

Evaluation of Sediments Using Rating Curve and Artificial Neural Network Methods by Combining Morphological Parameters of Basin (Case Study: Bagh Abbas Basin)

M. Hayatzadeh^{1*}, J. Chezgi¹, M.T. Dastorani²

(Received: Nov. 24-2013 ; Accepted : March 11-2015)

Abstract

Since the development of surface water control needs accurate access to flow behavior of sediment rates, the lack of sediment measurement stations, the novelty of most stations and the lack of statistics on the deposit make it difficult to properly evaluate and simulate the flow behavior and their sediments. In a watershed, the morphological characteristics and sediment load of flow affect each other. It is, thus, important to know about the extent of this relationship to manage and control the flow in downstream areas. In the present study, using artificial neural networks and sediment rating regression methods based on the data from 136 events and also morphological parameters, we have attempted to predict the sediment load of Bagh Abbas basin. In the first step, we used flow data to predict the sediment load of both methods, and then basin morphological characteristics such as the compactness factor and form factor were added to the models. The results of this study showed that by using neural networks of Multilayer Perceptron (MLP) type with Levenberg – Marquardt algorithm and the stimulation function of tangent Sigmoid with two hidden layers and four neurons in each layer, we can predict suspended sediment discharge rate with a sufficient accuracy. Accuracy of the results obtained from the ANN method was higher than the accuracy of rating curve method. In the evaluation of NGANN & GANN network methods and SRC & MARS regression methods, correlation coefficients were respectively calculated as 0.94, 0.93, 0.767, 0.766, and root mean square errors (RMSE), 0.45, 0.49, 2.3 and 2.3. Nash coefficient (NS) was calculated respectively as 0.71, 0.58, 0.27 and 0.23. Therefore, the most efficient method among the four models is artificial neural network combined with morphological data (GANN). Furthermore, the findings of the study show that adding geomorphological parameters to sediment rating has little effect on the model performance.

Keywords: Artificial Neural Network (ANN), sediment rating curve method, MARS method, Bagh Abbas basin.

1. Dept. of Watershed and Rangeland Management, School of Natur. Resour. and Desert Studies, Yazd Univ., Yazd, Iran

2. Dept. of Natur. Resour. and Environ., Faculty of Watershed and Rangeland Management, Ferdowsi Univ., Mashhad, Iran

*: Corresponding Author, Email: mhayatzadeh@gmail.com