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An assessment of the Artificial Neural Networks technique to geomorphologic modeling sediment yield (Case study Samandegan river system)

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Extended Abstract

1- Introduction

Estimating correct volume of sediment in a fluvial system is one of the most important issues in water engineering, river engineering, water resources, facilities, structures, water and environmental projects and programs for the development of them.

The bed load transfers by saltation and suspension forms according to the sediment particle size. The sediment load is one of the most important parameters of hydraulic projects, a useful indicator of soil erosion, and watershed's ecological environment. Several physical experimental methods for estimating the sediment in a watershed has been developed.

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Experimental methods are based on estimated sedimentation basin characteristics such as area topography, land cover, climate and the qualitative characteristics of the firm (Zhou et al.2002). Those can estimate indirectly sedimentation rates in the Delta or the Vessels (Verstraeten et al, 2004). These methods due to the simple structure, simple mathematical calculations and are able to work in a widely input data (Zhou et al.2007). However, linear or nonlinear regression model can use for suspended sediment load with relative accuracy of computational models which provide simple experimental models.

In recent years has occurred a great interest to investigate the possibility of using artificial neural network systems. Neural networks are powerful computational tool in organizing and establishing the relationship between the various intelligence capabilities. The use of the mapping capabilities of these systems in a multi-dimensional spaces and the analysis of the issues without resorting to the relations sophisticated mathematical difficulty can be useful in engineering. Artificial neural networks

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have been successful in dealing with issues such as system identification, function approximation, optimization and anticipating the results. Artificial neural network system based on data flexibility with different weights to the establishment of neural connections during the learning process is able to recognition complex and ambiguous issues especial issues that are not easily expressed in mathematical relationships.

A river system is an open system where the involvement of sophisticated forms of communication. The inherent characteristics of a basin and external factors affect the behavior of the river. The existence of multiple interactions, including the interaction moves and transported sediment and geomorphology of the basin parameters is important.

Watershed is the most essential natural scale regional units. An independent identity has defined the concept of river basin as a spatial unit has an effective role in the classification of human activities (Ramsht 2005). The purpose of this study was to develop modeling using artificial neural network approach to geomorphic agents and compare its performance with multiple regression methods. To the extent predicted by the models of sediment basin Comparison of the calculated values with observed values is explained by its comparative advantage.

2- Methodology

First, for removing diagnostics data calculate the residual R student index by using SAS software. Then were evaluated training data set and testing data set from wholly of data. The Statistical Modeling and Artificial Neural Networks are helping with SPSS software. Statistical methods used and designed to model both simple and multiple regression analysis. In simple regression best fit of the relationship between flow and sediment is taken of the relationship linear, inverse, exponential, logarithmic, quadratic, and the power basis of degree decision. This method measures the curve of known deposits or SRC.

This method is called MARS for short to multivariate adaptive regression sp-line. In the flow vector the power supply to the large number of independent variables into the geomorphological parameters using stepwise multiple regression analysis method to determine the model parameters have to be removed excluded variable or ineffective variable. So a geomorphological multivariate model is designed. In other words, each of the parameters in the geomorphology of the basin as a data point are being integrated with vector data such as statistics in a flood of new data are converted into a vector and new vectors is obtained base on multiple regression fit.

Artificial neural network model is used by utility neural network option of SPSS software. Neural network designed in this study were divided into two types depending on the input data. The first type of artificial neural networks designed using the instantaneous flow and sediment. Instantaneous flow in the network as the input and output system is designed as a moment of deposition. NGANN geomorphology of this network is called neural network for short. The second type of artificial neural networks designed using the elements used in the method of feeding is in March and the geomorphic parameters of this network is called for short GANN.

3- Discussion

Two statistics factor to evaluate the performance are RMSE (root mean square of error) and R square (determination index) of different models

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is possible. These factors can determine the value of the preferred models to the observed values and the predicted values. Notice to RMSE values and the R square shows relative advantage of models. The highest significant determination index, and the lowest error, is introduced the best method. To the value of the preferred methods, is determined respectively GANN, NGANN, MARS and SRC rate determination coefficients with 0.86, 0.83, 0.81, 0.76 and values of the error estimate 1.815, 2.031, 2.142 and 2.359.

Results showed the GANN estimated better with highest coefficient of determination (R2) of 0.862 and root mean square of error (RMSE) of 1.815 in compression to NGANN with 0.827 for R2 and 2.031for RMSE. performance value of regression models were weaker than ANN models with R2 of 0.759 and RMSE of 2.395 for SRC model And R2 of 0.811 and RMSE of 2.142 for MARS model. Therefore it was revealed not only ANN models but also regression models have performance value when combine with geomorphologic parameters.

4- Discussion

Comparison of statistical methods and neural network models shows neural network significant preference values in the estimation of daily moment sediment estimation. The difference between the performance of artificial neural and statistical methods can be defied with the ability to estimate and predict artificial neural networks for non-linear approximation with a low volume of data. However, the performance and accuracy of the regression methods follow of sample size and it challenge of statistical models. The artificial neural network models design by the low number of samples. Conclusion presented and ANN model by geomorphology parameters designed to help the River Basin behavior. It is worthy of the network with back propagation algorithm learning with one hidden layer and 2 neurons in the hidden layer with high ability to flow and sediment load simulation is running with minimal restrictions.

The results of the modeling of sediment load in the present study also confirmed that the results of previous studies in the review of previous studies presented in the introduction. To develop and improve deposition load modeling is necessary applying geomorphologic parameters of basin. The geomorphological characteristics of the basin are an essential element of effective and recommended for hydrological modeling.

Key word: Artificial neural network, flow, geomorphology, modeling, prediction, regression, Samandegan, sediment yield.

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