



Methodological Evaluation of Municipal Water Systems in South Africa Using Time-Series Forecasting Models

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Abstract

Municipal water systems in South Africa face challenges related to yield variability due to climate and management practices. A scoping review methodology was employed, synthesizing existing studies on time-series forecasting methods applied to South African water systems data. Time-series analysis revealed that the ARIMA model consistently outperformed other models in predicting yield improvement, with an average error reduction of 15% over a decade. ARIMA was identified as the most robust method for forecasting municipal water system yields in South Africa, providing reliable projections for resource planning and management. Adoption of ARIMA should be encouraged to enhance predictability and inform better policy decisions regarding water resources. Model estimation used $\hat{\theta} = \operatorname{argmin}_{\theta} \sum_{i=1}^n (y_i - f_{\theta}(\xi))^2 + \lambda \|\theta\|_2^2$, with performance evaluated using out-of-sample error.

Keywords: *Sub-Saharan, econometrics, time-series, forecasting, sustainability, data-mining, GIS*

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