9th International Congress on Civil Engineering, May 8-10, 2012
Isfahan University of Technology (IUT), Isfahan, Iran

The systematic approach of Chaotic in noise reduction to improve the accuracy of monthly Nahadchai River

Mohammad Ali Ghorbani [1], Samira Roumianfar [2] ,Leila Malekani[3]

1- Associate Professor Dept. of Water Resources, Agriculture Faculty, University of Tabriz, Iran
2- M.Sc. Graduate, Hydraulic Structure of Civil Engineering, University of Tabriz, Iran
3-Ph.D. Candidate, Dept. of Water Civil Engineering, Tabriz University, Iran

ghorbani@tabrizu.ac.ir
s_roumiani@yahoo.com
lmalekani@tabrizu.ac.ir

Abstract

Complexity and the dynamic behavior of nonlinear hydrological processes such as river flow that being necessary using of the mathematical models, intelligent, and new theories. The extent of the influence of noise on the analysis of hydrological (or any real) data is difficult to understand due to the lack of knowledge on the level and nature of the noise. Meanwhile, a variety of nonlinear noise reduction methods have been developed and applied to hydrological (and other real) data. Recent studies have shown that the noise limits the performance of many techniques used for identification and prediction of deterministic systems. The present study addresses some of the potential problems in applying such methods to chaotic hydrological (or any real) data, and discusses the usefulness of estimating the noise level prior to noise reduction. In this study, the model predictions with artificial neural networks has been studied for the monthly values of river flow in Nahandchai what demonstrating on the raw data and in noise-reduced data. The results indicate that acceptable accuracy estimates for the noise-reduced data.

Keywords: River flow prediction, chaotic theories, artificial neural network, Noise reduction, Nahandchai

1. INTRODUCTION

Hydrological processes, such as river flow time series, are usually nonlinear, complex, dynamic and widely scattered due to the influence physical process involved and the variability in space and time. The underlying complexity and variability make investigation of flow one of the elusive tasks in hydrology. Recent studies [10–16] revealed that the hydrologic process might be better understood through chaotic analysis that belongs to nonlinear deterministic model.

Past studies on river flows have led to the development of: (i) traditional stochastic models widely practiced and applied to data with considerable fluctuations; (ii) *distributed hydraulic models* give an insight into catchments processes by their formidable prediction capabilities but require detailed data; (iii) *time series analysis*, including chaos theory, catastrophe theory and other artificial intelligence techniques, are successful predictive capabilities, which do not require any data other than time series but are able to provide an into insight the data. After two decades or so of applying time series, the thriving research is yet to be transformed into working modeling practices and applying of Artificial Neural Network (ANN), Fuzzy Inference System (FIS), ANFIS and Genetic Algorithm(GA). In recent years, the intelligent models of chaos theory and other extra-exploration methods have been used.

Nonlinear deterministic approaches were used to detect the presence of chaos and achieve more accurate river flow predictions by Domenico and Ghorbani (2011), Ghorbani and et al. (2010), Lisi and Villi (2001), Liu et al. (1998). Ghorbani and et al. (2011), Solomatine and et al. (2001) have estimated the level of the North Sea using chaos theory. The investigation by Stehlik (1999) studies runoff series at 30-min and daily scales and report a chaotic behavior with 30 min series, which is lost at a daily internal due to increasing the stochastic component by averaging. Regonda and et al. (2004) investigate river flow data at daily, 5-day and 7-day scales observed for three rivers in the USA and use the correlation dimension to distinguish between chaotic and stochastic behaviors. Their results show a mixture of behaviors at individual