Raifall
2018	800
2019	750
2020	920

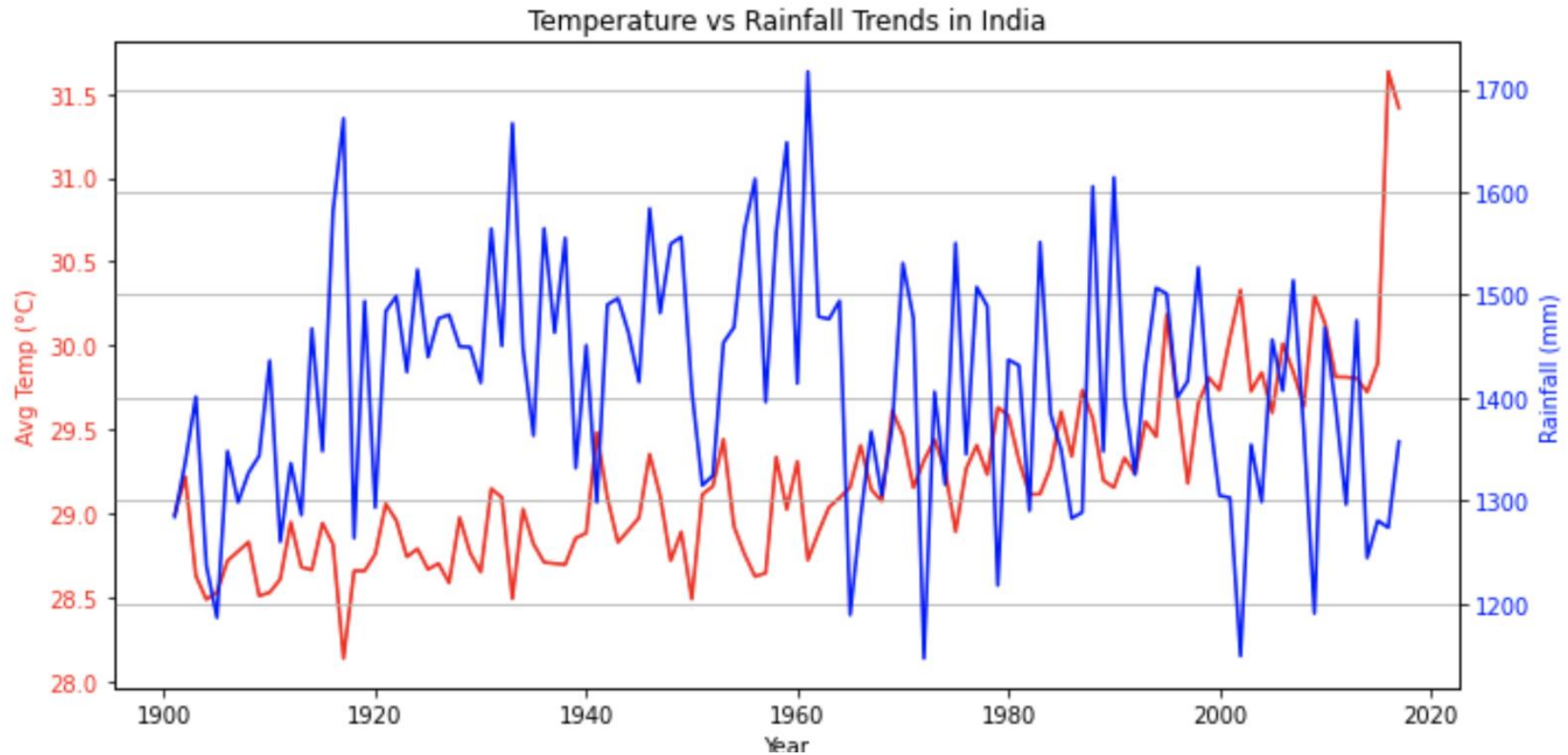
Rainfall	
Year	Rafall
2018	860
2019	55
2021	55

Air Quality	
Year	Tempratur
2018	55
2021	
2021	24.6
2021	24,6
2021	24,6

Visualization (1)

How average annual temperature and rainfall have changed over time in India.



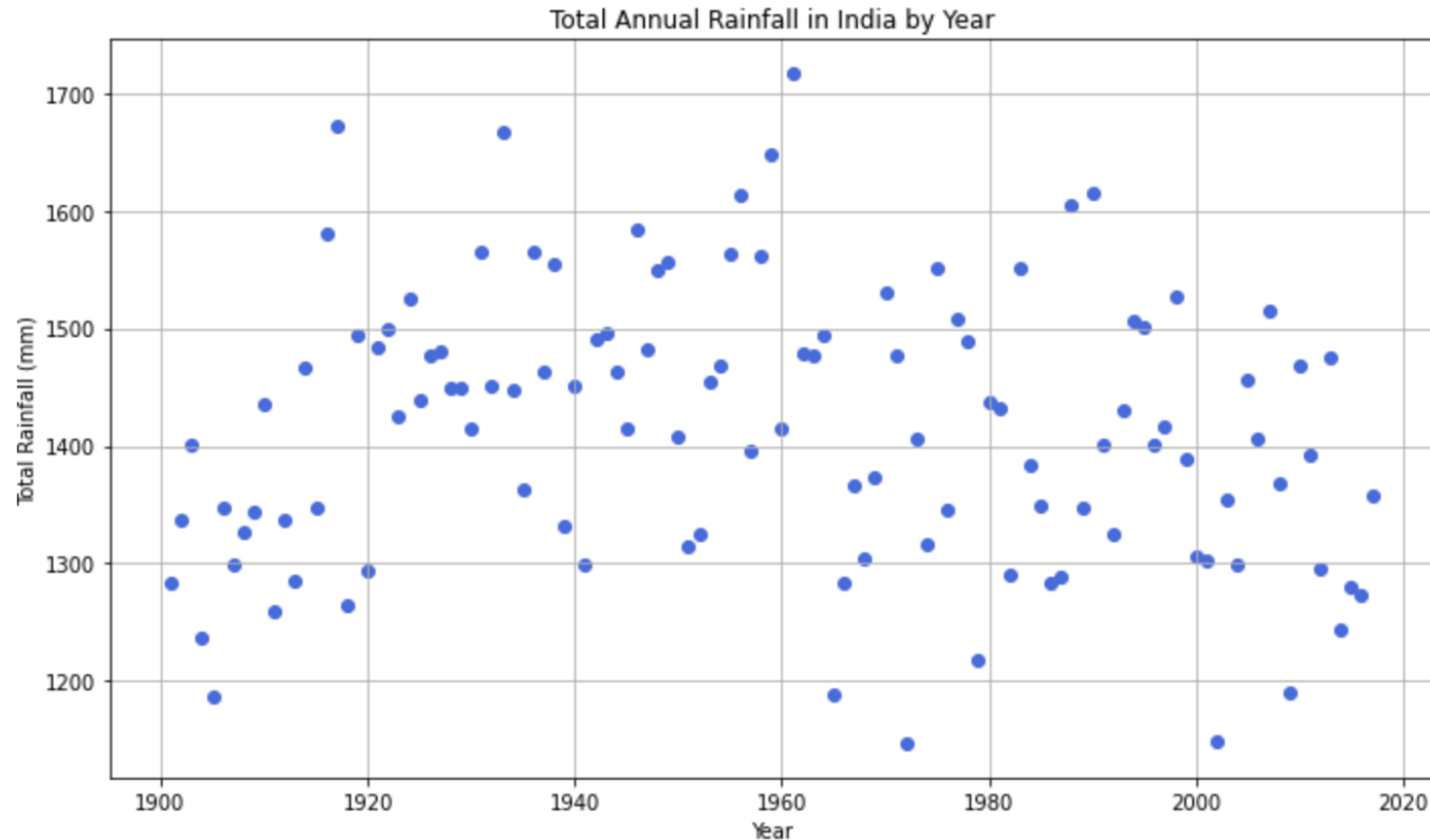


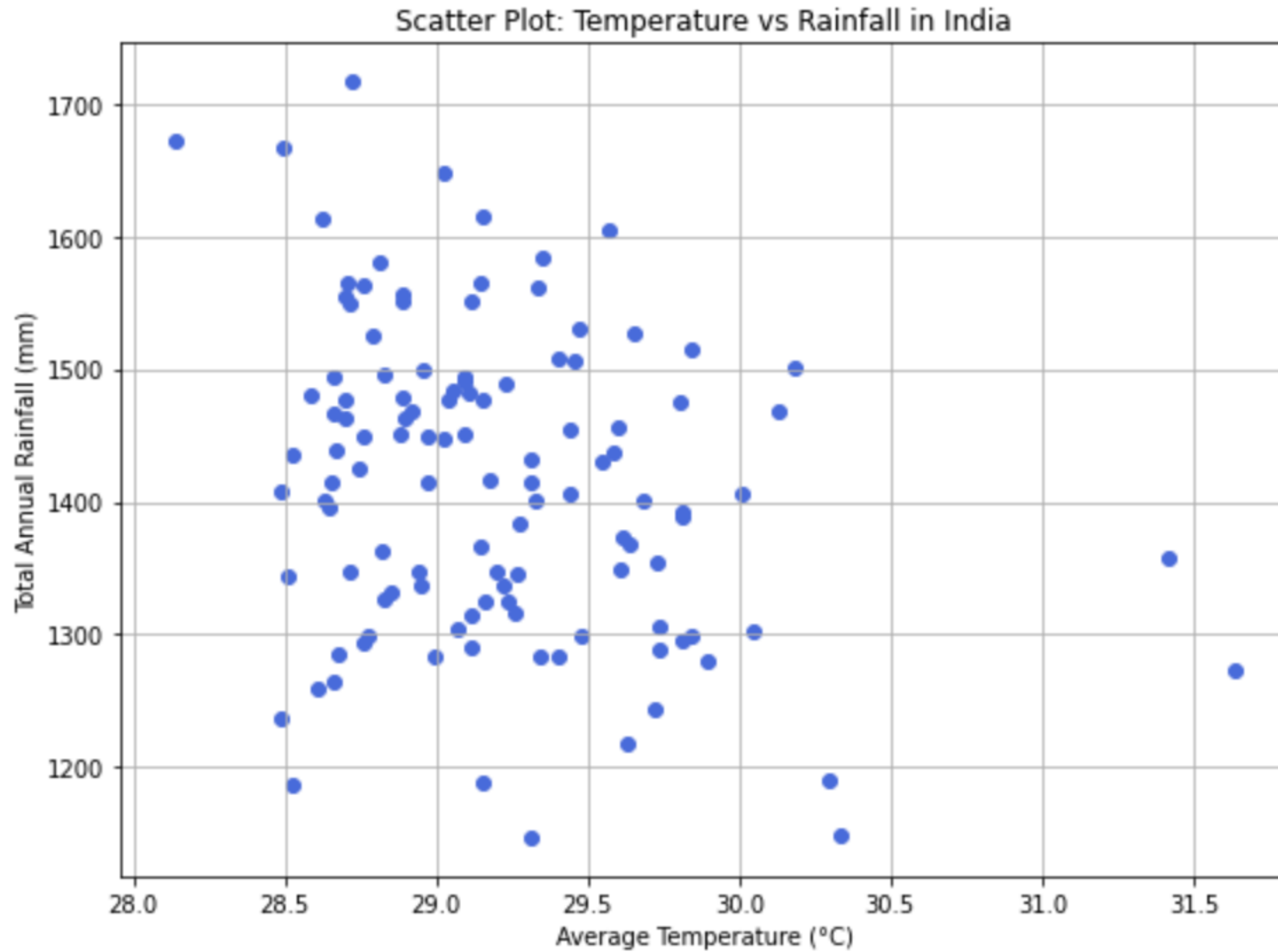
The average temperature in India shows a steady upward rise over the years, whereas rainfall patterns appear more irregular and fluctuating.

The chart makes this contrast clearer by displaying both trends on the same timeline, highlighting the lack of a strong visual correlation between rising temperatures and rainfall totals.

Visualization (2)

India's total annual rainfall trends across the years



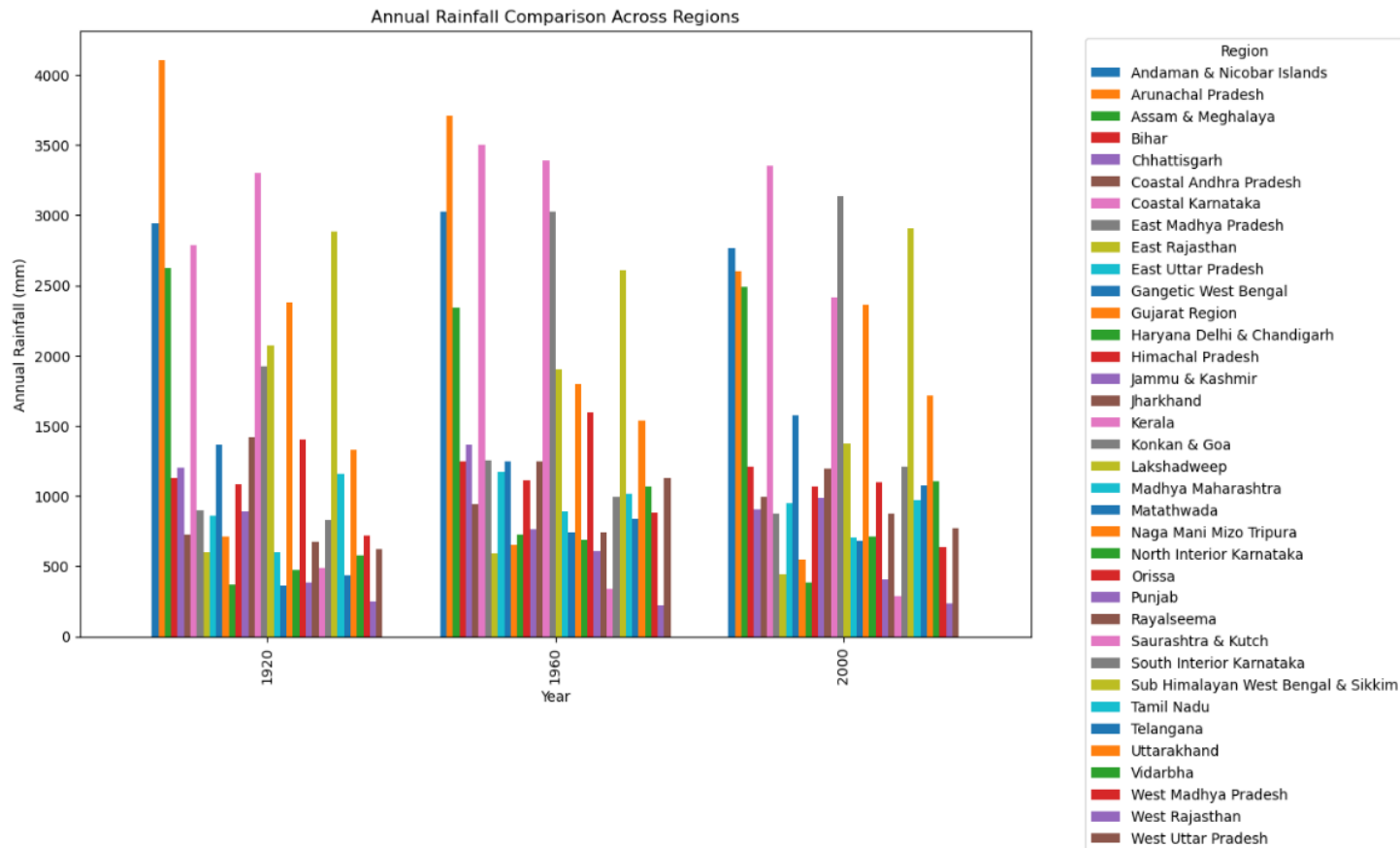


As temperature increases beyond $\sim 29.5^{\circ}\text{C}$, total rainfall shows a slight tendency to decrease.

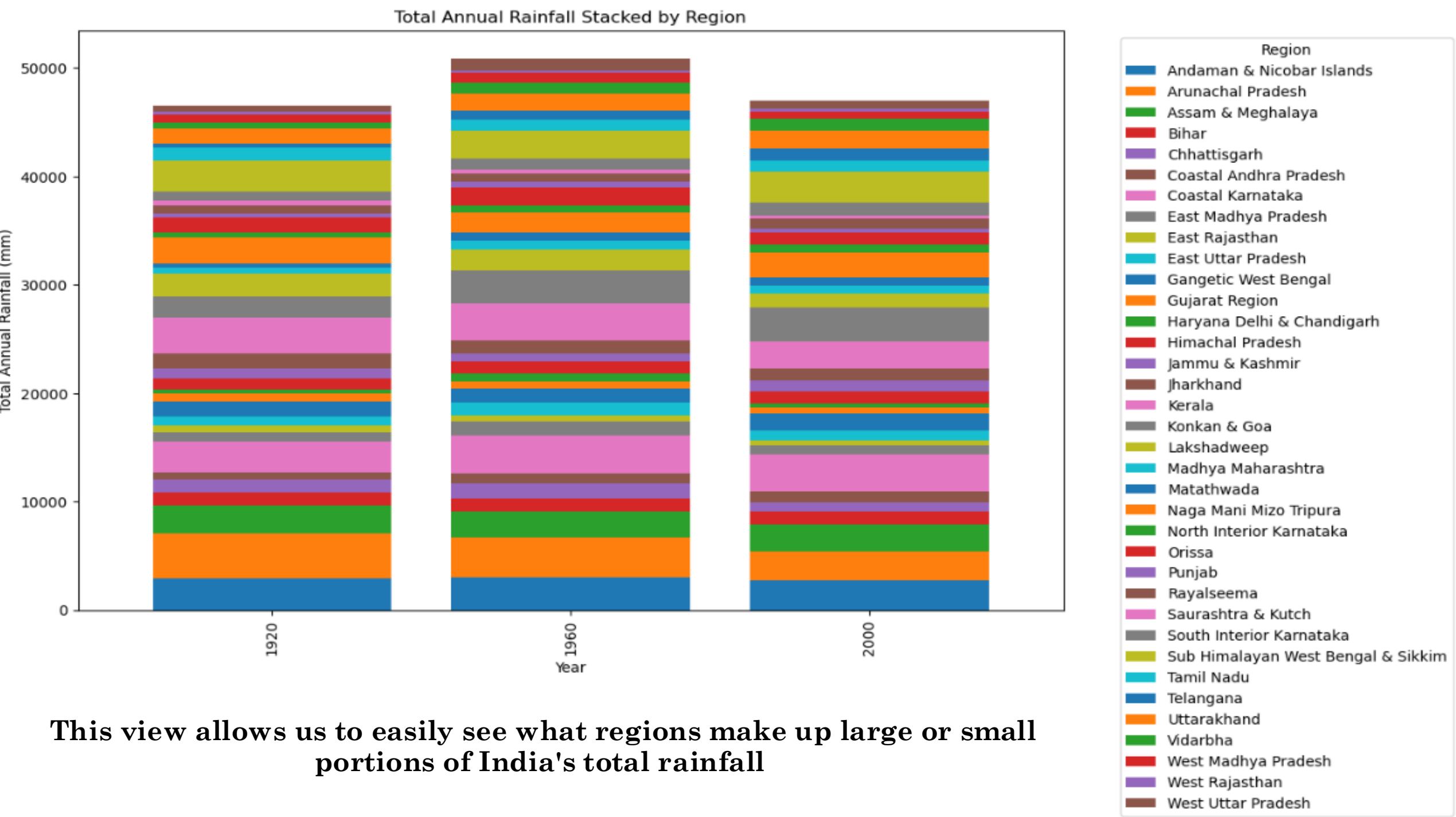
The densest cluster of high rainfall values seems to hover around 28.5°C to 29.5°C , while at higher temperatures (above 30°C), rainfall values are more spread out and even dip closer to the lower range (~ 1200 mm).

Visualization (3)

India's Annual Rainfall across Regions

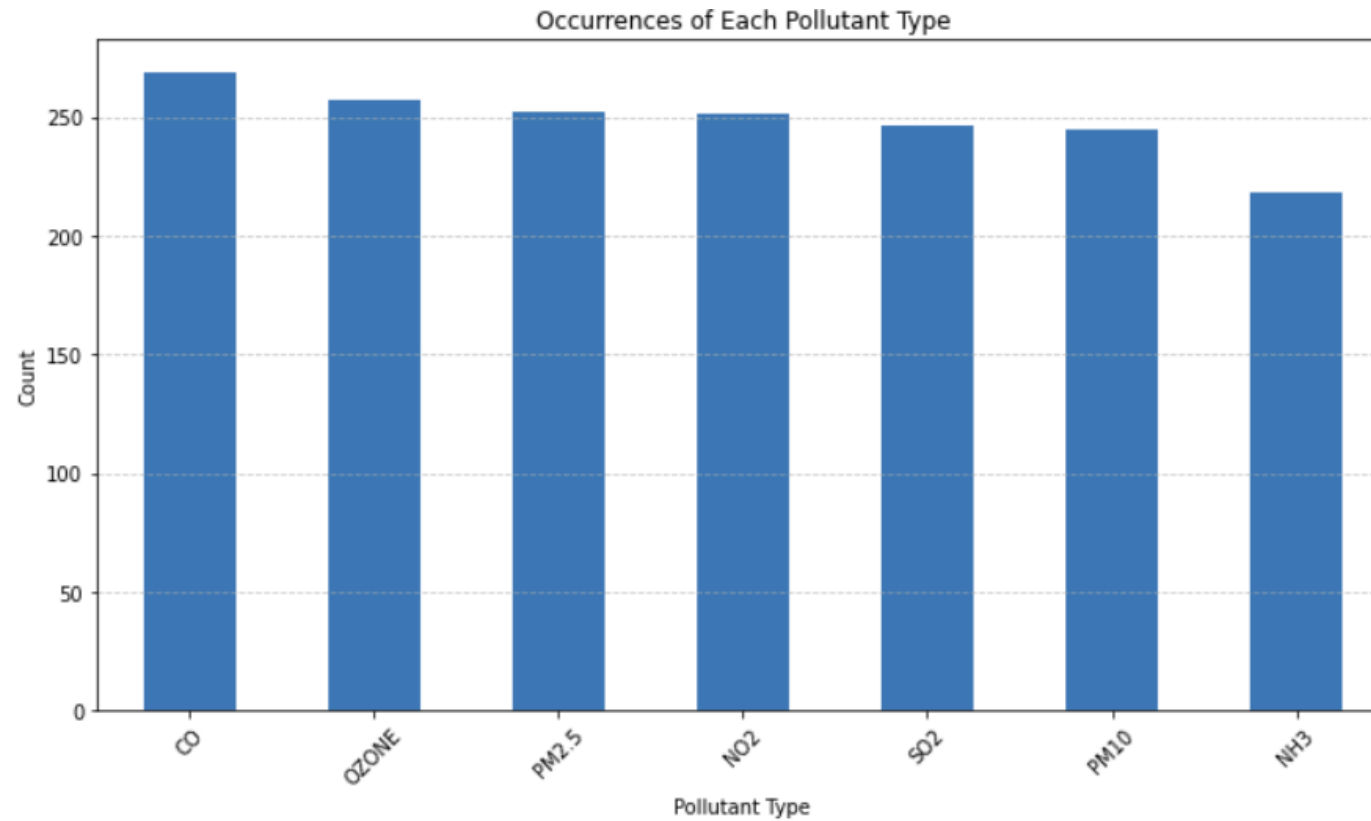


- We can see that rainfall varies across regions
 - Specific regions regularly receive more or less rainfall
- Rainfall has stayed somewhat consistent over the years



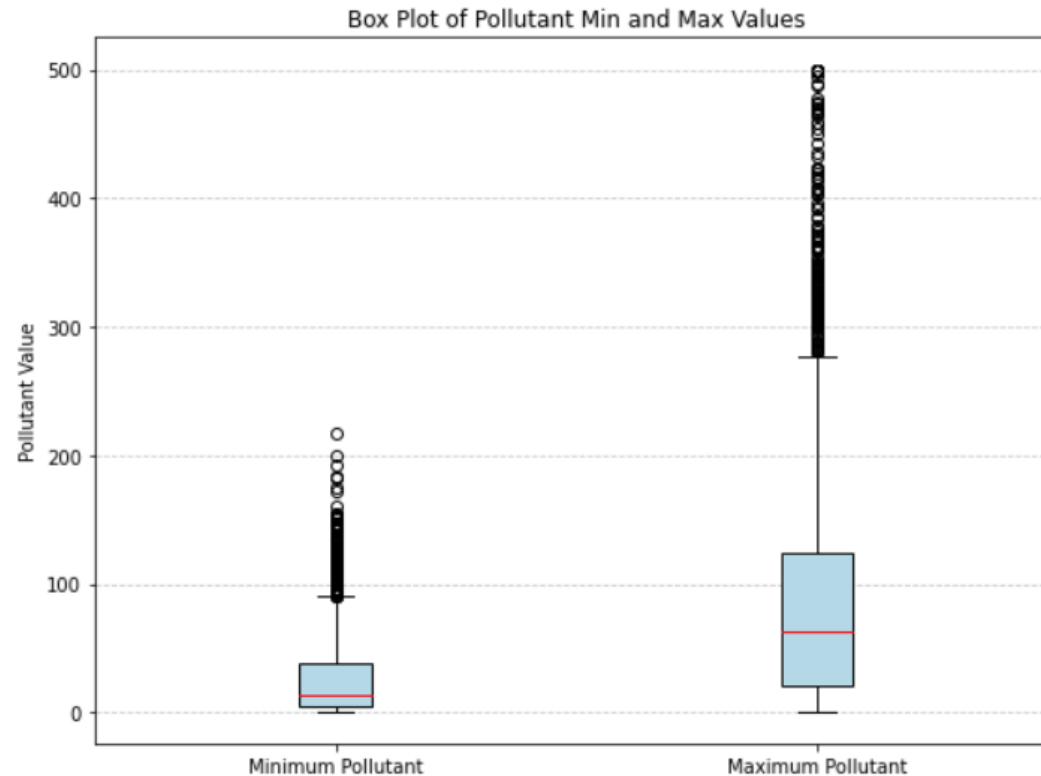
Visualization (4)

Number of Occurrences of each type of pollutant



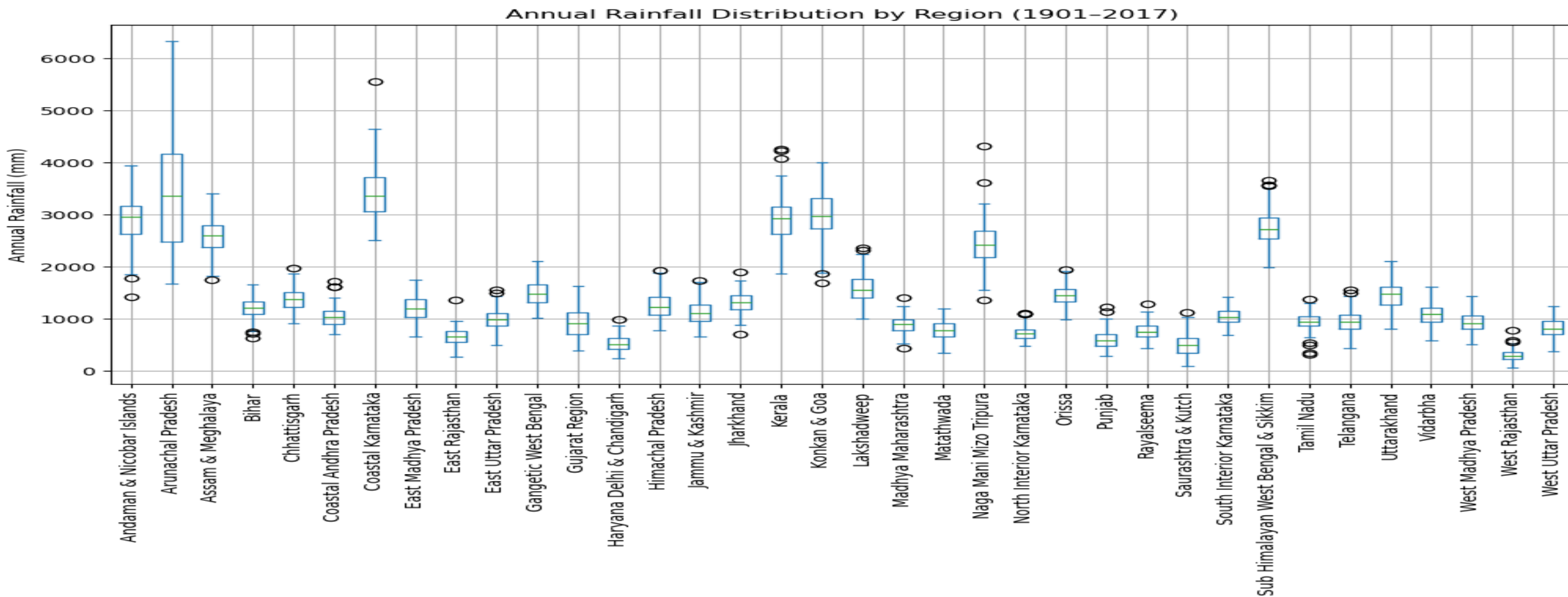
Visualization (5)

The minimum, 25th percentile, median, 75th percentile, and maximum of each of the minimum and maximum number of pollutants detected

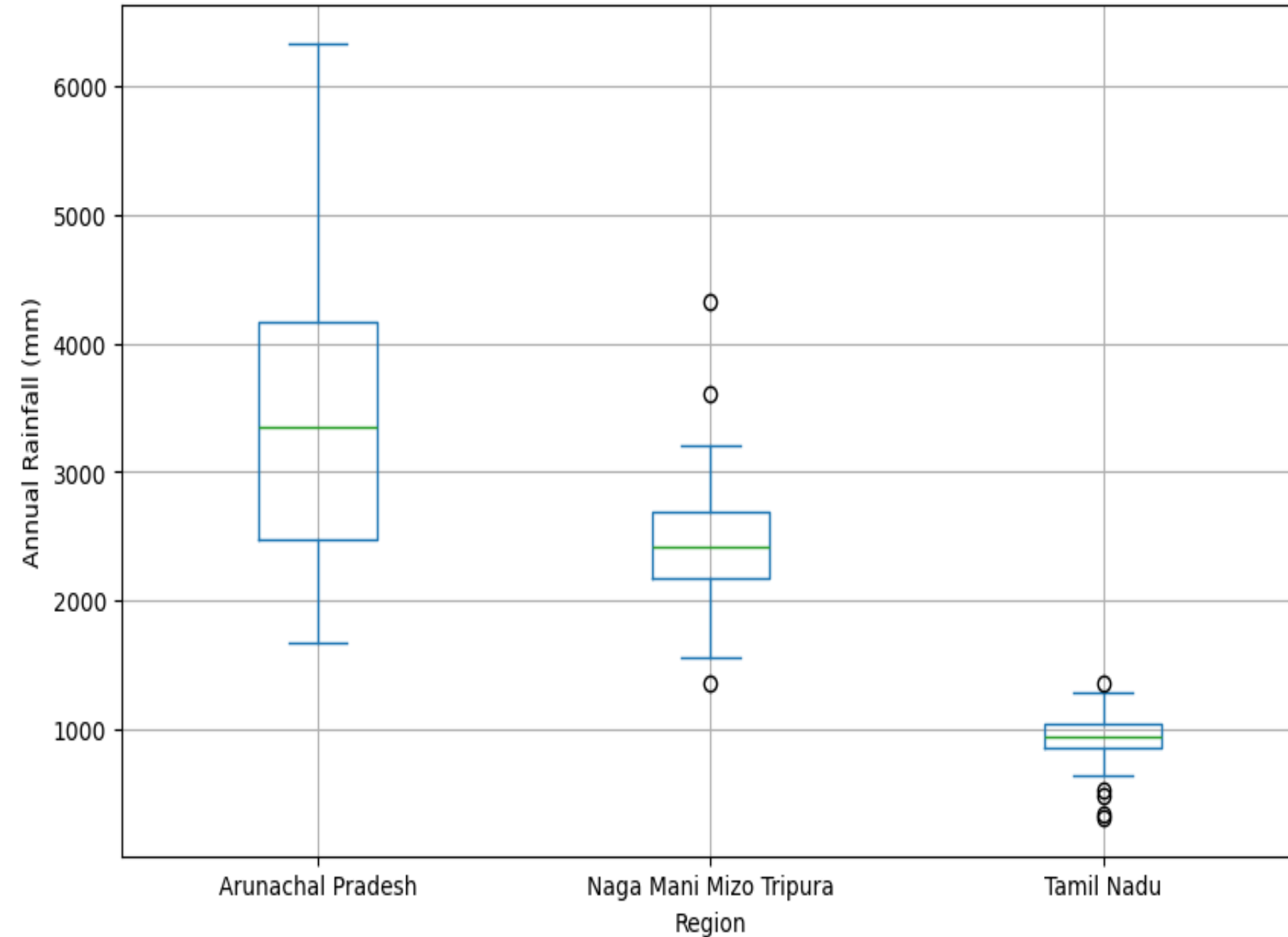


Visualization (6)

India's Annual Rainfall by Region



Annual Rainfall Distribution for Selected Regions (1901-2017)



- **Certain regions have consistent rainfall**
- **Other regions are more dynamic**
- **Outliers can easily be seen**

Stacking and Pivoting

- We used the "pivot_table()" function to help utilize and understand the data for the rainfall in the country.
- When cleaning through the data of air quality, we used the "stack()" function to sort the data, making the data easier to visualize.
- The "stack()" function helps convert the data from a long structure into a wide structure.
- These functions allow us to better comprehend and analyze the data.