

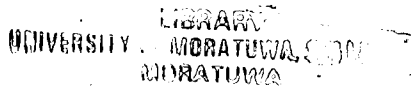
RAINFALL RUNOFF MODEL FOR

UMA-OYA BASIN

BY

S.T.B. EKANAYAKE

BSc (Eng) • Hon • MIE (SL) • MICE (London) • CEng.



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



S.T.B. EKANAYAKE

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LIST OF SYMBOLS AND ABBREVIATIONS

Symbols

- A - Area
- $Q_{t,i}$ - 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
- \bar{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
- \bar{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 - tth month

w₂ - Weight factor

6₁ - Runoff factor

6_n - Standard deviation

Σ - Summation

χ² - Chi-square parameter

% - percentage

Abbreviations

HCP - Hydrological crash programme

km - Kilometre

m - Metre



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mcm - Million cubic metre

mm - Millimetre

RF - Rainfall

RO - Runoff

WMS - Water management secretariat

u/s - Upstream

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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 Minipe 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;

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

$i = 0, 1, \dots, k$
 $t = 1, 2, \dots, 12$

The model structure 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 ($t=1,2,3,\dots,12$)

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



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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.