Research Directions You Can Take:

(A) Weather Forecasting

Approach:

Frame it as a **time series forecasting** problem.

Models to use:

- Classical: ARIMA, SARIMA
- ML: Random Forest Regressor, XGBoost Regressor
- DL: LSTM, GRU, Transformer-based models

Predict:

- Next day temperature.

(B) Rainfall Prediction

Problem: Predict **Rainfall Occurrence** or **Rainfall Amount**.

Why Important: Agriculture, water management.

Approach:

- **Binary Classification**: Rainy Day (0 or 1) → use Decision Trees, XGBoost, Random Forest.
- **Regression**: Predict Rainfall (mm) → ML Regression models.
- **Features**: Max temp, Min temp, RH morning/evening, PE, WS, BSS.

(C) Drought Detection / Dry Spell Analysis

- **Problem**: Identify **dry spells** based on consecutive no-rainfall days and meteorological indicators.
- **ML**: Cluster periods using unsupervised learning — K-means clustering or DBSCAN.

(D) Extreme Weather Events Detection

- **Problem**: Detect sudden increases in wind speed, high-temperature anomalies.
- **Approach**:
  - Outlier Detection methods:
    - Isolation Forest
    - One-Class SVM

(E) Climate Trend Analysis (No ML, but useful)

- **Trend Detection**:
    - Is temperature rising?
    - Is annual rainfall decreasing?
- Use:
    - Mann-Kendall Trend Test
    - Sen's Slope Estimator

Paper Title Suggestions

- *"Machine Learning-based Weather Forecasting using Multi-year Meteorological Data from Powarkheda Station (2021–2024)"*
- *"Rainfall Prediction using Supervised Learning: A Case Study from Central India"*
- *"Climate Trend Analysis and Predictive Modelling using Machine Learning: Evidence from 4-Year Weather Data"*