Data Article

Title: An Analysis Of How Local Weather Patterns Are Affected by Climate Change

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Abstract

This study analyses how local weather patterns in Thohoyandou, South Africa, have been affected by climate change using hourly temperature and precipitation data from January 1, 1990, to March 16, 2025, obtained from the Open-Meteo Historical Weather API. Machine learning models, including Artificial Neural Networks (ANNs) and Long Short-Term Memory (LSTM) networks, were utilised to identify trends and forecast future changes in temperature and rainfall. The findings aim to support local climate adaptation and policy planning by providing insights into long-term changes in weather patterns. The data are stored in an Excel file.

Specifications Table

Subject area	*Climate Science / Environmental Data Analysis*
More specific subject area	*Climate Change Modelling and Local Weather Forecasting*
Type of data	*Excel file*
How the data was acquired	*Downloaded using the https://open-meteo.com/en/docs/historical-weather-api*
Data format	*Raw and processed*
Experimental factors	*N/A*
Experimental features	*N/A*
Data source location	*Thohoyandou, South Africa (Latitude −22.95°, Longitude 30.49°)*
Data accessibility	*Publicly available from https://open-meteo.com/en/docs/historical-weather-api*
Related research article	*Forecasting Local Weather Trends under Climate Change: A Machine Learning Approach Using Data from Thohoyandou, South Africa*

Value of the Data

The data can be used to analyse and forecast local weather trends, study extreme events, support climate adaptation planning, and enable comparative climate research.

Data

The data used in this study is from Thohoyandou, South Africa, and it can be accessed from Open-Meteo Historical Weather API. The dataset comprises hourly observations of temperature (°C at 2 m), precipitation (mm/h), and associated climate variables from January 1, 1990, to March 16, 2025. The covariates used for modelling included date and calendar variables (day, month, hour), meteorological variables (temperature, precipitation, temperature anomaly, precipitation anomaly, relative humidity at 2 m, dew point at 2 m, wind speed at 2 m, wind direction at 2 m, and cloud cover), and lagged variables (temperature anomaly lag1, lag2, lag3, lag24, lag168, and precipitation anomaly lag1, lag2, lag3, lag24). These covariates were used in ANNs and LSTM models to forecast local temperature and precipitation patterns. The analytic data can be accessed from https://drive.google.com/file/d/1URVT6WfUfx0FKRvNbUl2Ce9lAyTsxaHD/view?usp=drive_link

Experimental Design, Materials, and Methods

Data used in the study are from Thohoyandou, South Africa. ANNs and LSTM models were applied to forecast temperature and precipitation using hourly weather data from 1990 to 2025.

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References

Open-Meteo Historical Weather API: https://open-meteo.com/en/docs/historical-weather-api (Accessed on 16 March 2025).