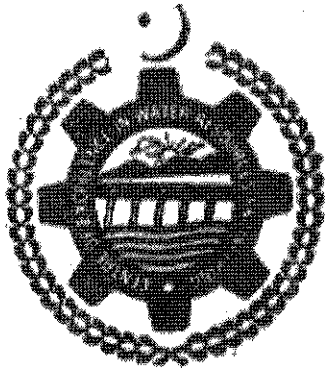
THESIS

ESTIMATION OF SEDIMENT LOAD FOR DIFFERENT STREAMS USING ARTIFICIAL NEURAL NETWORK



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ABSTRACT

Water is one of the most important necessities of life. If water is not available, no life on earth can survive. As the population of the world is increasing day by day, the fresh water demand is also increasing. The irrigation system of Pakistan is very big. It comprises of three major reservoirs, 16 barrages, 2 head works, 2 siphons across major rivers, 12 inter river link canals 44 canal systems (23 in Punjab, 14 in Sindh, 5 in NWFP and 2 in Balochistan) and more than 107000 water courses. Sediment deposition is one of the major problems in the irrigation system. It causes many problems. Movement of sediment in reservoirs mainly depends on water flow. Sediments are measured by different techniques.

A new approach was used in this study to determine the sediment load. The artificial neural network technique was used. The data used for the study was discharge, precipitation, temperature and sediment concentration. This data was collected from surface water hydrology project (SWHP) reports. The three years (1992 to 1994) data of Kanshi River at Gujjar Khan and five years (1991-1995) data of Jhelum River at Domel were used.

Two approaches were used for the study, one is artificial neural network (ANN) approach and the other is excel sheet model approach. In ANN model three No. of inputs (discharge, precipitation and temperature) were used. Sediment concentration data were used as target value. Different models were used, with different No. of inputs (3 inputs were discharge, precipitation and temperature) and hidden layer with different hidden neurons (one, two). Input and target values were entered in the model and no of hidden layers and other parameters for training were

set. The model was trained for the given number of inputs and target values. The training process stopped after it completed the given number of iteration or when the network stopped improving. The model produced output, errors, network weights and bias values as results. The results showed that the value of mean square error is high and the number of outputs produced was not complete. Thus ANN modeling results were found to be unsatisfactory.

Similarly ANN technique was used in the excel sheet model, weight and bias values and number of hidden layers were selected by trial and error procedure. Tan sigmoid transfer function was used in the excel sheet model. The results were better as compared to the ANN software. The results of the Kanshi river data from ANN model were used for the data of Jhelum. The weights and bias values of Kanshi River were used to calculate the sediment load for Jhelum River. The results showed that the errors generated by these models were negative which is not satisfactory so weight and bias values of one model are not applicable to the other models/ sites.

It is concluded that the neural network model did not yield the satisfactory modeling of river monthly sediment loads on the basis of river discharge, rainfall and temperature data in contrast to different scientists reported use of ANN model for different hydrologic predictions. The model did not train the network properly against the data entered as input and target in this study. It stops training the network before the assigned No of iterations. The values of weights and biases obtained after training the network from the ANN model are unrealistically high. In excel sheet model, the error values (MSE, RMSE) were smaller as compared to artificial neural network model. ANN model results are data specific and weight/parameters are not transferable to other data series/sites. Predictive capacity of ANN is uncertain.

It is recommended that the ANN model should be further developed so that it could be used for other data sets for prediction and not only for one data set. It should also produce some satisfactory results for monthly data sets as different scientists used this technique with daily data and produce satisfactory results. It should work in predictive mode as prediction for new scenarios at independent sites is the required tool and desired approach for engineers.