Title : Modeling and Forecasting Monthly Rainfall Variability in Upper Northern Thailand Using (2017–2025)

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Major : Data Science

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ABSTRACT

This study aims to develop and compare forecasting models to explain and predict monthly rainfall variations in Upper Northern Thailand by linking rainfall dynamics with maximum and minimum temperatures within a time-series framework. Monthly data from 2017 to 2025 were used. Data preparation included screening for outliers and missing values, followed by monthly aggregation (monthly rainfall as totals, and temperatures as monthly means). The data characteristics were examined using time-series plots and statistical tests to confirm the presence of trend and seasonality.

The analysis shows that rainfall exhibits strong seasonality and high variability, with high values during the rainy season and low values during the dry season. The study proposes and compares several forecasting models: ***SARIMA****, which forecasts using only the seasonal structure of the rainfall series;* ***SARIMAX****, which incorporates exogenous variables—maximum and minimum temperatures—to explain rainfall variability alongside climatic influences; and* ***ETS (Holt–Winters)*** *as a baseline model that captures trend and seasonality in a simple manner. Model performance was evaluated using the last 12*

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*months as a test set and the metrics **sMAPE**, **MAE**, and **RMSE**.*

*Comparative results indicate that statistical models accounting for seasonality and the ETS model can capture the seasonal rainfall pattern, but their accuracy differs across evaluation metrics. **SARIMAX** provides an advantage in interpreting the relationship between temperature and rainfall, whereas **ETS** produces stable forecasts in certain periods. This study summarizes guidelines for selecting appropriate models for rainfall data characterized by strong seasonality and high volatility, and the findings can support water-resource planning, flood and drought early warning, and agricultural decision-making in Upper Northern Thailand.*

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Zoology	สัตววิทยา
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Industrial Chemistry	เคมีอุตสาหกรรม
Materials Science	วัสดุศาสตร์
Physics	ฟิสิกส์
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