A SPATIO-TEMPORAL DROUGHT PREDICTION FOR SRI LANKA USING STANDARD PRECIPITATION INDEX

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179053B

Degree of Master of Science

Department of Mathematics

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Dissertation Submitted in Partial Fulfillment of the Requirements for the

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DECLARATION

I declare that this is my own work, and this Dissertation does not incorporate any material previously submitted for a degree or diploma in any other University or Institute of higher learning without an acknowledgement. To the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text. I retain the right to use this content in whole or part in future work.

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Name of Supervisor: DR. A.L.A.R R. THANUJA

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ABSTRACT

This research intends to construct an efficient drought forecasting model employing Spatio-Temporal Interpolation with Standardized Precipitation Index (SPI). Notable deviations in rainfall are now observed across the globe due to the global increase in mean annual temperature causing recurrent drought events, and Sri Lanka is among the severely affected by these incidents bringing serious economic impacts, particularly to its agricultural sector. Hence, accurate draught predictions are imperative for early alerts to mitigate its consequences and execute readiness measures. This study thus scrutinizes geostatistical and deterministic descriptive Spatio-Temporal interpolation techniques to find an optimal method. Research findings based on cross validation suggest that Geostatistical Spatio-Temporal methods significantly outperform Deterministic Spatio-Temporal methods for drought forecasting in this region. The combined use of SPI-3 and SPI-6 enabled the formulation of reliable forecasts regarding the onset, intensity and offset of drought conditions. Consequently, this model was able to successfully predict drought hazards for the upcoming season. It is therefore recommended that the affected districts prepare accordingly with revised cropping and harvesting strategies suitable for YALA and MAHA seasons in Sri Lanka.

Keywords: Spatio-Temporal Prediction, Seasonal Time Series, Standard Precipitation Index

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LIST OF ABBREVIATIONS

ACF	-	Autocorrelation Function
ADF	-	Augmented Dickey Fuller
AIC	-	Akaike Information Criterion
ARIMA	-	Autoregressive Integrated Moving Average
CDR	-	Climate Data Record
CH	-	Canova And Hansen
GDP	-	Gross Domestic Production
HEGY	-	Hylleberg, Engle, Granger and Yoo
IDW	-	Inverse Distance Weighting
JB	-	Jarque Bera's
KPSS	-	Kwiatkowski Phillips Schmidt Shin
LB	-	Ljung Box's
LOOCV	-	Leave One Out Cross Validation
MAPE	-	Mean Absolute Prediction Error
MSE	-	Mean Squared Error
MSPE	-	Mean Squared Prediction Error
PACF	-	Partial Autocorrelation Function
PDSI	-	Palmer Drought Severity Index

RMSPE	-	Root Mean Squared Prediction Error
SARIMA	-	Seasonal Autoregressive Integrated Moving Average
SMDI	-	Soil Moisture Drought Index
SPEI	-	Standardized Precipitation Evapotranspiration Index
SPI	-	Standardized Precipitation Index
STIDW	-	Spatio-Temporal Inverse Distance Weighting
STK	-	Spatio-Temporal Kriging
STOK	-	Ordinary Spatio-Temporal Kriging
STSK	-	Simple Spatio-Temporal Kriging
STSV	-	Spatio-Temporal Semi-Variogram
STUK	-	Universal Spatio-Temporal Kriging

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