



Runoff Prediction of Gharni River Catchment of Maharashtra by Regression Analysis and ANN Tool Box

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ABSTRACT

The present study deals with the prediction of runoff of a river catchment of maharashtra by using linear regression analysis and self organizing maps by handling numerical data. The prediction is done by using past data record. A mathematical model has been developed for rainfall runoff correlation.

Keywords: watershed, Runoff. Artificial neural network, Regression analysis, gharni river

1. INTRODUCTION

Runoff data is most important for the effective management of water resources and also for solving many engineering problems such as forecasting stream flow for the purpose of water supply, flood control, irrigation, drainage, water quality, power generation, recreation, etc. again the rainfall to runoff transformation process is one of the most complex hydrologic phenomena to analyze due to the tremendous spatial and temporal variability of watershed characteristics and precipitation patterns, and the number of geomorphologic parameter that are involved in the modeling processes.

Various methods have been developed to simulate the rainfall runoff process in the catchment. They can be classified as conceptual model and data driven model. The conceptual models are based on the several assumptions so as to simplify the model as there may be many variables which are difficult to consider all and also to have acceptability along with their assumption. These models require data to evaluate their performance and acceptability, for example unit

hydrograph by SHERMAN (1932). On the other hand data driven models are developed and validated completely based only on the length of the data series, for example ANN and regression model.

2. STUDY AREA AND DATA SOURCE

Data has been collected from water resource dept govt of Maharashtra for the catchment of Gharni. A catchment of river Gharni is in Latur district of Maharashtra. Series of data for about 10 years has been used for linear regression analysis and for ANN tool.

3. METHODOLOGY

3.1 DEVELOPMENT OF MODEL

The homogeneity between the two catchment has been developed by using their geomorphological parameter like area, perimeter, stream length, odor number etc. after finding a suitable similar catchment with gharni river the predicted and actual values have been compared for different set of input.

3.2 REGRESSIONAL ANALYSIS TO DEVELOP THE MODEL

We have developed a rainfall runoff pattern of Limb river Fig (1.1) shows input as of six days of rainfall and one day runoff as output for this model.

$Q(t+1)$ is next day's runoff,

$X_1R(t), R(t-1), R(t-2), R(t-3) + X_5R(t-4) + X_6R(t-5)$ is the previous 6 days rainfall,

$X_7Q(t)$ is previous one day runoff,

X_i is the regression coefficient, and C is constant (intercept).

Fig (1.2) shows the regression analysis using artificial neural network tools on mat lab and presents the training, validation results and gives the value of regression 'R'.

Table No. 1:- Six days of rainfall and one day runoff as output for this model.

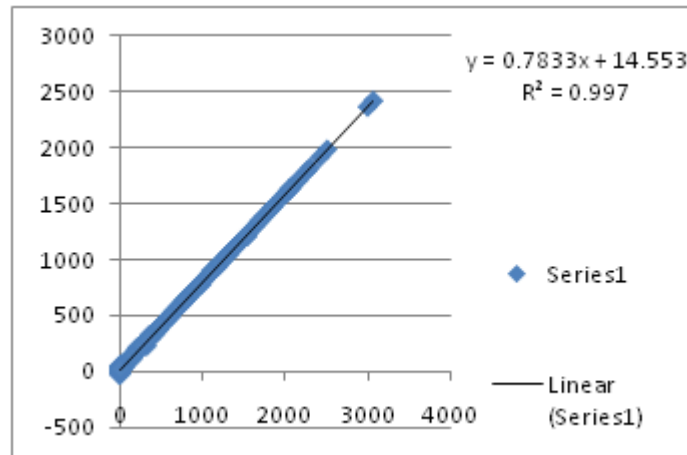
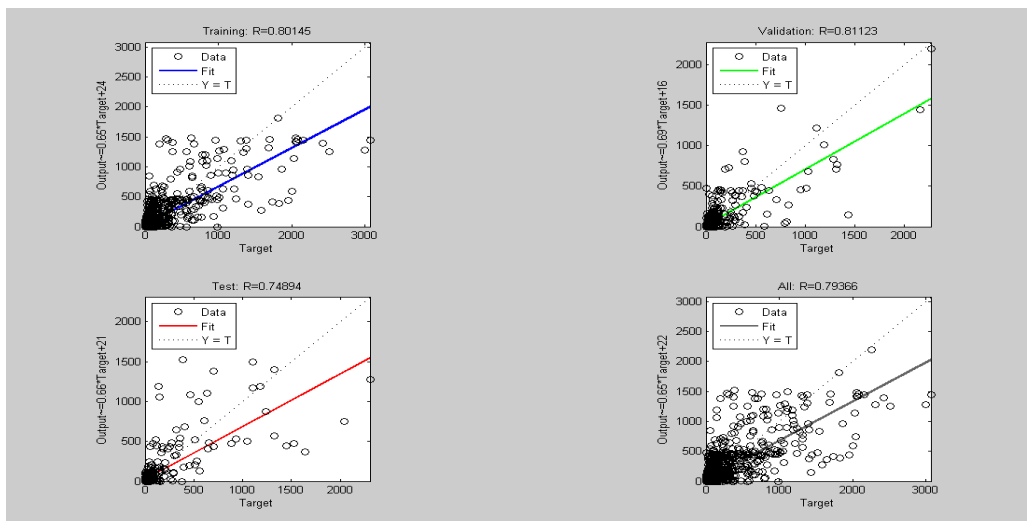


Table no. 2

Similarly we have used the data of yellamghat catchment and developed both the ANN and regression correlation.



4. RESULTS & SUMMARY

We found that the area as geomorphological parameter influence a lot over the rainfall runoff model. As when the parameters were classified in self organizing maps the group have been classified mostly based upon similar areas. Gharni river catchment has been grouped with yellamghat river catchment which having available rainfall runoff data.

The linear regression analysis done in excel and ANN tool box of MATLAB shows a result of $R = 0.997$ and $R = 0.7966$ respectively, which is acceptable.

CONCLUSION

The present study will lead to predict the runoff of a ungauged catchments of india. As this study has shown the area as the most influencing geomorphological parameter for classification of catchment, and thus we can develop a model to compare actual and predicted.

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