

A hybrid model for daily flow forecasting

Huynh Ngoc Phien* and Nguyen Tan Danh

Asian Institute of Technology, PO Box 4, Klong Luang, Pathumthani 12120, Thailand

Abstract

Having a simple structure, the Tank Model has been widely used in modelling the rainfall-runoff process of many watersheds. In this study, the model was slightly modified to make it suitable for forecasting daily discharges. Two basins in Vietnam, namely the Da Nhim and La Nga Basins were considered. The daily discharges were forecast one day ahead using daily rainfall and daily evaporation. It was found that forecast discharges for the smaller basin (Da Nhim) were not as good as those for the larger basin (La Nga).

In order to improve the forecasting performance of the Tank Model, a first-order autoregressive model, AR(1) was introduced to represent the error time series. The resulting hybrid model is the combination of the Tank Model and the AR(1) Model. Thus the forecast discharge for any day is obtained as the forecast value obtained from the Tank Model plus the forecast value of the error for that day. Application of the hybrid model to the above two basins was found to provide more accurate forecast values even though the overall performance of the hybrid model largely depends on the efficiency of the Tank Model.

Introduction

Forecasting of daily discharges has been an important problem in reservoir operations and to some extent, in flood protection. In this connection rainfall data are commonly used along with evaporation data and past discharge records.

There have been many models developed to model the runoff process using rainfall and evaporation as key factors. These are roughly classified as conceptual models and the Tank Model (Sugawara, 1961) has been widely used thanks to its simple structure and the automatic calibration procedure (Sugawara, 1979). In this study it was selected to forecast discharges for two basins in Vietnam, the Da Nhim and La Nga Basins. However, due to the fact that the model itself was not meant for forecasting, a slight modification in the treatment was made to render it suitable for forecasting purposes.

As is shown, the Tank Model alone did not perform very satisfactorily. Therefore a stochastic model was used to correct the discrepancies in the computed discharges of a deterministic rainfall-runoff model. The stochastic model used in this study was the first-order autoregressive model, AR(1), and the combined model becomes the hybrid model.

Selected basins

Two basins, Da Nhim and La Nga, situated between latitude 11°-12° 20' north and longitude 107° -108°30' west, in the tropical

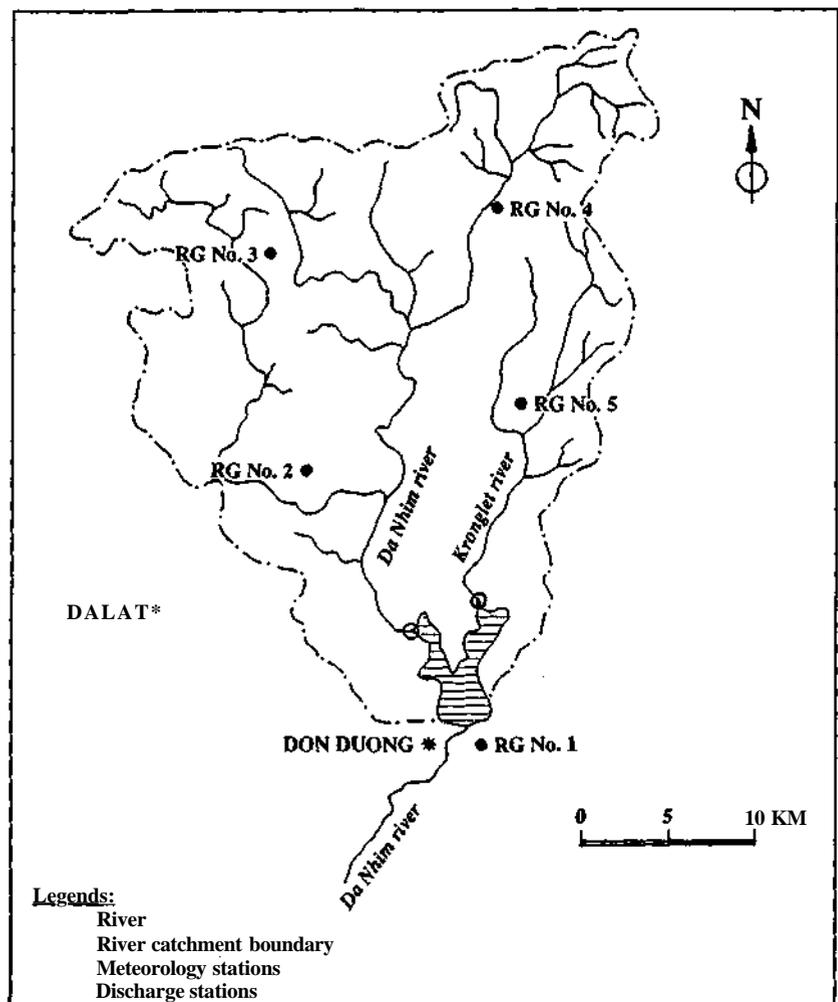


Figure 1
Location map of Da Nhim Basin and its monitoring stations

* To whom all correspondence should be addressed.
•(66-2) 516-5701; fax (66-2) 524-5721; e-mail hnp@cs.ait.ac.th
Received 12 December 1996; accepted in revised form 14 March 1997.