The use of ARIMA in predicting Groundwater Variability of the Jukskei River catchment of South Africa

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Abstract:
With groundwater resources under pressure, effective management is crucial for the sustainability of the vital Jukskei River catchment. This requires insights into future groundwater availability. This study employs autoregressive integrated moving average (ARIMA) modelling, an established time series forecasting approach, to predict future groundwater levels using past data. An ARIMA (1,1,0) model was developed utilizing 1992-2021 water level data. Data gaps were filled via interpolation to create a continuous 29-year series, though the limited dataset restricts model complexity. The AI-enabled model suggests average water levels will remain relatively stable near 22.1m until 2031, with minor fluctuations. However, wide confidence bounds reflect the inherent uncertainty in natural systems forecasting with restricted data. While providing a data-driven water availability outlook, the method's assumptions that past patterns continue unchanged merits consideration alongside other influencing factors. This research highlights the promise of AI in augmenting environmental analysis, but further data integration with methods like LSTM neural networks may enhance robustness. Groundwater level modelling delivers actionable intelligence for balancing utilization and sustainability of precious water resources in the Jukskei catchment. What makes this study different is its application or deployment of ARIMA on 460 boreholes in the context of 460 Jukskei Catchment.

Keywords:
Groundwater, predictions, ARIMA.