RAINFALL RUNOFF MODEL FOR

UMA-OYA BASIN

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A DISSERTATION SUBMITTED IN PARTIAL

FULFILMENT OF THE REQUIRMENTS

FOR THE DEGREE OF

MASTER OF ENGINEERING

DEPARTMENT OF CIVIL ENGINEERING

UNIVERSITY OF MORATUWA, SRILANKA

FEBRUARY 1985

RESPECTFULLY DEDICATED

TO

AMMA AND APPACHCHI

ACKNOWLEDGEMENT

The author wishes to express his appreciation and sincere thanks to Dr. Sunil Wickramasuriya of Department of Civil Engineering of University of Moratuwa, Srilanka and Mr. Palitha Manchanayake of Water Management Secretariat of Mahaweli Authority, Srilanka for the encouragement, guidence, assistance and valuable suggestions offered througout the study, and in the presentation of this thesis.

He is also much thankful to his employer, Chairman Mahaweli Engineering and Construction Agency, Srilanka, for granting the leave of absence. He also wishes to thank the Department of Meteorology and Irrigation Department for allowing permission to use the data and other valuable information that required.

Miss. K. V. S.De Silva and other staff members of the Water Management Secretariat of Mahaweli Authority are thanked for their assistance, and the author wishes to express his deep indebtedness to Mr. P. P. Ratnayake, computer programmer for continued assistance and encouragement given.

Last, but not the least, he expresses his gratitude and sincere thanks to his wife Bungi and son Ruwan, whose moral support has been an inspiration.

This dissertation has not been previously presented in whole or part to any university or institution for a higher degree.

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13th of Feb. 1985

LIST OF SYMBOLS AND ABBREVIATIONS

Symbols

- A - Area
- $a_{t,i}$ - Model coefficient of t^{th} month
- D_{x-z} - Distance between rainfall station x & z
- K - Order parameter
- $MM_{x,t}$ - Mean monthly rainfall of station x of month t
- $MM_{z,t}$ - Mean monthly rainfall of station z of month t
- N - Calibration period
- n - Number of rainfall stations
- n_t - Memory parameter of month t
- P - Rainfall
- p - year p
- $\overline{P}$ - Mean of P
- P_t - Mean monthly areal rainfall over the calibration period
- $P_{p,t}$ - Mean monthly areal rainfall of t^{th} month of p^{th} year
- $P_{x,t,y}$ - Monthly rainfall value of station x, for month t of year y
- $P_{z,t,y}$ - Monthly rainfall value of station z, for month t of year y
- Q - Runoff
- $\overline{Q}$ - Mean of Q
- Q_t - Mean monthly runoff over the calibration period
- $Q_{p,t}$ - Observed monthly runoff of t^{th} month of p^{th} year
- $\hat{Q}_{p,t}$ - Estimated monthly runoff of t^{th} month of p^{th} year

R - Correlation coefficient

T - Time in seconds

t - t^{th} month

w_z - Weight factor

σ_t - Runoff factor

σ_n - Standard deviation

Σ - Summation

χ^2 - Chi-square parameter

% - percentage

Abbreviations

HCP - Hydrological crash programme

km - Kilometre

m - Metre

mcm - Million cubic metre

mm - Millimetre

RF - Rainfall

RO - Runoff

WMS - Water management secretariat

u/s - Upstraem

CONTENTS

ABSTRACT

The Rainfall-Runoff model presented here could be used to predict the monthly runoff values at the ungauged site of Uma Oya confluence, and hence monthly runoff values at the Mnipe anicut in the Mahaweli river. These estimated monthly runoff values are needed for the operation of the control gates of Minipe right bank and left bank main canals, in order to divert water to system B, C and E respectively. Although there are long periods of rainfall records over the Uma Oya basin, the availability of runoff records is limited and are available for the two upstream gauging stations at Welimada and Talawakanda across the Uma Oya. As the location of the Uma Oya confluence is different from the locations of the river gauging stations, the model parameters need to be regionalized so that the runoff at any location of the Uma Oya river could be estimated.

A deterministic black-box regression model for rainfall-runoff simulation in the two sub-basins at Welimada & Talawakanda is developed. The model is mathematically expressed as;

$$Q_{p,t} = n_t \left[\sum_{i=0}^{k} a_{t,i} \, P_{p,t}^{i} \right]$$

$i = 0, 1 \text{-----} k$

$t = 1, 2 \text{-----} 12$

The model struture depends on two key parameters, which are;

1. An Order parameter- K (an integer, greater than or equal to 1)
2. A Memory parameter- n_t (t=1,2,3............,12)

An order parameter K, characterizes the runoff behavior of the basin .ie. When K=1, the catchment is linear and for K >1, the catchment is non-linear.

A memory parameter n_t characterizes the memory of the rainfall-runoff process

The order parameter K is determined from monthly rainfall-runoff functional relationships and the model coefficients $a_{t,i}$ are estimated for the same functional relationships by the least-square technique for both sub basins. Finally the model coefficients are regionalized over the Uma Oya basin, so that the model can be used to estimate monthly runoff at the ungauged site of Uma Oya confluence. These estimated runoff values have been compared with the runoff values of observed differences between Rantambe and Randenigala of Mahaweli river, before application of the model.