

Forecasting Extreme Rainfall in Kelani River Basin under Changing Climate

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Extreme precipitation events are becoming more frequent all over the world including tropical countries like Sri Lanka and are attributed to climate change. Frequent heavy precipitation brings frequent floods which severely affects lives, properties and the economic development of the country. The Kelani river catchment is one of the most vulnerable river basins for floods in Sri Lanka and the flood damages caused are high as the river flows through the commercial capital of the country. Therefore, it is a timely requirement to understand the occurrence of future extreme events to prepare for flood mitigation and necessary adaptive measures.

In this study, a Statistical Downscaling Model (SDSM) was utilized to downscale past and future General Circulation Model's (GCM) data available at a coarse resolution to the Kelani catchment. In this analysis the Kelani catchment was considered as two sub-catchments. Rainfall in the upper catchment was estimated by using seven rainfall gauging stations and the rainfall at the Colombo gauging station was used as the rainfall at the lower catchment. The observed data along with reanalysis data from National Centers for Environmental Predictions (NCEP) for the period from 1961 to 1975 and from 1976 to 1990 was used for calibration and validation of the model respectively for both upper and lower catchments. The GCM data from the Hadley Centre experiments under A2 (high emission scenario) and B2 (low emission scenario) scenarios published by Intergovernmental Panel on Climate Change (IPCC) was employed to forecast daily rainfall up to year 2099. An uncertainty analysis was carried out in order to have the assurance on the downscaled GCM outputs.

The forecasted rainfall was analysed for extreme value distributions for past, near future and far future according to Gumbel and Generalized Extreme Value (GEV) distributions, in order to compare the rainfall variation during these three periods and have estimates about the future condition of the Kelani river basin. Forecast of annual rainfall and annual maximum rainfall in both upper and lower catchments show an escalating trend of rainfall in future. This is an indication of increase in future rainfall extremes and highlights the necessity to prepare for adaptive measures.