SEASONAL CLIMATE FORECASTS FOR WATER AND ENVIRONMENTAL MANAGEMENT

This thesis was submitted to the Department of Civil Engineering of the University of Moratuwa in partial fulfillment of the requirements for the degree of Masters of Engineering in Water Resources Engineering and Management

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Declaration

The work included in the thesis in part or whole has not been submitted for any other academic qualification at any institution

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ABSTRACT

The network of about 15 meteorological stations in Sri Lanka provides the baseline temperature data upon which most climatological studies are based. Since the data serve many primary users both local and foreign each year, and untold secondary users, quality control is an important consideration.

The quality of the monthly temperature data at the main stations of the Sri Lanka Department of Meteorology and Agriculture were evaluated based on station histories, comparison with other stations and internal consistency of the data. The Global Historical Climatology Network (GHCN) has previously carried out such quality control for 11 Sri Lankan stations. 15 stations, each of which were of a longer duration than used in the GHCN analysis. The data that failed to pass the quality control based on multiple checks and consistency of statistical relationships of mean temperature among the different stations were discarded. An estimate has been constructed for the temperature record for each station based on its best-correlated stations alone. The comparison of the actual and constructed data brings out shifts in mean and variance and a technique to adjust the data has been formatted. There have been several relocations of stations and changes of instrumentation that caused these shifts. Overall, the dataset resulting from this work is more comprehensive while meeting all the standards used in the GHCN work

The present quality control leads to a much smaller set of data being discarded. It is found that major inconsistencies are present in the nineteenth century records of several stations.

Effective use of available water resources is a serious problem facing the world as it enters the 21st century. An important source of concern in water resources management is the occurrence of severe and sustained droughts that deplete reservoir storage to dangerous levels. Such droughts are often associated with low frequency climatic fluctuations, such as the El Nino Southern Oscillation (ENSO).

Forecasting future reservoir inflows or rainfall requires an understanding of the nature and causes of climatic variability. There have been significant advances in physically based models of the climatic and hydrologic systems in recent decades. However their operational utility beyond a few days or weeks, and accuracy of their forecasts remain rather limited. Consequently, where long historical records of the variables of interest are available, statistical approaches could provide a basis for useful seasonal to inter annual flow forecasts.

Identification of the oceanic or atmospheric variables that form useful predictors of rainfall is an important step in developing a long-term forecasting model. Third chapter is of a study to develop a framework for rainfall probabilistic forecasting using available climatic information.

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LIST OF ABBREVIATIONS USED

SST	-	Sea Surface Temperature
GHCN	-	Global Historical Climate Network
ASLT	-	All Sri Lankan Temperature
CUSUM	-	Cumulative Sum
GA	-	Government Agent
SD	-	Standard Deviation
UB	-	Upper Boundary
LB	-	Lower Boundary
ASLT(com)	-	All Sri Lankan Temperature Computed
ENSO	-	El Nino Southern Oscillation
SO	-	Southern Oscillation
CCS	-	Correlation Coefficients
FIS	-	First Inter monsoon Seasons
SWMS	-	South West Monsoon Season
SIMS	-	Second Inter monsoon Season
NEMS	-	North East Monsoon Season
FMA	-	February, March, April
MJJ	-	May, June, July
ASO	-	August, September, October
NDJ	-	November, December, January
SOI	-	Southern Oscillation Index
SST	-	Sea Surface Temperature

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