THESIS

NON-STATIONARY REGIONAL FLOOD FREQUENCY ANALYSIS AT UN-GAUGED SITES

BY

MUHAMMAD IMRAN AZAM
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ABSTRACT

The catchment area of the Jhelum River and its tributaries is 33000 km^2. The river catchment includes gauged and un-gauged sub-catchments with many similarities. In this study, Canonical correlation analysis (CCA) was used to explore the correlation between un-gauged (Domel, Dollai, Sopore and Dudhnial) and gauged sub-catchments (Chinari, Azad Pattan, Mangla, Kohala, Nosheri, Muzaffarabad, Garihabibullah, Palote, Kotli and Naran) of the Jhelum River catchment. Flow from fifteen gauging stations was obtained for detailed analysis out of which eight are located at the Jhelum River, three on the Neelum River, two on the Kunhar River and one each on Poonch and Kanshi Rivers, respectively. CCA included attributes of the selected sub-catchments (e.g. catchment area, main channel slope, latitude, longitude, elevation, length of channel and mean precipitation) as dependent (catchment area, main channel slope) and independent (latitude, longitude, elevation, mean annual rainfall) variables. Linear regression was applied to transfer flood data of gauged catchments to the un-gauged sub-catchments showing high correlation based on CCA. Flood frequency analysis was performed on the flood series (statistically transported) of the un-gauged sub-catchments. Floods of different return periods, thus obtained, were compared with the floods of identical return periods estimated through graphical method.

The results of CCA showed that two main characteristics of the gauged and un-gauged sub-catchments i.e. catchment area and main channel slope (treated as dependent variables) possess varying levels of correlation. High correlation (R^2 =0.95) was observed in case of catchment area while main channel slope has limited correlation (R^2 = 0.58). Furthermore, the relationship between dependent and

independent variables (latitude, longitude, length of rainfall, elevation and mean precipitation) showed that high correlation exist between length of channel and catchment area ($R^2 = 0.94$) and Rainfall; and main channel slope ($R^2 = 80$). In general, the results of CCA based on selected multivariate tests of significance showed that four un-gauged sub-catchments Domel, Dollai, Sopore and Dudhnial are fairly correlated with the gauged catchments of Chinari, Kohala, Chinari and Nosheri, respectively and flow data from these gauged sub-catchments can be transferred to the un-gauged sub-catchments through linear regression. The flood frequency analysis for the un-gauged sub-catchments showed that CCA Method is more suited for the estimation of floods of different return periods as compared to Graphical method of estimation. The comparison of floods of different return periods estimated by CCA Method with those estimated by graphical method showed that graphical method predicts under estimated results.