🌧️ Tamil Nadu Rainfall Metrics Dashboard – Data Analysis & Insights

📌 1. Project Overview and Objective

This project presents an analytical study of rainfall trends across districts and seasons in Tamil Nadu, using data transformation and interactive visualization techniques.
The aim of this dashboard is to identify rainfall distribution patterns, monitor seasonal variations, assess district-wise flood risk indicators, and derive actionable insights for better weather monitoring and planning.

🎯 Objective

- To clean, prepare, and analyze rainfall data using Excel & Power BI.
- To visualize seasonal, monthly, and district rainfall variations interactively.
- To support decision-making related to flood risk, travel safety, and agricultural planning.

📂 2. Data Source

Feature	Description
Source	https://ndap.niti.gov.in/dataset/7319?tab=data
Duration	2024–2025
Domain	Weather Analytics / Climate Monitoring / Disaster Management

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❓ 3. Problem Statement

This dashboard solves the following analytical needs:

- To examine district-wise rainfall concentration and detect flood-prone zones.
- To analyze seasonal and monthly rainfall trends (Actual vs Normal).
- To study variation in rainfall intensity categories (Normal, Excess, and Deficit).
- To derive actionable insights for travel safety and emergency planning based on rainfall deviation.

📌 4. Attribute (Column / Feature) Details

Attribute Name	Data Type	Description
Date	Date	Daily rainfall data
Month	Text	Month of rainfall measurement
Year	Integer	Reporting year
District	Text	District location
Actual Rainfall	Numeric	Recorded rainfall value (mm)
Normal Rainfall	Numeric	Expected climatological rainfall (mm)
% Departure	Numeric	Percentage difference from normal rainfall
Severity	Text	Rain intensity category (Excess/Normal/Deficit)
Season	Text	Seasonal rainfall classification

🛠️ 5. Tools & Technologies Used

Tool	Purpose
Excel	Data Cleaning, Formatting, Date Conversion
Power BI	Data Modelling, DAX Measures, Visualizations, Analytics
Power Query	Data Transformation & Pre-processing

🧹 6. Data Pre-Processing (Excel / Power Query)

🔧 Tasks Performed:

- Removed duplicates & handled missing rainfall values.
- Standardized date formats and column naming.
- Filtering & Sorting: Organized data to focus on relevant records.
- Converted data into fact and dimensional table for seamless reporting.

💡 7. Data Modelling and DAX (Power BI)

🔷 Data Model Overview

The dataset was organized using a ***star schema***, separating lookup tables and fact tables for efficient analysis and optimal performance.

Key relationships were established to ensure accurate filtering and aggregation across visuals.

🔷 Dimension & Fact Tables

- District (Dimension Table) – Contains unique district names and metadata.
- Calendar (Dimensional Table) – Includes Year, Month, Month Name, and Season fields.
- Rainfall Metrics (Fact Table) – Stores daily, monthly, and seasonal rainfall values along with calculated variance fields.

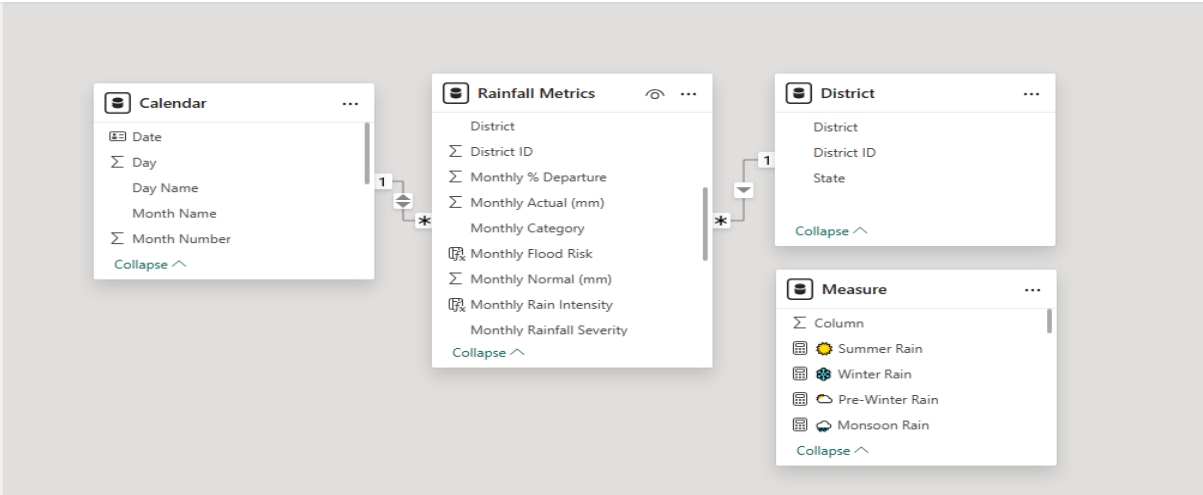
🔷 Primary Key Creation

A unique District ID (primary key) was generated to link the district dimension with the Rainfall Metrics fact table.
This ensures:

- Referential integrity
- Clean relationships
- Improved filtering using the district slicer

🔷 Relationships

- District Table *(District ID)* → Rainfall Metrics *(District ID)*
- Date Table *(Date / Month / Year)* → Rainfall Metrics *(Date)*
- One-to-many cardinality used between dimension and fact tables**.**



📊 Key DAX Measures Created

- Monthly Actual Total
- Monthly Normal Total
- Monthly % Departure
- Monthly Difference
- Monthly Flood Risk Measure
- Monthly Rain Suggestion
- Trend Classifications (Increase/Decrease)
- Total Rainfall YoY Change
- Seasonal Rain Classification

🧮 Key Calculated Columns

To enhance analytical accuracy, several **calculated columns** were created in Power BI for deriving rainfall metrics such as variance percentages, severity classification, trend indicators, temporal grouping (month/season), and district-level comparisons.

- Monthly Rain Intensity
- Monthly Travel Advice
- Season Trend
- Monthly Weather Mood
- Monthly Flood Risk

📅 Calculated Table

Calendar Table (Date Dimension) was created using DAX to enable accurate time intelligence operations such as monthly trends, season-wise grouping, cumulative calculations, and year-over-year comparisons. This table serves as a key dimension for linking all date-based fields in the rainfall dataset.

Purpose of Calendar Table:

- Standardizes all date-related relationships
- Enables month, quarter, and year-based analysis
- Supports time intelligence (YoY, MoM, cumulative rainfall]

📊 8. Dashboard Overview & Visualizations

Dashboard includes:

Feature	Purpose
Cards (Seasonal Totals)	Shows rainfall by season (Winter, Monsoon, Summer, Post-Monsoon)
Donut Chart (Intensity Breakdown)	Shows % of Normal, Excess & Deficit rainfall
Funnel Chart (Top District)	Displays districts receiving highest rainfall
Monthly Line + Cluster Chart	Compares Actual vs Normal rainfall with % departure
Flood Risk Map	Highlights critical flood-prone districts
Seasonal Waterfall Chart	Shows contribution of each season to yearly rainfall variation
Suggestion Card	Provides rainfall-based travel recommendation
Ribbon Chart (Yearly Seasonal Rainfall Difference)	Shows how each season contributed to yearly rainfall variation for 2024 and 2025.

🔎 9. Insights & Findings

🔷 Key Findings

- Monsoon remains the **strongest contributor** to annual rainfall across both years.
- A significant portion of months show **rainfall deficits**, indicating irregular weather patterns.
- Few districts such as **Nilgiris, Coimbatore, and Mayiladuthurai** consistently receive higher rainfall and are flagged as high flood-risk zones.
- Rainfall distribution across seasons is **uneven**, showing high variation between 2024 and 2025.

🔷 Descriptive Insights (What the data shows)

- The dashboard highlights a **clear dependence on monsoon rainfall**, while Winter shows minimal contribution.
- Many districts experience **deficit or excess rainfall**, reflecting inconsistent climatic behaviour.

🔷 Diagnostic Insights (Why it happened)

- High rainfall in districts like Nilgiris and Coimbatore is due to **geographical and climatic factors**, making them prone to heavy rainfall.
- Deficit months occur due to **weakened monsoon spells**, seasonal transitions, and reduced moisture inflow.
- Seasonal imbalance suggests **variations in monsoon strength** and uneven rainfall spread across the state.

🔷 Predictive Insights (What is likely to happen)

- Districts with repeated excess rainfall may continue to remain **flood-prone zones** in future cycles.

- Monsoon will likely remain the **key determinant** of annual rainfall.
- Increasing rainfall variability could lead to **unpredictable monthly rainfall patterns**.

🔷 **Prescriptive Insights (What should be done)**

- High-rainfall districts should adopt **flood-preparedness measures** such as improved drainage and early warning systems.
- Deficit-prone areas should prioritize **groundwater recharge, rainwater harvesting, and irrigation planning**.
- Seasonal monitoring and rainfall deviation tracking should inform **agriculture planning and water resource allocation**.
- Policy makers should focus on **regional water management** based on district-level rainfall behaviour.

🏳️ **10. Conclusion**

The TN Rainfall Metrics Dashboard demonstrates how rainfall analytics can support **public safety, flood monitoring, climate study, and agricultural decision-making**. By combining data preprocessing with interactive Power BI visualizations, the dashboard ensures informed interpretation of rainfall trends and risk assessment across the region.