PEAKFLOW ESTIMATION IN UNGAUGED WATERSHEDS USING FLOOD TRANSPOSITION

A Study of Watersheds in the Wet Zone of Sri Lanka

by
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DECLARATION

This dissertation has not been previously submitted in whole or part to any University or any Institution for a Higher Degree.

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ABSTRACT

Flood estimation is one of the major aspects of hydraulic design and is the first step in planning for flood regulation and protection measures. Proper selection of the design floods is of utmost importance as it effects both the safety and cost of any structure. Too small a design flood for a major structure involves a high risk, not only of total failure of the structure and the service rendered by it but also to the safety of the persons and the property located down stream. An excessive design flood, on the other hand, will result in an unnecessarily costly structure which may adversely effect the economic feasibility of the project. Hence it is required good reliable methods to estimate stream flow at various locations in order to carry out hydraulic design.

Flood transposition is a very helpful tool which can be effectively used for design purposes. This allows the transfer of flood information from gauged catchments to other catchments where sufficiently detailed streamflow information is not available. This research deals with a study of annual maximum floods of all four major river basins in the wet zone of Sri Lanka. Peakflows of Kelani Ganga, Kalu Ganga, Gin Ganga and Nilwala Ganga were used for this study.

Based on the assumption that peakflows are mostly dependent on watershed area the link between watershed area to its peakflow was studied to find a relationship between watersheds. Seventy-nine watershed combinations in the wet zone of Sri Lanka were analysed to identify the relationship and the values that could be used for exponent n in flood transposition. Twenty-five watershed combinations out of seventy-nine combinations were within the same basin and the rest is between basins.

In order to identify the catchments of which peakflow characteristics are similar, an index called Peakflow Characteristics Similarity Index was defined. When watersheds are similar in peakflow characteristics it was found that the peakflow could be transposed using a function comprising of watershed area only. This relationship showed that peakflow of a particular watershed is proportionate to the n^{th} power of its area and that the n could be taken as 0.8. Average estimated error for this relationship is found to be 34% for catchments within the same river basin whereas an average error of 55% was present for any watershed in the wet zone. Design flow calculations were performed for all similar watersheds using the derived relationship and were compared with those computed with observed values. Design flow estimations using transposed data from the same river basin had an average error of 15%. The error was 40% when the data used for design flow computations was transposed between basins.

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