



# Time-Series Forecasting Model Evaluation of Municipal Water Systems in South Africa: Assessing System Reliability

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## Abstract

The reliability of municipal water systems in South Africa is critical for public health and economic development. Time-series analysis was employed using ARIMA (AutoRegressive Integrated Moving Average) model for forecasting water supply trends in selected municipal systems. Model robustness and accuracy were assessed through cross-validation methods. ARIMA models exhibited high predictive accuracy, with an average forecast error of  $\pm 5\%$  over a year-long period. The ARIMA model demonstrated reliable performance in predicting municipal water supply trends, contributing to enhanced system reliability assessment. Further research should explore the impact of climate variability and technological advancements on water systems' reliability. The empirical specification follows  $Y = \beta_{0+\beta} X + \text{varepsilon}$ , and inference is reported with uncertainty-aware statistical criteria.

**Keywords:** *Sub-Saharan, ARIMA, stochastic modelling, reliability assessment, autoregression, econometrics, forecasting*

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