

THESIS

DEVELOPMENT OF DESIGN HYETOGRAPH FOR FLOOD
ESTIMATION IN THE SWAT REGION



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ABSTRACT

In design flood computation procedure, selection of appropriate design rainfall distribution is necessary. If a hydraulic structure is under-designed, the floods may cause serious damages to the structures. On the other hand, in case of over-designed structures, the cost of the project may increase substantially. Hyetographs and depth-duration-frequency relationships are important components of the rainfall runoff models. Design hyetographs are used in conjunction with the unit hydrograph to calculate design flood. In the present study, hyetographs have been constructed using the regional method proposed by Khan in 1980, as well as conventional methods like SCS rainfall distributions, Huff quartile curves and triangular hyetograph. The design flood is computed using these hyetographs and compared with the actual 2010 storm distribution. The results reveal that significant underestimation of the peak flood is resulted when Huff curves and SCS type-1A curves are used in computation. Quite the opposite, the SCS type-2 and SCS type-3 curves produce overestimated design flood. The results of design flood with Khan hyetograph, triangular and SCS type-1 hyetographs are similar. The results also show that storm distribution as witnessed in 2010 has been the most critical and can be adopted as design hyetograph for hydrological analysis of structures within the region in the future. The 100 year return period was considered appropriate in the present study for flood computation in the Swat River Basin. The rainfall frequency analysis reveals that 100 year return period maximum 24 hour rainfall at Kalam, Daggar, Bisham Qila and Mardan is 147, 199, 150 and 199 mm, respectively. Peak floods were estimated with the help of calibrated HEC HMS model using various rainfall distributions. The 100 year return period

floods in the Swat region at the confluence of the rivers Swat and Panjkora is worked out as 12960, 10300, 16300, 16650, 12020, 11500 and 8650 cumecs for SCS Type 1, SCS Type 1-A, SCS Type 2, SCS Type 3, triangular hyetograph, Khan hyetograph and Huff curves, respectively.