Journal of Hydrogeology & Hydrologic Engineering

Editorial

A SCITECHNOL JOURNAL

Hydrological simulation and uncertainty analysis using the improved TOPMODEL in the arid Manas River basin, China

Ming-Hsu Li*

Graduate Instittue of Hydrological & Oceanic Sciences, Taiwan

***Corresponding Author:** Ming-Hsu Li, Graduate Instittue of Hydrological & Oceanic Sciences, Taiwan

Tel: 03-4222964; E-mail: mli@ncu.edu.tw

Received date: March 1, 2021; **Accepted date:** March 15, 2021;

Published date: March 23, 2021

Introduction

Understanding the mechanism of complicated hydrological processes is important for sustainable management of water resources in an arid area. This paper carried out the simulations of water movement for the Manas River Basin (MRB) using the improved semi-distributed Topographic hydrologic model (TOPMODEL) with a snowmelt model and topographic index algorithm. A new algorithm is proposed to calculate the curve of topographic index using internal tangent circle on a conical surface. Based on the traditional model, the improved indicator of temperature considered solar radiation is used to calculate the amount of snowmelt. The uncertainty of parameters for the TOPMODEL model was analyzed using the generalized likelihood uncertainty estimation (GLUE) method. The proposed model shows that the distribution of the topographic index is concentrated in high mountains, and the accuracy of runoff simulation has certain enhancement by considering radiation. Our results revealed that the performance of the improved TOPMODEL is acceptable and comparable to runoff simulation in the MRB. The uncertainty of the simulations resulted from the parameters and structures of model, climatic and anthropogenic factors. This study is expected to serve as a valuable complement for widely application of TOPMODEL and identify the mechanism of hydrological processes in arid area. The deterioration of aquatic ecosystems due to changeable hydrological processes is an on-going issue in many basins world widely. Hydrological processes are affected by complex factors such as soil properties, land use type, climate, and topographic conditions and vary spatially and temporally. Therefore, prediction of water resource availability is a difficult problem restricted by the implementation of water shortages and integrated river basin management in many basins. Hydrological models are efficient tools to create new management strategies for better utilizing current hydrological theories.

Numerous watershed hydrologic models have been adopted for the simulation of streamflow in the last decades to solve watershed problems14. These models include Soil and Water Assessment Tool (SWAT), and Hydrological Simulation Program Fortran (HSPF) and semi-distributed Topographic hydrologic model (TOPMODEL). Xie and Lian (2013) compared the performance of hydrologic simulation of HSPF and the SWAT model in the USA and found that HSPF can generate more accurate discharge predictions15. Although many models are powerful and efficient for solving watershed problems, they are difficult to calibrate when considering various hydrology and water quality processes, especially in the arid area16,17. Low vegetation coverage, thick aeration zone and unique climatic conditions contribute to the complicated hydrological processes in arid area. TOPMODEL is widely used all over the world18, but rarely consider the influence of topographic index and snowmelt on watershed runoff. As an excellent representation of semi-distributed models, TOPMODEL is popular and widely used in watershed scales. The semi-distributed Topographic hydrologic model (TOPMODEL) is a rainfall runoff model based on a simple theory of watershed hydrological similarity, with the topographic index as the index of hydrological similarity. To improve the applicability of TOPMODEL in the Manas River, the internal tangent circle on a conical surface method proposed by Yong (2009) is used for computing topographic index distribution in this paper24. Furthermore, this paper includes the consideration of solar radiation and calculates the snowmelt using the improved temperature index coupled with TOPMODEL. There are three general aspects contributing to uncertainty in hydrology: uncertainty in hydrological phenomena, model structures, and parameter estimation. Beven (1992) proposed generalized likelihood uncertainty estimation (GLUE) method to estimate hydrological uncertainty, which represents the latest developments in this field. Therefore, the uncertainty of model parameters is studied using the GLUE method.

Citation: Li MH (*2021) Hydrological simulation and uncertainty analysis using the improved TOPMODEL in the arid Manas River basin, China. J Hydrogeol Hydrol Eng 10:3.*