

Abstract

This study compares the performance of ARIMA and ARIMA-Fourier models for forecasting daily air temperature in Surabaya from 2020 to 2024. This research is motivated by global climate change, which leads to rising air temperatures, and the Urban Heat Island (UHI) phenomenon in Surabaya, which exacerbates urban temperature increases, impacting public health and activities. The ARIMA method is employed as a basic time series approach, while ARIMA with Fourier series input is incorporated to capture more complex seasonal patterns using sine and cosine components. Model validation is conducted through four test data scenarios: one, three, six, and twelve months. The results consistently show that the ARIMA with Fourier series input model outperforms conventional ARIMA in capturing seasonal fluctuations. Specifically, the ARIMA with Fourier series input model with $k = 150$ harmonics yields the best Mean Squared Error (MSE) and coefficient of determination (R^2) values across all scenarios. The six-month scenario is identified as the most optimal due to its balanced accuracy and stability. Therefore, the ARIMA with Fourier series input model is recommended for medium- to long-term air temperature forecasting in regions with consistent seasonal climate patterns.

Keywords: *ARIMA, ARIMA-Fourier, Fourier Series, Seasonality, Temperature Forecasting, Surabaya, Time Series*