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ScienceDirect
Mathematics and Computers in Simulation 81 (2011) 1419–1429
MATHEMATICS AND COMPUTERS IN SIMULATION
www.elsevier.com/locate/matcom

An assessment of modelling capacity to identify the impacts of climate variability on catchment hydrology

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Received 7 December 2009; received in revised form 21 April 2010; accepted 7 May 2010
Available online 31 May 2010

Abstract

The aim is to investigate the consistency or variability of catchment response over time and space and evaluate the predictive error caused by the impacts of climate variability on streamflow. For this purpose, both data- and top-down model-based analyses of the dynamic relation between rainfall and runoff for selected sub-catchments have been undertaken. Data analysis techniques (e.g. trend analysis, deconvolution and baseflow filtering) were used to assess the temporal and spatial variation in the hydrologic response characteristics for each site. The lumped conceptual rainfall–runoff model IHACRES CMD (Catchment Moisture Deficit) version is applied to the sub-catchments to assess the adequacy of the model response in representing the impact of weather patterns on streamflow. Several performance criteria have been used to evaluate the performance of the model in each calibration period using a multi-criteria approach. The IHACRES-3S (3 Storage) model is applied to assess low flow behaviour and capture the timing in the switch between baseflow and no flow periods. Rainfall–runoff model performance characteristics of each sub-catchment are quite related to their incident rainfall regime. Sub-catchments which are located in a lower rainfall regime show poor to average model performance. The reduction in performance in R^2 is due to the poor fitting to the peaks for both large and small streamflow events, with the model underestimating the highest flow peaks, and overestimating smaller peaks. Further work will be needed to assess observed data reliability and improve model performance in order to separate the impacts of climate variations and land use change on hydrological response. An appropriate model structure having a variable partitioning between quick and slow flow components is under consideration and techniques are being used to identify problematic periods and events with high error in the observational data.

Keywords: Climate variation; Data-based analysis; Model-based analysis; Model adequacy; IHACRES

1. Introduction

The effects of land use change on streamflow are easily veiled by climate variability due to the comparative magnitudes of these impacts. Additional factors impeding the separation of land use change impacts from the effects

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doi:10.1016/j.matcom.2010.05.007