Seasonal Rainfall Pattern Analysis for 2010: A Data-Driven Approach

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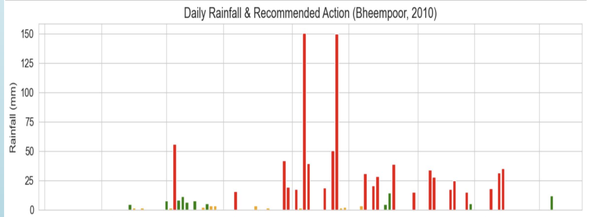
Abstract

This study analyzes rainfall data across Telangana to understand temporal, spatial, and seasonal variations. Using district and mandal level data from 2010, the analysis explores rainfall trends, intensity, and distribution patterns. Tools like Power BI and Python were used for visualization and data processing. The findings highlight monsoon dominance, regional disparities, and actionable insights for crop and water management.

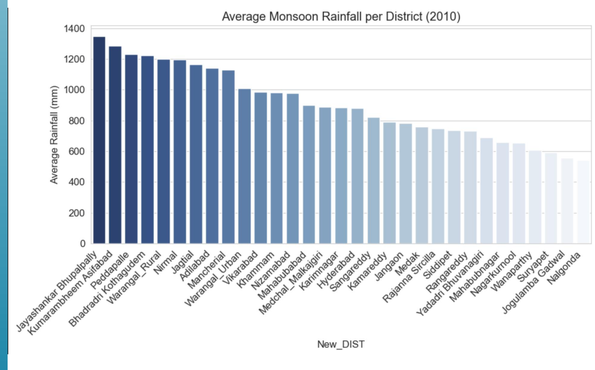
Figure 1: Month-wise Monsoon Intensity (Alternative Seasonal View)



Introduction

Rainfall plays a crucial role in agriculture, water resources, and planning. Understanding rainfall distribution helps in predicting droughts and floods and making data-driven decisions. This project aims to visualize and interpret rainfall data at multiple levels district, mandal, monthly, and seasonal to derive meaningful insights.
The analysis also demonstrates how tools like Power BI and Python can simplify complex datasets into understandable visuals useful for planning and decision-making.

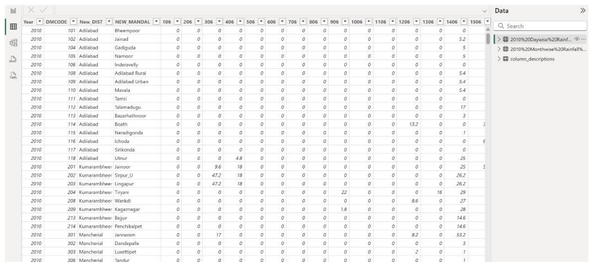
Figure 2: District-Level Monsoon Rainfall (2010)



Materials

The dataset used includes 2010 Daywise and Monthwise Rainfall Data of Telangana, containing fields like District Name, Mandal Name, Day/Month, and Rainfall (mm). Power BI was used for interactive visualization, mapping, and seasonal analysis, while Python (pandas, matplotlib) handled rolling averages and anomaly detection. Microsoft Excel was used for basic data cleaning and formatting.

Figure 3:Screenshot of dataset in Power BI data view

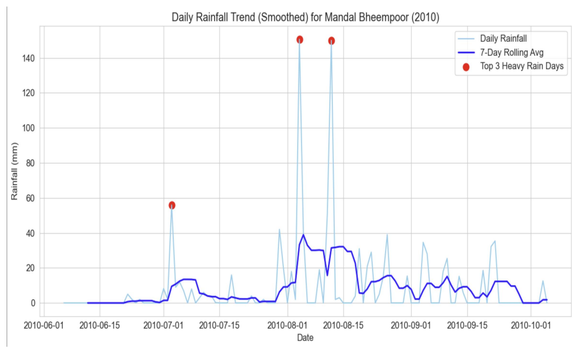


Methodology

The analysis was divided into six topics for clarity and focus:

1. Overview: State-level rainfall distribution and summary charts.
2. Granular Data: Mandal-level comparison and drill-down analysis.
3. Temporal Precision: Daily and monthly rainfall trends with moving averages and anomaly highlights.
4. Seasonal Analysis: Comparison of monsoon vs non-monsoon rainfall and contribution of each monsoon month.
5. Rainfall Classification: Categorization into Low, Medium, and High rainfall zones using total monsoon rainfall.
6. Utility: Linking rainfall categories to actionable insights such as crop choice and irrigation priorities.

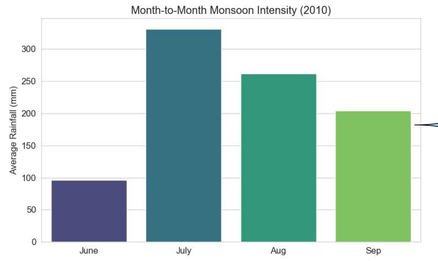
Each topic used appropriate datasets (daywise or monthwise) and tools (Power BI for dashboards, Python for line and box plots).



Results

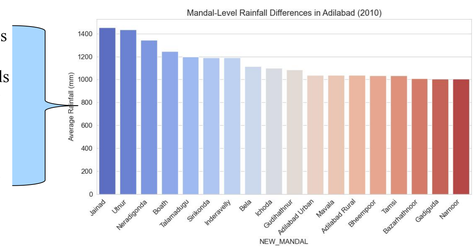
The Power BI visuals show clear spatial and temporal variations in rainfall across Telangana:

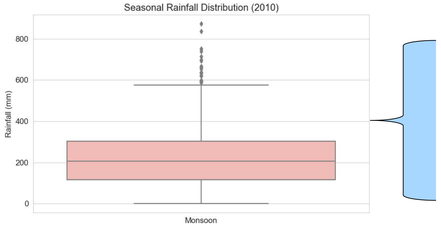
- District-level analysis revealed Jayashankar Bhupalpally and Kumaram Bheem Asifabad as the regions with the highest average monsoon rainfall, exceeding 1000 mm annually.
- Peddapalle, Bhadradri Kothagudem, and Warangal Rural also showed consistently high rainfall, supporting robust water resource planning.
- Seasonal analysis demonstrated that July consistently contributed the largest proportion to overall monsoon totals, showing pronounced intra-seasonal peaks.
- Box and violin plots of seasonal rainfall distribution confirmed the presence of both high outliers and broad spread, underlining risk of floods and droughts within the same period.
- Pie and bar charts indicated that approximately 54% of mandals experienced low rainfall, while only 22% were in the high rainfall risk group.



This bar chart illustrates the average monsoon rainfall intensity for each month in 2010, revealing that July has the highest rainfall, followed closely by August and September, while June records the lowest.

This bar chart compares average annual rainfall across different mandals in Adilabad district for 2010, revealing that Jainad and Utnoor recorded the highest rainfall, while Namoor observed the lowest.

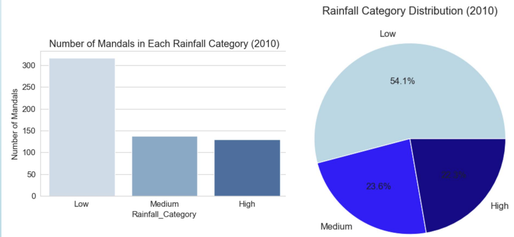




This box plot displays the monsoon rainfall distribution for 2010, showing that most areas received between 150–300 mm, while several districts experienced extreme outlier rainfall events above 600 mm.

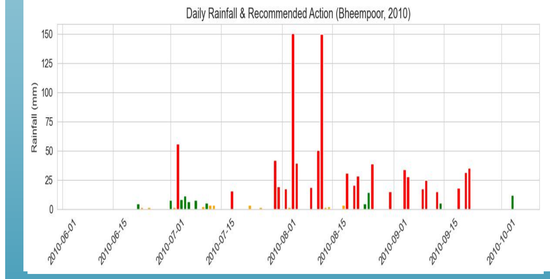
Conclusion

The project successfully visualized rainfall data to uncover spatial and temporal rainfall patterns. It demonstrated how Power BI and Python can convert raw rainfall data into meaningful insights. Seasonal and classification analyses highlighted the diversity of rainfall behavior across regions, emphasizing the need for localized strategies in agriculture and water management.



Recommendations

•Prioritize water resource planning for districts and mandals consistently recording high annual rainfall to prevent flooding and optimize reservoir levels.
•Implement targeted drought mitigation strategies for low-rainfall mandals, including rainwater harvesting and micro-irrigation support.
•Schedule pre-monsoon agricultural activities in July and August, the months with the highest rainfall contribution, to maximize crop yield.



Acknowledgements

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