Weather Trend Forecasting — Report

PM Accelerator Mission

“Our mission is to empower data-driven decision making by accelerating insights into global weather and climate trends.”

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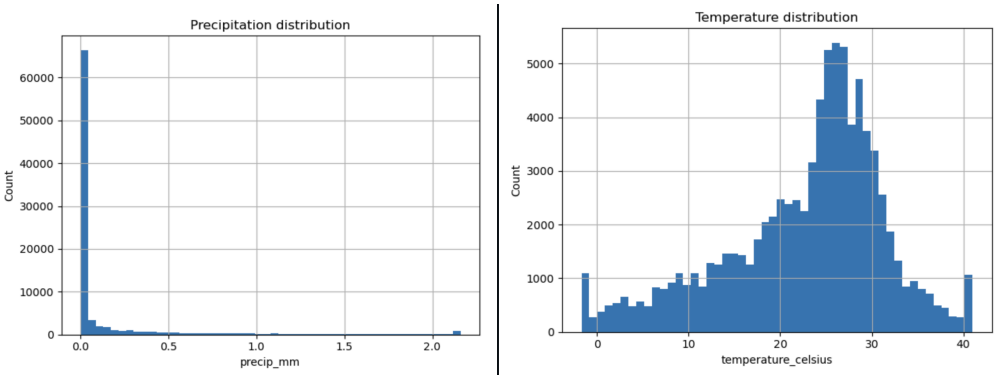
1. Data Cleaning

We standardized column names, parsed timestamps, handled missing values (median/mode), clipped outliers, and aggregated data to a daily resolution.

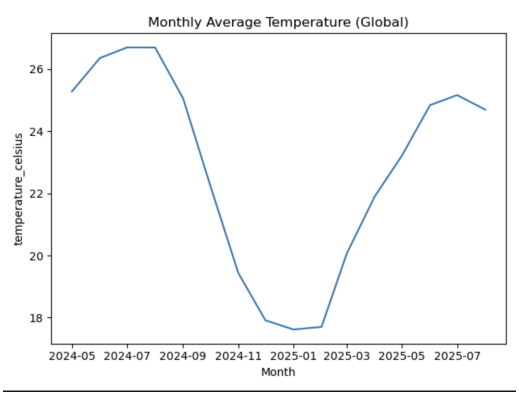
The cleaned dataset enables robust downstream analysis and ensures consistency across countries and variables.

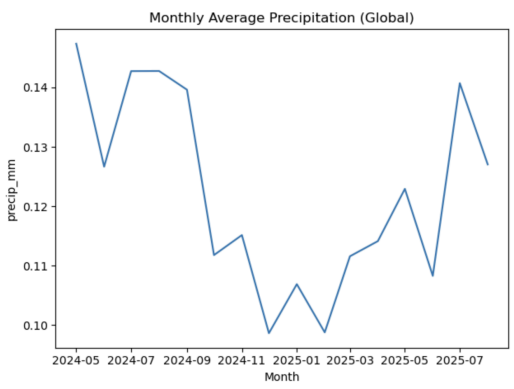
2. Exploratory Data Analysis (EDA)

EDA revealed:

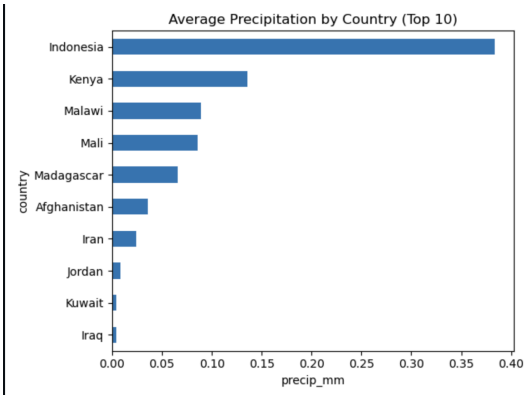
- **Temperature & Precipitation distributions** (histograms show wide variation across regions)
- 

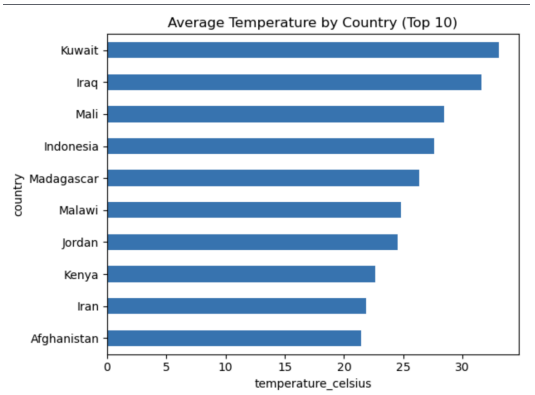
- **Monthly & annual cycles** (clear seasonal patterns in temperature and rainfall)



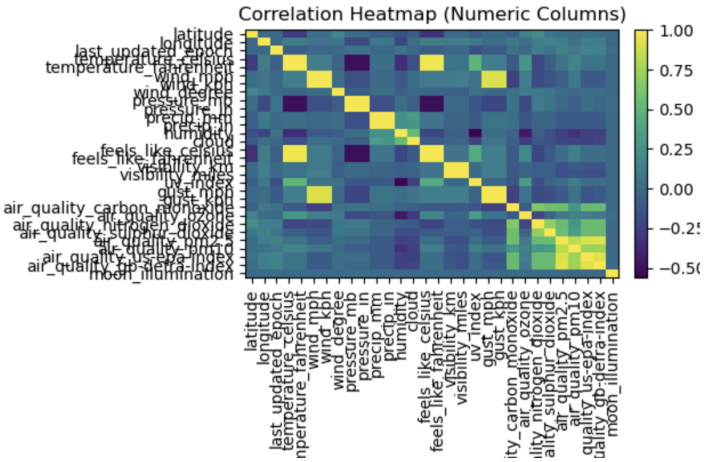


- **Country-level differences** (Top 10 countries ranked by average temperature and precipitation)





- **Correlation heatmap** (strong relationships between temperature, humidity, and air quality indicators)



3. Basic Forecasting Models

Implemented three baselines and ARIMA:

- **Naive** → forecast equals last observed value
- **Seasonal Naive** → forecast equals value from same weekday last week
- **ARIMA** → autoregressive integrated moving average model

Performance was evaluated with **MAE, RMSE, and MAPE**.

Forecast vs Actual plots illustrate that Naive gives flat lines, while Seasonal Naive captures weekly seasonality. ARIMA performs better but may need seasonal tuning (SARIMA).

4. Conclusion & Future Work

This project demonstrates a full workflow:

- Data cleaning & preprocessing
- Exploratory analysis
- Baseline & ARIMA models
- Advanced forecasting (Prophet, XGBoost, ensemble)
- Climate & spatial analysis

Future extensions:

- Deep learning with LSTM for sequence prediction
- Deployment of forecasts via API (Flask/FastAPI)
- Interactive dashboards (Streamlit/Tableau)

Deliverables

- Cleaned dataset (data/cleaned_weather.csv)
- Jupyter notebooks (01–03)
- Generated plots (visuals/)
- Final report (this document)
- README.md (project summary & instructions)