ASSESSMENT OF CLIMATE CHANGE IMPACT ON STREAMFLOW IN THE CHALIYAR BASIN

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ABSTRACT

The increase in concentration of carbon dioxide and other greenhouse gases in the atmosphere is expected to have significant effect on hydrological regimes. General Circulation Models (GCMs) are probably the best available tool to provide estimates of the effect of increasing amounts of greenhouse gases in the atmosphere on rainfall and temperature, through a continuous, three dimensional simulation of atmospheric, oceanic and cryospheric processes. However the spatial resolution of these models (250km x 250km) is not compatible with that of watershed hydrologic models. To overcome this problem, the output from the GCM is downscaled with the help of Regional Climate Models (RCMs), thereby projecting the output to a finer resolution (25km x 25km). In this study, a general methodology is presented in order to use the downscaled output from a RCM directly in a hydrologic model for evaluating the impact of climate change on water resources. The hydrologic model used is the Soil and Water Assessment Tool (SWAT). The study area is a part of the Chaliyar River Basin in Kerala, India. Outputs from two scenarios, A2 and B2 are used in

the RCM to predict future scenarios. Two important climate variables, viz. rainfall and temperature are generated. These are then input to the physically based hydrological model, SWAT to estimate the effect of climate change on stream flow. Calibration and validation of the SWAT are performed using data for a period of 5 years, viz. 1987-91 and 1999-2003, respectively. Goodness-of-fit measures such as the Nash-Sutcliffe efficiency and the coefficient of correlation (R^2) are evaluated to test the performance of the model. These values are found to be reasonably high, suggesting that model performance is reasonably good. It is predicted that annual streamflows in the river basin would significantly reduce in both the scenarios considered in this study. Results of the study indicate that basin hydrology is very sensitive to projected climate changes.