PowerBI Project

Telangana State Weather Data Analysis

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A. Data Source

Dataset file link
https://drive.google.com/file/d/1VlNLN_ub9x9ZwIfSNXtJ4ruK_efQPOfc/view?usp=sharing

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B. Problem Statement

The objective of this project is to conduct an in-depth exploratory and analytical study of weather patterns across districts and mandals in Telangana, utilizing historical data on rainfall, temperature, humidity, and wind speed. The study aims to uncover temporal trends, spatial differences, seasonal behaviors, and extreme weather events, ultimately generating actionable insights for improved climate understanding and planning.

The dataset includes weather data recorded across various districts and mandals over a multi-year period, capturing the following variables:

- Rainfall (mm)
- Temperature (Min/Max in °C)
- Humidity (Min/Max in %)
- Wind Speed (Min/Max in km/h or m/s)

C. Data Description

- **District**: This column identifies the district in which the weather data was recorded, providing geographical context.
- **Mandal**: A more localized identifier within the district, the Mandal column gives detailed information about the specific area of data collection.
- **Date**: This column records the date of the weather observation, allowing for time-series analysis.
- **Rain (mm)**: This column indicates the amount of rainfall measured in millimeters. It helps in understanding precipitation patterns and trends.
- **Min Temp (°C)**: The minimum temperature recorded in degrees Celsius. This helps in analyzing the lowest temperature trends.
- **Max Temp (°C)**: The maximum temperature recorded in degrees Celsius. This provides insights into the highest temperature trends.
- **Min Humidity (%)**: This column records the minimum humidity percentage, giving insights into the driest conditions**.**
- **Max Humidity (%)**: The maximum humidity percentage, providing information about the most humid conditions.
- **Min Wind Speed (Kmph)**: The minimum wind speed recorded in kilometers per hour, highlighting the calmest wind conditions.
- **Max Wind Speed (Kmph)**: The maximum wind speed recorded in kilometers per hour, showing the windiest conditions.

D. Key Goals

1. Rainfall Analysis

- Which district received the highest average rainfall over the given period?
- How does the monthly rainfall distribution vary across different mandals?
- What is the trend in rainfall over the years for each district?
- How does rainfall vary seasonally in different districts?
- What are the rainfall patterns on specific important dates across districts?
- Compare the annual rainfall between two selected districts.
- Identify periods of high rainfall intensity in each district.
- Detect any anomalies in the rainfall data over the years.
- What percentage of annual rainfall occurs each month in different districts.

2. Temperature Insights

- What are the average minimum and maximum temperatures for each district?
- How does the temperature vary seasonally in different mandals?
- Identify any significant temperature anomalies or patterns over the years.
- What is the daily temperature range (difference of min and max temperature) in each district?
- Analyze the trend in minimum and maximum temperatures over the years.
- Identify periods of extreme temperatures in each district.
- What is the distribution of temperatures in different districts throughout the year?
- Compare the temperature patterns between two selected districts.
- Analyze the correlation between minimum and maximum temperatures.

3. Humidity Patterns

- Compare the average minimum and maximum humidity levels across districts.
- How do humidity levels change with seasons in different mandals?
- Detect any anomalies in humidity levels over the years.
- What is the daily humidity range (difference between min and max humidity) in each district?
- Analyze the trend in minimum and maximum humidity levels over the years.
- Identify periods of extreme humidity in each district.
- What is the distribution of humidity levels in different districts throughout the year?
- Compare the humidity patterns between two selected districts.
- Examine how humidity variations affect health outcomes in different districts (if relevant data is available).

4. Wind Speed Analysis

- What are the average minimum and maximum wind speeds for each district?
- How does wind speed vary throughout the year in different mandals?
- Identify any significant wind speed patterns or outliers in the dataset.

- What is the daily wind speed range (difference between min and max wind speed) in each district?
- Analyze the trend in minimum and maximum wind speeds over the years.
- Identify periods of extreme wind speeds in each district.
- What is the distribution of wind speeds in different districts throughout the year?
- Compare the wind speed patterns between two selected districts.
- Examine how variations in wind speed affect daily activities in different districts (if relevant data is available).

5. Comprehensive Weather Insights

- Create a dashboard that shows key weather metrics (rainfall, temperature, humidity, wind speed) for each district.
- Analyze the relationship between rainfall and other weather parameters (temperature, humidity, wind speed).
- Identify any extreme weather events (e.g., very high rainfall, temperatures) and their impact on different districts.
- Analyze the overall trends in key weather metrics over the years.
- Identify seasonal patterns in weather metrics across different districts.
- Compare comprehensive weather patterns between two selected districts.
- Detect any anomalies in the comprehensive weather dataset.
- What is the distribution of key weather metrics (rainfall, temperature, humidity, wind speed) throughout the year?

E. Insights

1. Rainfall Analysis

- Highest average rainfall district: Warangal Rural with 6.74mm average rainfall.
- Monthly distribution: Most rainfall occurs from June to October, peaking in July.
- Trend over years: Varies by district, generally stable with slight fluctuations.
- Seasonal variation: Highest in monsoon (Jun–Sep), lowest in winter.

- Important dates: Key dates like 15 Aug and 26 Jan show low rainfall.
- Annual comparison: Warangal Rural gets more rainfall than districts like Mahbubnagar.
- High intensity periods: Detected during July–September in multiple districts.
- Monthly % share: July contributes 20–30% of annual rainfall in most districts.

2. Temperature Insights

- Avg min/max temp: Varies from 18°C to 40°C; Nizamabad records higher max temps.
- Seasonal variation: Summer (Apr–Jun) is hottest, winter (Dec–Jan) is coolest.
- Anomalies: Sudden spikes in March–May indicate heatwaves.
- Daily range: Typically 10–15°C; higher in drier districts.
- Trend over years: Slight increase in max temperatures over time.
- Extreme periods: Heat extremes in May, cold extremes in December.
- Distribution: Most districts fall between 25–35°C throughout the year.
- District comparison: Nizamabad is hotter, Khammam slightly cooler.
- Correlation: Strong positive correlation between min and max temps.

3. Humidity Patterns

- Avg humidity: Coastal districts have higher humidity; inland areas lower.
- Seasonal change: Peaks during monsoon, drops during summer.
- Anomalies: Extremely low humidity in May and high spikes in August.
- Daily range: Around 30–50% variation within a day.
- Trend over years: Slight increase in monsoon humidity levels.
- Extreme periods: High in August; low in March–May.
- Distribution: Varies 30–90%, depending on district and month.
- District comparison: Warangal Urban has higher average humidity than Adilabad.

4. Wind Speed Analysis

- Avg wind speeds: Generally 6–12 kmph; max reaches 25–30 kmph during storms.

- Year-round variation: Higher in summer (May–June); calmest in winter.
- Patterns/outliers: Outliers appear during cyclonic or stormy months.
- Daily range: Commonly 5–10 kmph difference within a day.
- Yearly trend: Fairly consistent with occasional peak years.
- Extreme periods: High wind speeds in June due to monsoon onset.
- Distribution: Most districts have moderate wind throughout the year.
- District comparison: Coastal districts experience higher wind speeds.
- Impact on activities: Not assessed—requires external data (agriculture, aviation).

5. Comprehensive Weather Insights

- Rainfall vs others: Negative correlation with temp, positive with humidity.
- Extreme events: Detected during monsoon storms and summer heatwaves.
- Overall trends: Slight rise in temp, stable rain, variable humidity.
- Seasonal patterns: Clear monsoon peak, dry summers, cool winters.
- District comparison: Heat and dryness in Nalgonda; wet and humid in Warangal.
- Metric distribution: Rainfall and humidity are skewed; temp is bell-shaped.

F. Conclusion

Telangana’s weather data reveals clear seasonal patterns with peak rainfall during the monsoon (June–September), especially in Warangal Rural, which records the highest average rainfall. Temperatures range from 18°C to 40°C, with heatwaves in summer and cold spells in winter, particularly in Nizamabad and Khammam. Humidity peaks in August and is lowest in summer, with coastal districts being more humid. Wind speeds are moderate year-round, rising during the monsoon onset. Overall, rainfall remains stable, temperatures show a slight upward trend, and humidity varies seasonally. Key weather extremes and anomalies align with storm and heatwave periods, with notable district-wise differences across all metrics.