RUNOFF CHARACTERISTICS OF A CATCHMENT IN THE SOUTH-WESTERN PART OF SRILANKA.

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(A)INTRODUCTION - The yeilding pattern of water from season to season and its variation within a river system from upstream to downstream was looked into on a Srilankan catchment, namely the Kaluganga basin (2600km^2), in order to forecast the discharge. Kaluganga, which begins from the central hilly areas (1500m M.S.L.) of Srilanka and flows to the south-western coast, is located in the part of Srilanka which receives 2600mm of rainfall annualy.

(B)HYDROLOGICAL DATA - The discharge measuring points being Dela(210 km^2) Ratnapura (627.3km^2), Kukulegama (315.1km^2), Ellagawa (1353.1km^2) and Putupaula (2599.9km^2) from upstream to downstream of the Kaluganga river system and the rainfall guaging points being Geekiyanakanda, Galatura, Allupolla and Deepdena are as in FIG-1. The basin was divided to the above mentioned sub basins and the rainfall was distributed to these sub basins by the use of the Theisen method. Six sets of data, namely every other month from the year 1988 was selected from all five discharge measuring stations for analysis.

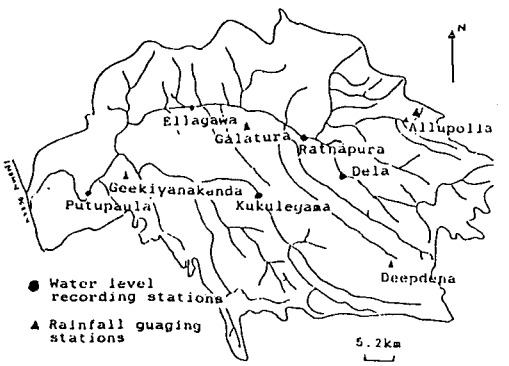

FIG-1 KALUGANGA BASIN

(C)METHOD OF ANALYSIS - The discharge was seperated into two components, namely ground water flow component and subsrface flow component using the filter separation method. The unit graphs of each component for all six sets of data were obtained using the Auto reggresive coefficient method. From the unit graphs obtained it was observed that, while there is no appreciable variation from upstream to downstream of the river system, that there exist a clear pattern in the variation of the unit graphs from season to season. This phenomena was observed for each runoff component and for all the data analysed. From this it was concluded that the catchment could basically be divided to three types

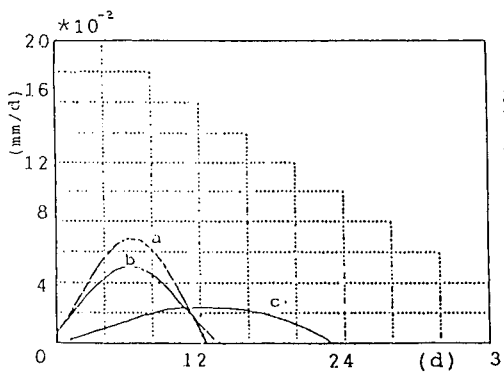

FIG-2(a) 3 TYPES OF GROUND WATER FLOW UNIT GRAPHS

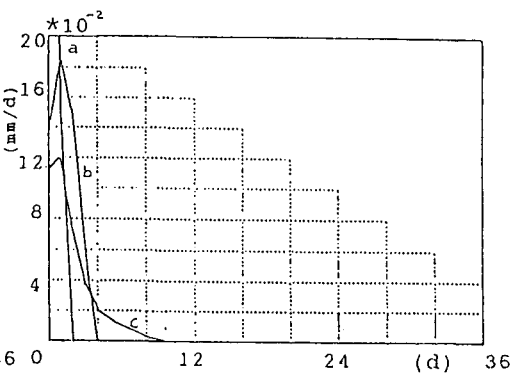

FIG-2(b) 3 TYPES OF SUBSURFACE FLOW UNIT GRAPHS

of unit graphs as in FIG-2. If the unit graphs are called a, b and c as in FIG-2 then, the applicability pattern is a,b, c,b,c,b and the applicable period of each being two months are January-February, March-april, May-June, July-August September-October and November -December respectively.

(D)FORECASTING OF DISCHARGE
The rainfall is separated to two components using equation (1), and the discharge is calculated using equation (2) and the above mentioned unit graph pattern.

$$XX(N)=XN(N)*RR*XL(N)$$
for subsurface flow

$$XX(N)=XN(N)*RR*(1-XL(N))$$
for ground water flow (1)

XN : rainfall (mm/h)
RR : runoff ratio

$XL = \alpha * XN^{\beta}/(1.0\text{mm/h})$,
$\alpha = 0.5$, $\beta = 1$,
$0 \leq XL < 0.95$

$$YY(N) = \sum_{k=1}^{k_{max}} h(N)*XX(N-k) \qquad (2)$$

h(N) : unit graph values

FIG-3 indicates the calculated and observed discharge for the year 1988 for Dela. As observed from FIG-4(a) and FIG-4(b) the degree of accuracy of the calculated hydrograph is comparatively high. This model was applied for the years 1986 and 1984, and the same results were obtained.

(E)CONCLUSION - A model is developed to forecast the discharge of the Kaluganga basin with sufficient accuracy. However it is intended to investigate further regarding the rainfall distribution equation (1) and the exact timing of the applicability and inapplicability of the relevant unit graphs.

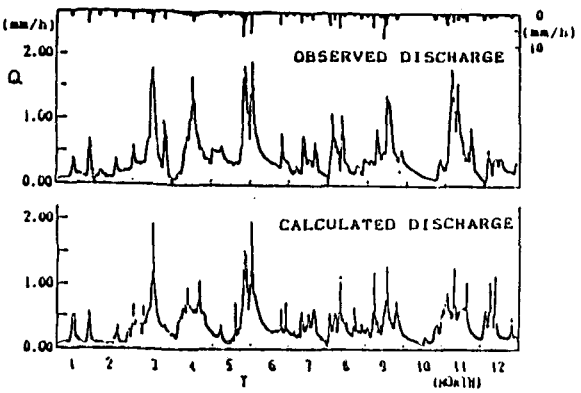

FIG-3 OBSERVED AND CALCULATED DISCHARGE

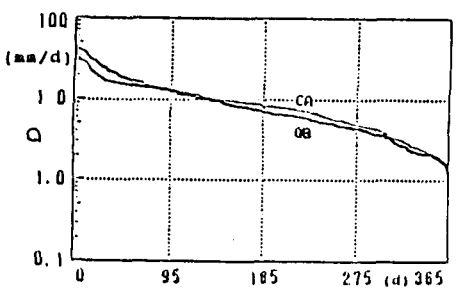

FIG-4(a) LOG PLOT OF OBSERVED AND CALCULATED DISCHARGE ARRANGED IN DECENDING ORDER

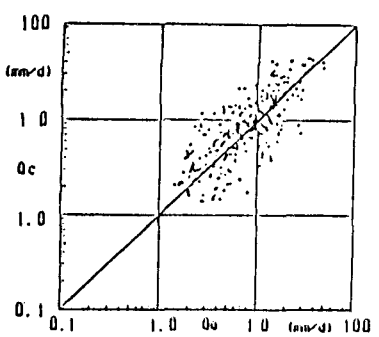

FIG-4(b) DIRECT LOG PLOT OF Q_{CA} VS Q_{OB}

REFERENCE 1)Irrigation Dept. Srilanka, Kaluganga river basin.
2)Meteorological Dept. Srilanka, Rainfall data of North--Western province.
3)A.Kanamaru, T.Mishima and S.Nakaoka : Runoff characteristics of a small mountain catchment(1), Chugoku-Shikoku Civil Eng. Soc. Lecture abstract report, pp.96,97 (1989).