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Spatiotemporal Groundwater Status Modelling using Deep Learning Techniques

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Abstract

Groundwater monitoring is crucial for Sustainable Water Resource Planning and data-driven decision-making. Conventional approaches for modelling groundwater status have limitations in accurately capturing the complex nature of environmental processes. Deep Learning techniques are emerging tools for addressing groundwater patterns' non-linearity and dynamic nature. However, proper models are lacking in the way explicitly developed for groundwater status monitoring in Sri Lanka. This research aimed to overcome this issue by proposing a Deep Learning model for monitoring changes in groundwater status and comparing its effectiveness with traditional manual data logging systems and primary modelling approaches especially used in the country. The research focused on developing a robust Deep Learning model that integrated spatiotemporal variations of groundwater levels using a combination of Deep Learning techniques and geo-statistical kriging. The model was tested in Malwathu Oya River Basin in Anuradhapura covering the Regolith Aquifer System of Hard Metamorphic Rock region, a controlled geographic boundary as a pilot implementation and subsequently can be applied to the entire groundwater system in Sri Lanka. Overall, the Long Short Term Memory Neural Network-based model had shown promising results for groundwater prediction at over 90% of the stations with reliable accuracy. The findings of this research have contributed to the advancement of groundwater resource management practices in the country and provided valuable insights into the potential of Deep Learning for improving groundwater monitoring accuracy and efficiency.

***Keywords**:* Groundwater status, Spatiotemporal forecasting, Sequence patterns, Geo-statistics, Deep Learning