Indian Climate Analysis

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Introduction

In this project, we've utilized two datasets obtained from an open-source data repository platform. The initial dataset presents Indian Subdivision-wise Rainfall data spanning from 1901 to 2017, while the second dataset encompasses yearly Temperature data for India during the same timeframe.

- Table 1 (rainfall_india) :

This particular table has total 4187 no. of Records or Rows and 22 Fields or Columns. All recorded Rainfall are measured in Millimeter.

Fields Descriptions :

Record_Counter : Depicting the ROW numbers

SUBDIVISION: Regions considered due to similar Topological features (This particular dataset contains total of 36 Subdivisions) .

YEAR: The year during which rainfall occurred.

The **next 12 Columns** are the different months . i.e. Month wise rainfall

ANNUAL : Total Annual Rainfall for a particular Subdivision in a particular Year .

The **next 4 columns** are the cumulative time period to show the seasons (Seasonal Rainfall) .

And **the last 2 columns** are the Latitude and Longitude of a particular Subdivision .

- Table 2 (temperatures) :

This particular table has total 117 no. of Records or Rows and 18 Fields or Columns. All recorded Temperature are measured in °C .

Fields Descriptions :

YEAR: Year in which Temperature has recorded .

The **next 12 Columns** are the different months . i.e. Month wise Temperature.

ANNUAL : Average Annual Temperature for a particular Year .

The **next 4 columns** are the cumulative time period to show the seasons (Seasonal Average Temperature) .

Research Objectives

- **Data Cleaning**: Clean and prepare the data for analysis.
- **Database Queries**: Extract specific information efficiently using SQL.
- **EDA Insights**: Reveal data patterns and trends.
- **Climate Change Impact**: Assess climate change effects on India's climate.
- **Correlation Analysis**: Identify relationships between rainfall and temperature.
- **Regional Variations**: Explore spatial variations in climate data.
- **Time Series Analysis :** Identify the trend of Precipitation and Temperature over different years.
- **Forecasting Values** : Forecast future climate trends using historical data.
- **Visualizations**: Use interactive visuals to convey results effectively.
- **Documentation**: Maintain comprehensive project documentation.

List of Findings

1A. Subdivisions wise Five Regions with Highest Average Annual Rainfall from 1901 to 2017

1B. Subdivisions wise Five Regions with Least Average Annual Rainfall from 1901 to 2017

2. Year wise Total Annual Rainfall Trend of 20th Century in India (with 6 years of Forecasting)

3. Year wise Average Annual Rainfall and Average Annual Temperature Trend in India

4. Top 5 Subdivisions where India sees most Rainfall in Monsoon

5. Percentage of Total Rainfall in Monsoon over Total Annual Rainfall from 2000 to 2017

6. Annual Rainfall Trend in Gangetic West Bengal (Southern Half of West Bengal) from 1901 to 2017

7. Annual Rainfall and Temperature Trend in Gangetic West Bengal (Southern Half of West Bengal) from 1901 to 2017

8. Trend of Average Temperature and Total Rainfall in SUMMER (March to May) in Gangetic West Bengal from 2000 to 2017

9. Seasonal Rainfall Comparison in India between 1917 and 2017

10. Month wise Rainfall Comparison between Uttarakhand and Kerala

11. State wise Average Annual Rainfall distribution in India

Finding 1(A). Subdivisions wise Five Regions with Highest Average Annual Rainfall from 1901 to 2017

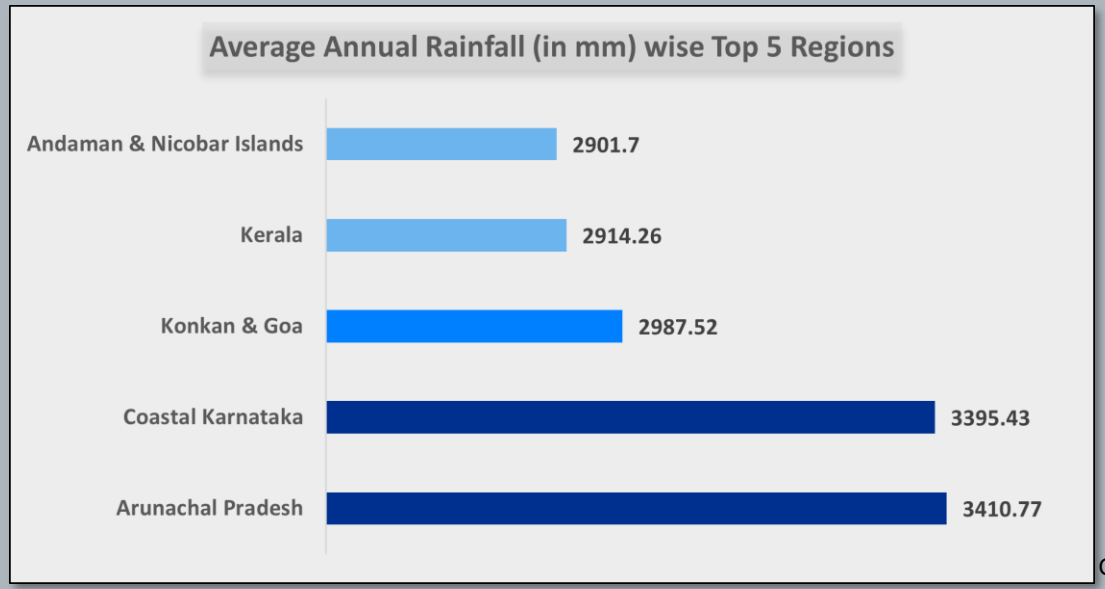


Chart 1A

Here are the leading five regions in India with the highest levels of rainfall, measured in millimeters. As shown in the chart, Arunachal Pradesh and Coastal Kerala received the most rainfall in India, followed by the Konkan & Goa region, Kerala, and the Andaman & Nicobar Islands.

Finding 1(B). Subdivisions wise Five Regions with Least Average Annual Rainfall from 1901 to 2017

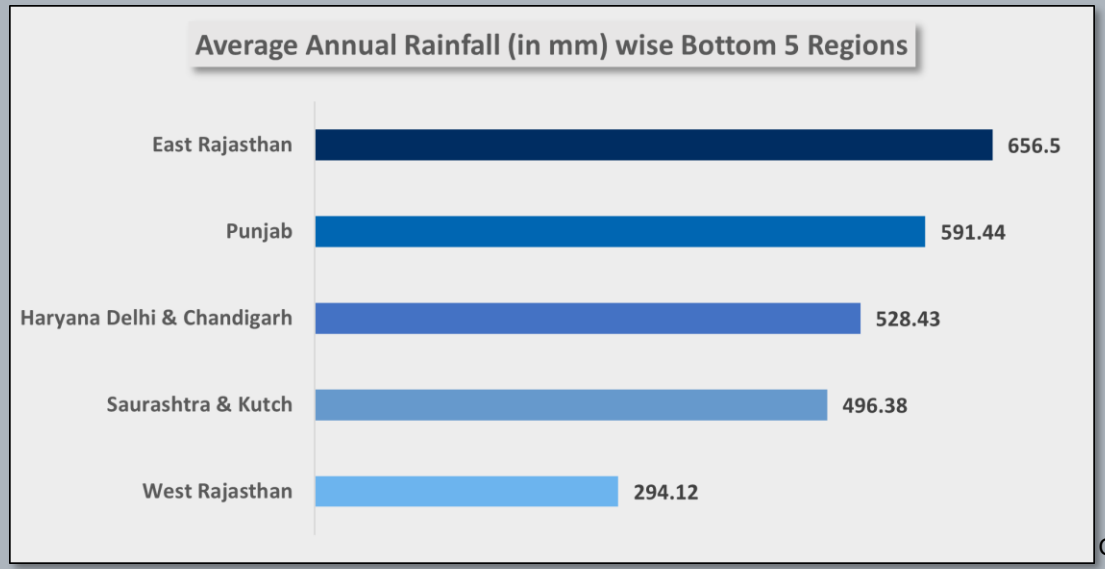


Chart 1B

Here, we have the five regions in India with the lowest levels of rainfall, measured in millimeters. As depicted in the chart, West Rajasthan stands out as the driest region in the entire country. Additionally, when comparing East and West Rajasthan, East Rajasthan receives more rainfall. Furthermore, the analysis reveals that Saurashtra and Kutch (a part of Gujarat), as well as Delhi, Chandigarh, and Punjab, receive lower rainfall compared to other regions in India.

Finding 2. Year wise Total Annual Rainfall Trend of 20th Century in India (with 6 years of Forecasting)

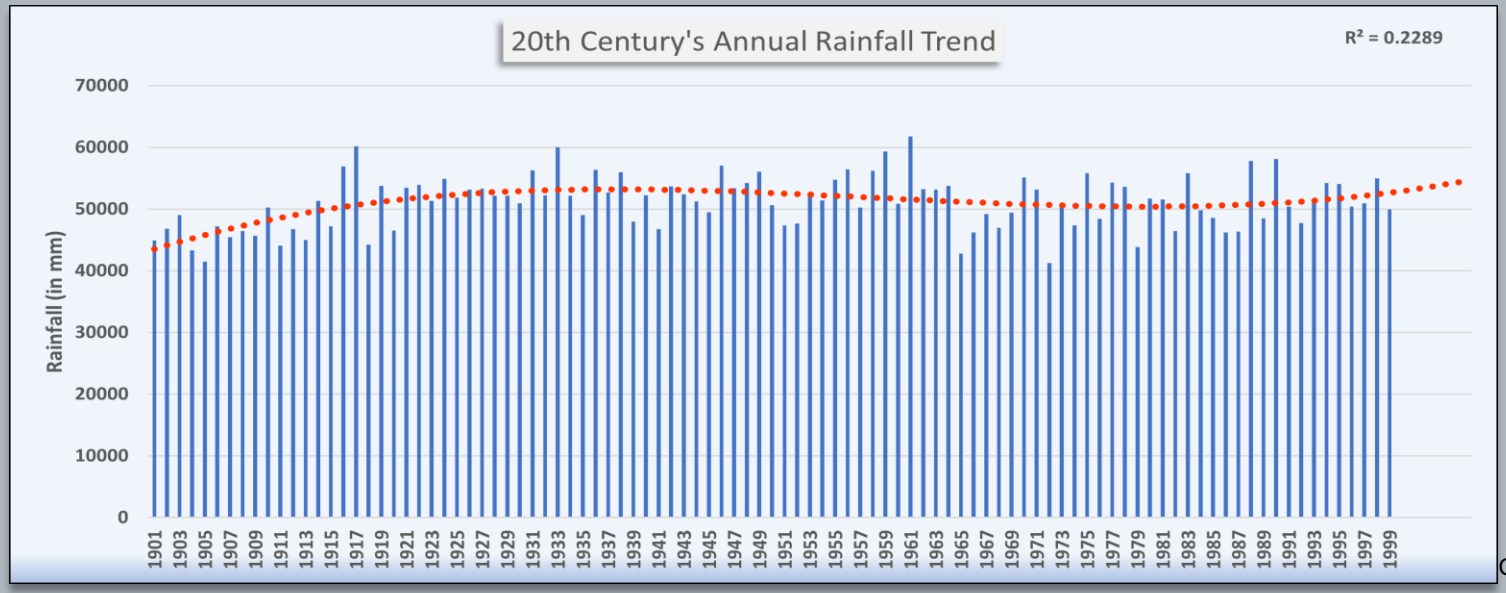
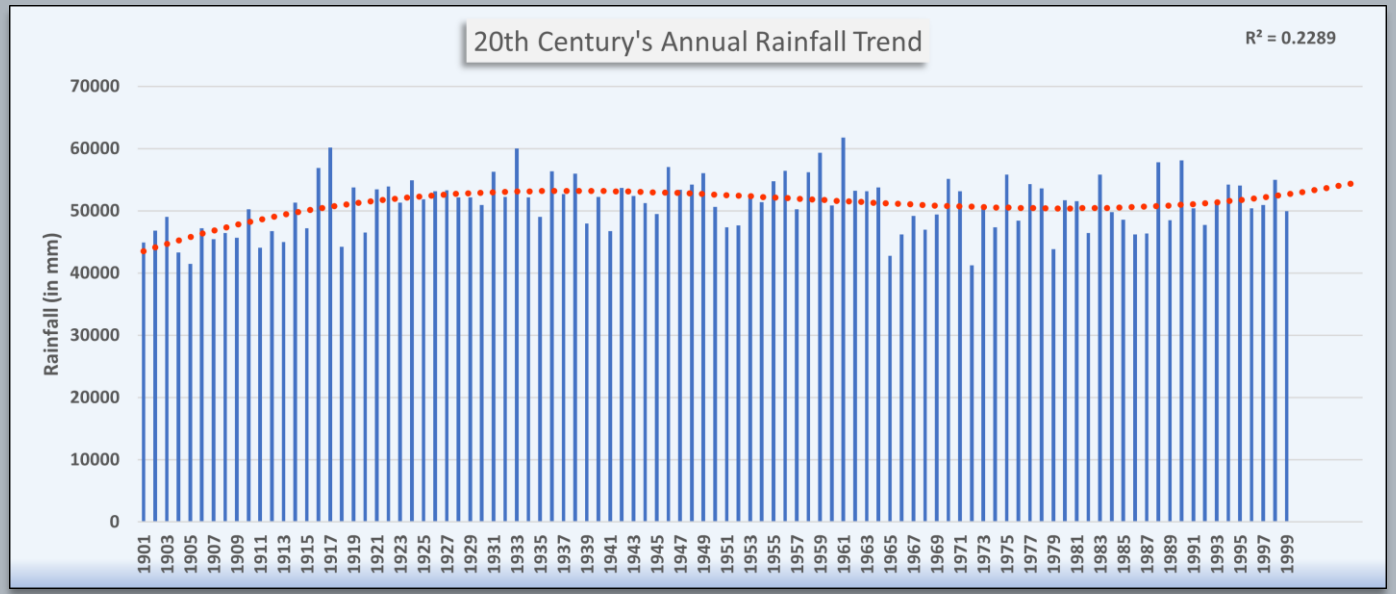


Chart 2

This chart illustrates the Rainfall trend in India throughout the 20th Century, spanning from 1901 to 1999. From this chart, we can discern that at the outset of the century, India experienced annual rainfall of less than 50000mm. However, as time progressed, precipitation levels gradually increased. Notably, between 1916 and 1964, India witnessed its highest annual rainfall. Subsequently, there was a gradual decline in precipitation, but from 1988 onward, annual rainfall began to rise again. In the year 1961, India recorded its highest annual rainfall within the provided range, exceeding 60000mm.

Finding 2. Year wise Total Annual Rainfall Trend of 20th Century in India (with 6 years of Forecasting)



In the chart, you'll notice a red dotted trendline that predicts rainfall trends from 2000 to 2005, suggesting an expected 55000mm of rainfall in 2005. Interestingly, the actual data for that year closely matches the forecast, with the total annual rainfall measuring around 52000mm.

Here 3rd order Polynomial function is used to show the trendline as it's fits best to the datapoints.

Actual Query driven Result

	YEAR	Total_Rainfall_in_India
▶	2000	46981.6
	2001	46897.9
	2002	41358.5
	2003	48759.1
	2004	46753.5
	2005	52430.8

Finding 3. Year wise Average Annual Rainfall and Average Annual Temperature Trend in India

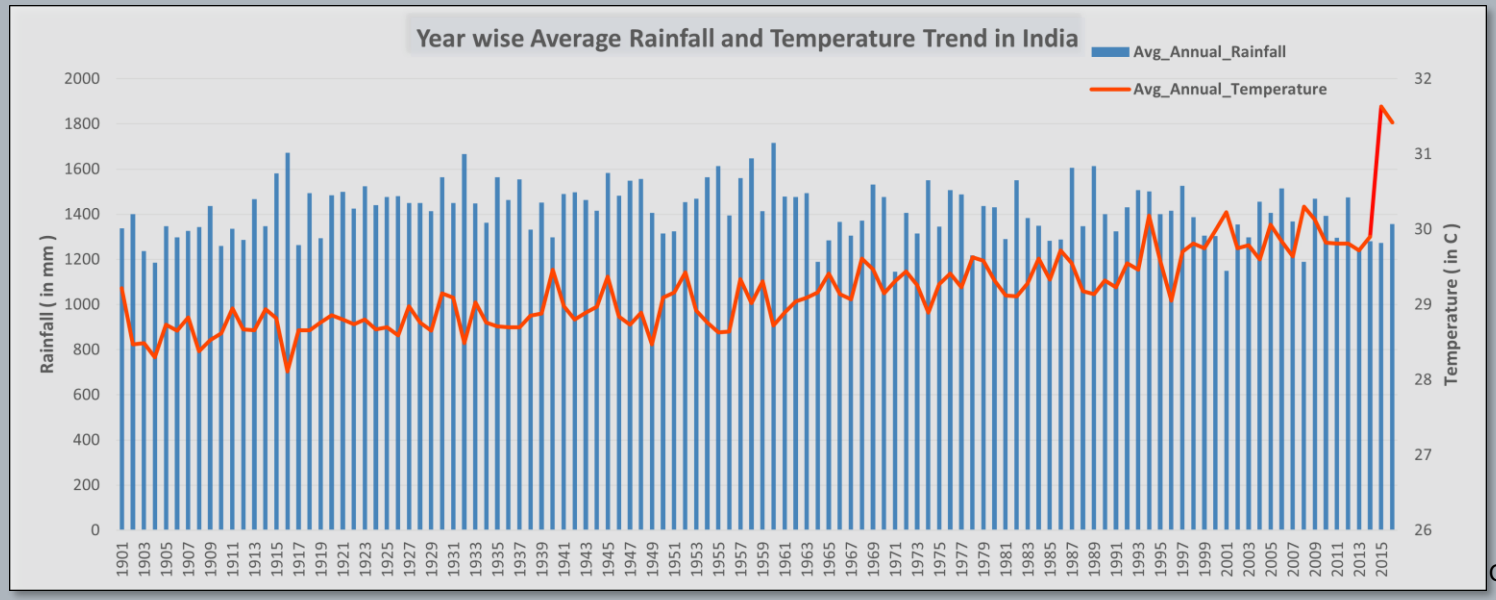


Chart 3

In this chart, the main vertical axis showcases Average Annual Rainfall (in mm), while the secondary vertical axis represents Average Annual Temperature (in °C) trends in India from 1901 to 2017. For instance, in 1917, we observed an average annual rainfall exceeding 1600mm, accompanied by an average annual temperature of approximately 28°C. Similarly, in 1995, the average annual rainfall measured around 1400mm, with the average annual temperature exceeding 30°C.

From this chart, a noticeable trend emerges: Average Annual Temperature in India exhibits a gradual year-by-year increase, culminating in a significant 2°C jump starting in 2015. Intriguingly, in contrast, Average Annual Rainfall does not display substantial changes; instead, it shows a gradual decrease. This pattern strongly suggests a clear indication of climate change.

Finding 4. Top 5 Subdivisions where India sees most Rainfall in Monsoon

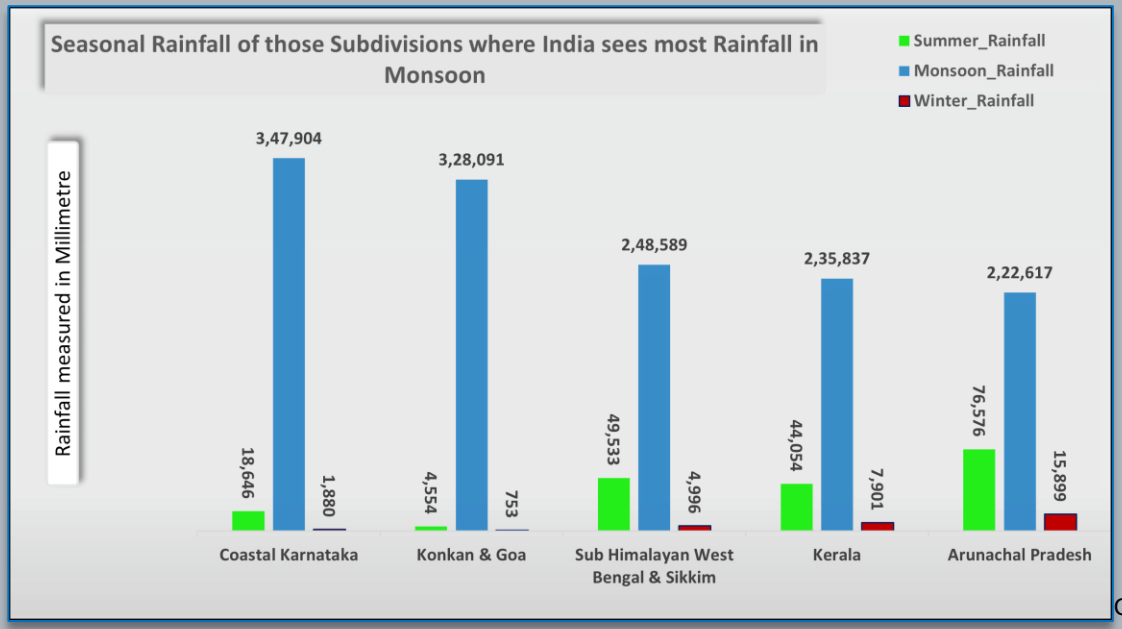


Chart 4

As this chart depicts Coastal Karnata, Konkan & Goa, Sub Himalayan WB & Sikkim, Kerala, Arunachal Pradesh these are the Five region in India where India sees most Rainfall in Monsoon (June to September). We can clearly interpret that Southern part of India receives most rainfall in Monsoon. Although compared to southern part , Sub Himalayan WB & Sikkim and Arunachal Pradesh receive more Rainfall in Summer (March to May).

Finding 5. Percentage of Total Rainfall in Monsoon over Total Annual Rainfall from 2000 to 2017

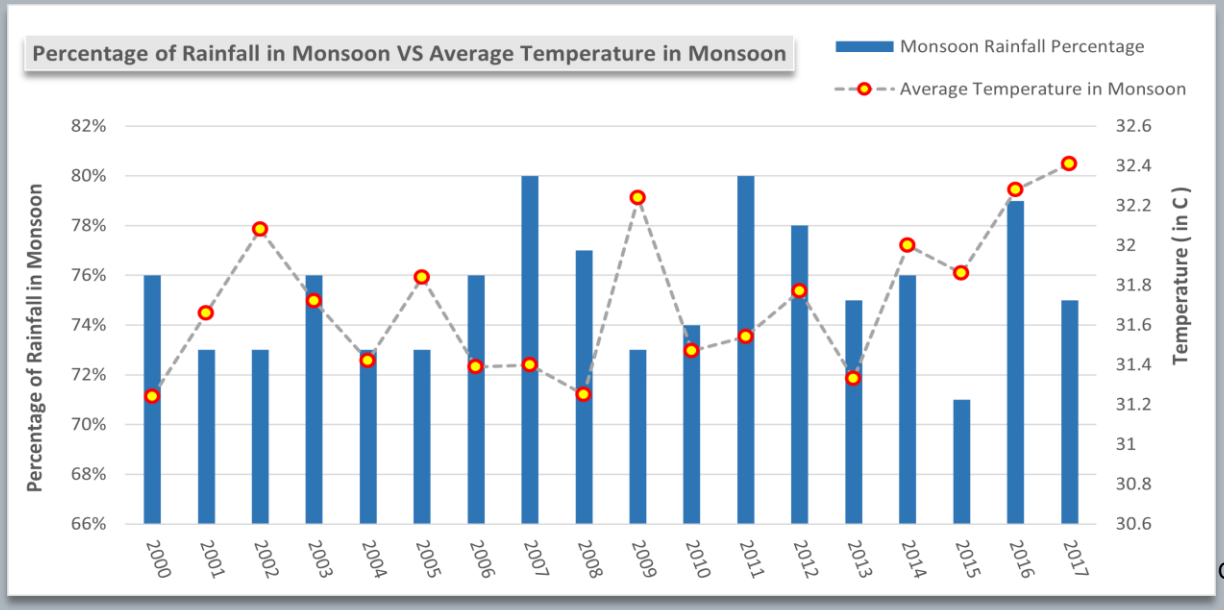


Chart 5

In this Chart the Primary Vertical Axis represents the Percentage of Rainfall in Monsoon over Total Annual Rainfall and Secondary Vertical Axis represents the Average Temperature (°C) in Monsoon from 2000 to 2017 in India.

From this chart we can interpret that in 2015, the Monsoon season had the lowest Rainfall Percentage, accompanied by an Average Temperature exceeding 31°C. This suggests that the Monsoon weather in 2015 was notably hot. Conversely, in both 2007 and 2011, the Rainfall Percentage during the Monsoon hovered around 80%. Additionally, in 2017, the Monsoon season recorded an Average Temperature exceeding 32°C.

Finding 6. Annual Rainfall Trend in Gangetic West Bengal from 1901 to 2017

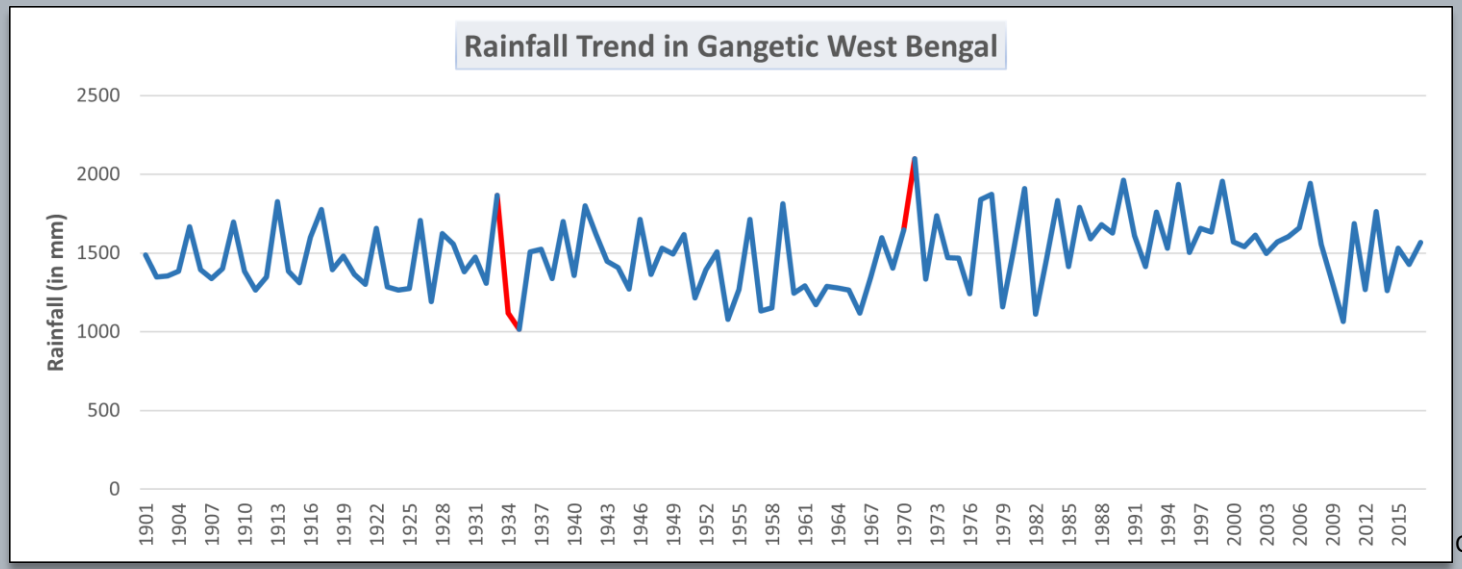


Chart 6

This chart illustrates the Annual Rainfall Trend in the southern part of Gangetic West Bengal from 1901 to 2017, with rainfall data measured in millimeters.

From this graph, it's evident that rainfall in the Gangetic West Bengal region has shown considerable year-to-year variability. Notably, in 1935, the region experienced its lowest recorded rainfall within this range, approximately 1000mm. Conversely, in 1971, the region saw its highest rainfall, exceeding 2000mm. Typically, annual rainfall in this area fluctuates between 1000mm and 2000mm.

Finding 7. Annual Rainfall and Temperature Trend in Gangetic West Bengal from 1901 to 2017

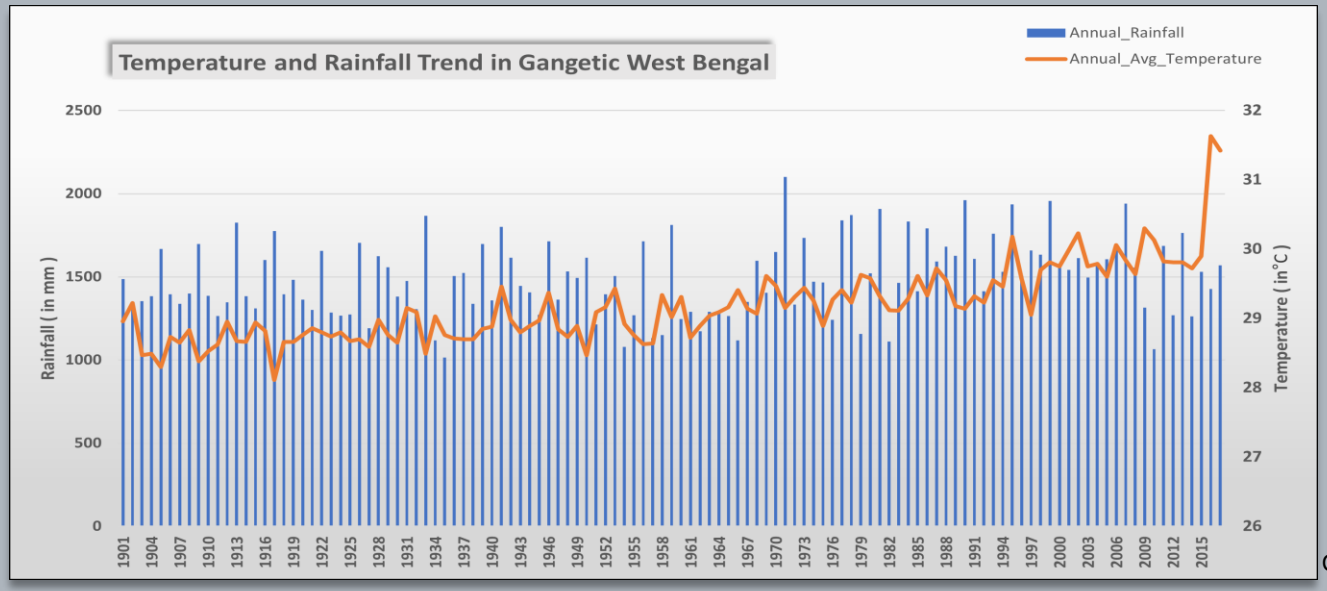


Chart 7

In this chart, the primary vertical axis portrays Total Annual Rainfall (in mm), while the secondary vertical axis represents the Average Annual Temperature (in °C) trend in the Gangetic West Bengal (Southern part of West Bengal), spanning from 1901 to 2017.

The chart illustrates a consistent upward trend in Average Annual Temperature over the years. Interestingly, when we compare this with Annual Rainfall, we notice that the rainfall doesn't exhibit significant variations. This observation strongly suggests a clear indication of climate change in the region.

Finding 8. Trend of Average Temperature and Total Rainfall in SUMMER in Gangetic West Bengal from 2000 to 2017

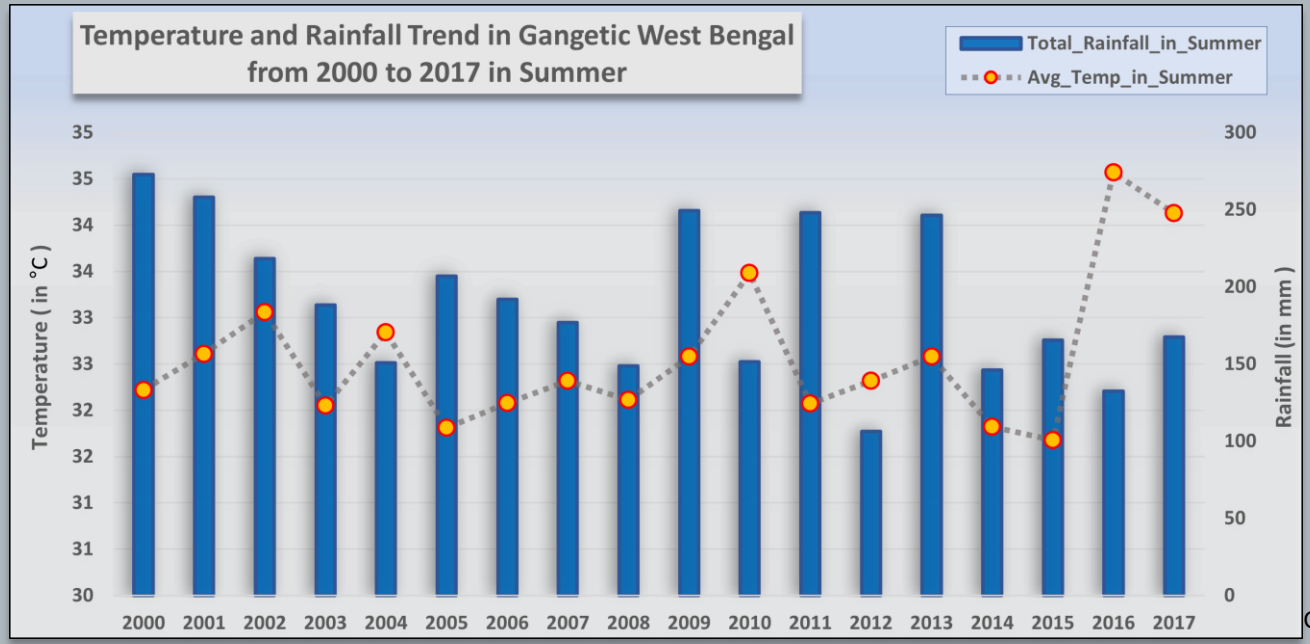


Chart 8

In this chart, the primary vertical axis displays Average Summer Temperature (March to May) in °C, while the secondary vertical axis shows Total Summer Rainfall (in mm) for the Gangetic West Bengal (Southern part of West Bengal) from 2000 to 2017.

The chart reveals that Average Summer Temperatures typically range between 32°C and 33°C. However, after 2015, there's a notable and significant increase in Summer Temperatures. Interestingly, despite this temperature change, Total Summer Precipitation remained relatively stable with minimal variation.

Finding 9. Seasonal Rainfall Comparison in India between 1917 and 2017

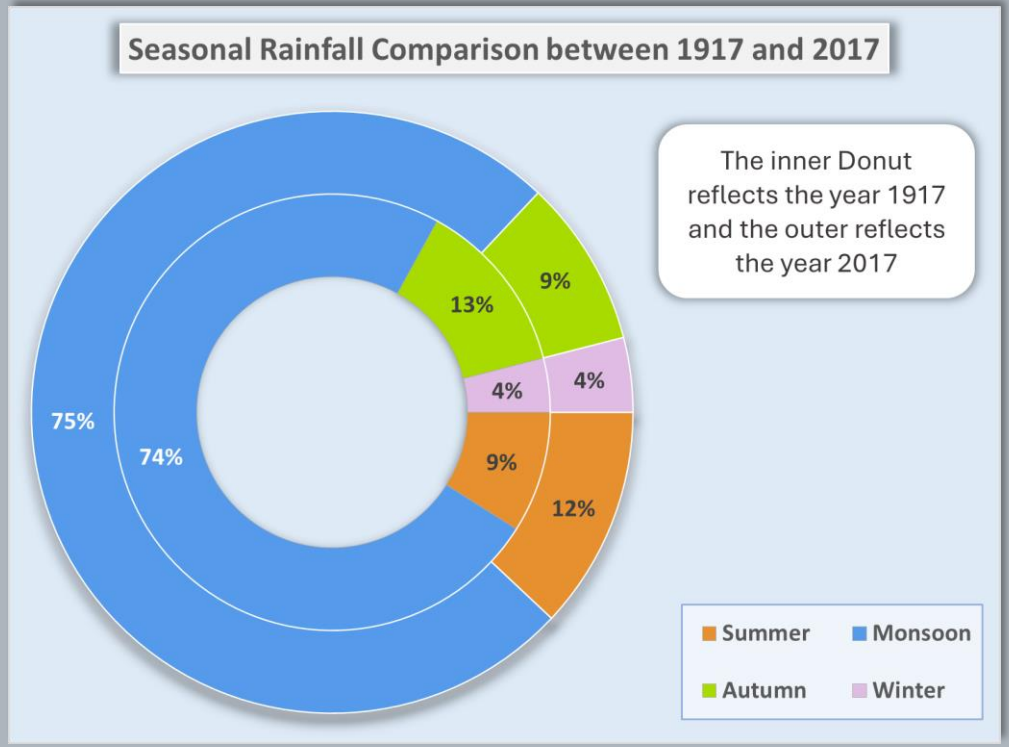


Chart 9

This chart portrays the Seasonal Rainfall Percentage compared between the years 1917 and 2017.

From this chart, we can observe that despite a Century-long gap, Monsoon Rainfall remained relatively consistent. Notably, Winter Rainfall exhibited virtually no change. However, the most noticeable differences in Rainfall occurred during Summer and Autumn.

Finding 10. Month wise Rainfall Comparison between Uttarakhand and Kerala

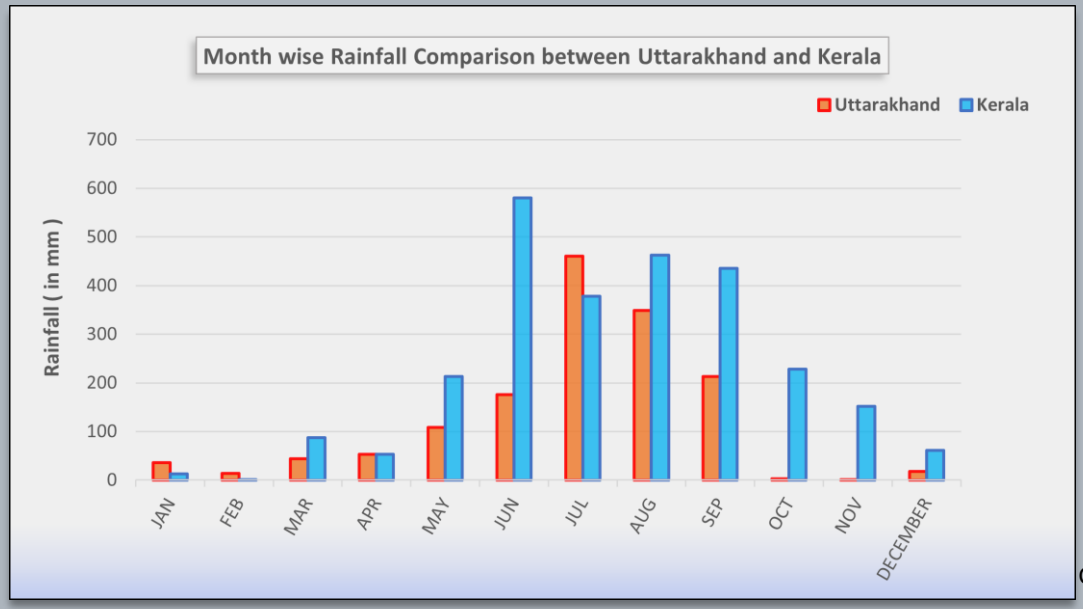


Chart 10

This chart presents a month-by-month Rainfall comparison between Uttarakhand (a northern state of India) and Kerala (a southern coastal state of India) for the year 2017.

As indicated by the chart, the majority of Rainfall occurred in both states from June to September. However, it's noteworthy that Kerala received a higher total Rainfall than Uttarakhand throughout the entirety of 2017.

Finding 11. State wise Average Annual Rainfall distribution in India

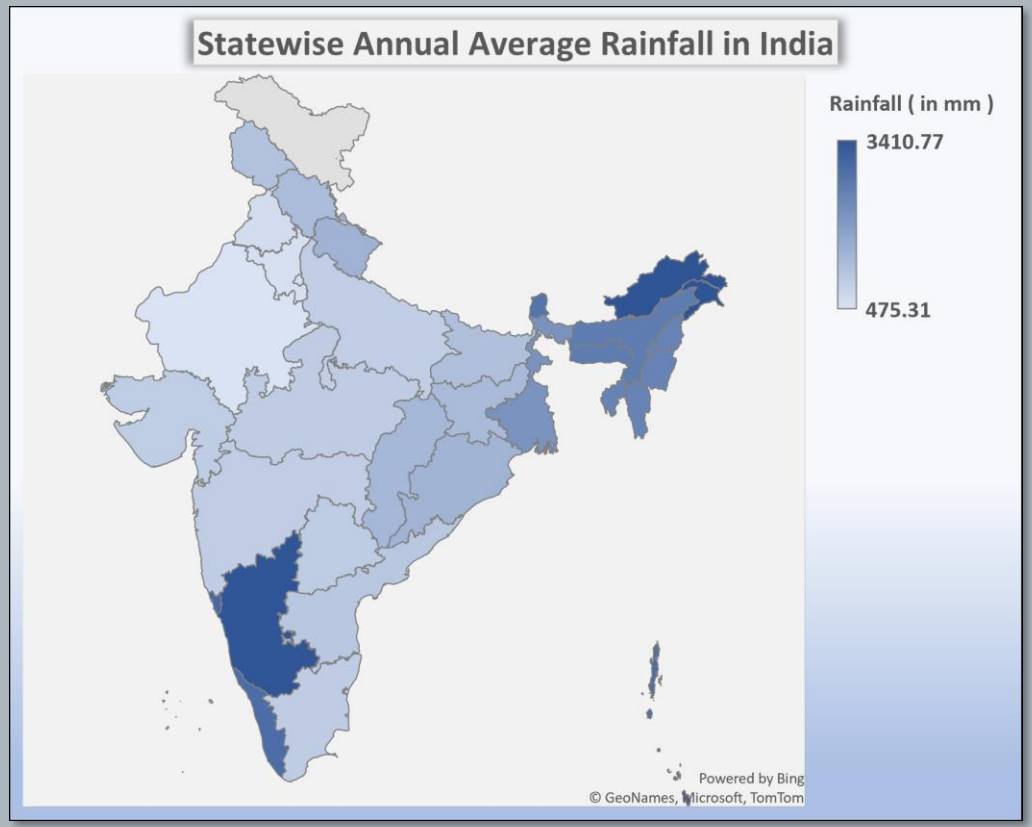


Chart 11

In this map, the areas with darker shading indicate higher levels of Rainfall measured in millimeters.

By examining this Rainfall distribution map of India, it becomes apparent that the regions along the Southern Coast and in the Northeastern part of the country receive the highest levels of Rainfall. In contrast, the Northwestern region, specifically Rajasthan, experiences the lowest Rainfall levels.

THANK YOU