THESIS

FLOOD FORECASTING BY USING DIFFERENT HYDROLOGICAL MODELS FOR THE SAWAT RIVER

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Submitted By

MUHAMMAD HASSAN REHMAN
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ABSTRACT

A flood is an anomalous high water flowing, which flows over the embankments along either natural or artificial streams. Floods occur mainly due to intense storms which cause more runoff than the capacity of the stream within its normal channel section. Flooding could also be accentuated due to poor operation of dams and barrages across the river. Effective flood management requires structural as well as non-structural measures. In 2010 flood came in July following by the heavy monsoon rains in the KPK province. According to Government data the floods directly affected about 20 million people, destruction of property, livelihood and infrastructure with a death toll of 2000. The Pakistan economy was harmed by extensive damage to infrastructure and crops. Such disasters may occur in any part of our country in any flood season having poor warning system to the affected population. The question naturally arises "Can something be done to stop or reduce those? Is it possible to forewarn the flood threatened population by means of definite flood warnings?

Flood forecasting techniques are used to save from these damages in future. Flood forecasting is an important component of Flood warning, where the distinction is a set of forecast time profiles of channel flows or river levels at various locations. In present study the runoff will be determined by using distributed hydrological computer model. It will help to understand the performance of different hydrological softwares/models in evaluation of floods in the River Sawat.

Streamflow simulation is often challenging in mountainous watersheds because of irregular topography and complex hydrological processes. Rates of change in precipitation and temperature with respect to elevation often limit the ability to reproduce stream runoff by hydrological models. The Soil and Water Assessment

Tool (SWAT) and HEC-HMS were used for simulating streamflow and forecast the flows in the Sawat Catchment located in the Northwest of Pakistan of KPK province in Upper Indus Basin (UIB). The Sawat River from Kalam to Chakdara selected for this study and the catchment area covers 5737 km^2, where most of the land cover is dominated by forest, range grasses, agriculture land and 14 % is glacier. Kalam valley is situated in the upper reach of Swat district and at the lower point it meets at the Chakdara where the flow from the upper reach accumulates. The average annual rainfall is 1030 mm with 101.6 mm expected in monsoon season. October and November are the dry months with average rainfall of 30 mm per month. HEC-HMS and SWAT hydrological models were used to simulate flood movement and runoff simulation for different time steps. Streamflow calibration was done at daily time steps as well as monthly for the period of 1995–1999, and validated for 2001–2005 in both hydrological models.

SWAT model showed a better result for simulation and flow forecasting as compared to HEC-HMS. SWAT Model performance was evaluated both visually and statistically where a good relation between observed and simulated discharge was found. HEC-HMS model results showed high peaks in most of the events as it is compared with observed flows.

The study results have exposed the ability of SWAT model for flow forecasting with better value of Mean squared error, R^2 and NSE than HEC-HMS model. The (R^2) values for daily and monthly values were obtained as 0.6143 and 0.9044 respectively for runoff. For forecasting process, measured and simulated daily and monthly flows have a good match with slightly under-predicted or over-predicted in some months. The forecasted period was selected from 2006-2007 to see the better results. Over all SWAT results for forecasting was of a satisfactory.