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Estimation of Flood Discharge in Darrehrood Sub-Basins of Ardebil Province Using Basin Physiographic Characteristics

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1- Introduction

Flood is a natural phenomenon, which threatens the life and properties of a large number of people all over the world, yearly. Flood discharge, regarding water resource exploitation, flood control, construction of dams, basin management, and hydrologic studies, is of high importance in studies. Therefore, the accuracy of these studies and the safety of waterworks and water structures depend on the methods of studies to a large extent. It is impossible to manage water resources in basins without the accurate determination of the peak flood discharge. The advances in flood estimation techniques have made it possible to use rainfall-runoff models to assess the hydrographic properties of the flood in watersheds and decrease the risks of the flood. In studies on water resources, it is of high importance to determine the flood discharge of different basins. Studies of Dile and Srinivasan (2014) and Hoseini *et al*. (2017) showed that basin level and rainfall can be the most important factor in runoff flow. Consequently, proper simulation and modeling of flood runoff are the important parameters in flood management in the region. However, it is necessary to use new models to determine flood hydrograph parameters. So, this study aimed to determine the peak flood discharge of the Darrehrood basin using regression mode for return periods of 10, 25, 50, and 100 years.

2- Methodology

Darrehrood basin is located in Northwest Iran. The basin is surrounded by mountains and is considered the main basin of Ardabil Province. It lies within 47°30' to 48°55' longitude and 37°45' to 39°42' latitude. Its area is approximately 12900 km^2. Discharge data were collected from 16 hydrometric stations with a statistical period of 15 years during 2001-2015. Incomplete data related to stations were completed using statistical methods and considering the best statistical distribution of floods in the studied sub-basins, floods with different return periods were calculated then the physiographic characteristics of sub-basins that affect flood rate include: area, slope, shape factor, height average, concentration- time, and curve number achieved using ArcGIS and WMS (watershed

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modeling system). To evaluate the model, maximum error (ME), root mean square error (RMSE), relative percentage error (ε), mean absolute error (MAE), coefficient of determination (R^2), Coefficient of residual mass (CRM), and model efficiency (EF) were used.

3- Results and Discussion

The model calibration results showed that the simulated peak discharge and flow volume are in good correspondence with the observed values, so that, the lowest goodness of fit (R^2) value in the return periods of 10, 25, 50, and 100 years were estimated to be 97, 96.6, 95.8 and 94.7 %, respectively. The results showed that the linear regression model with very good accuracy can predict the peak discharge in the sub-basins in Darrehrood using the physiographic parameters of the basin and with increasing the return period, the accuracy of the model is slightly reduced. Model evaluation indicators for the return period of 100 years include root mean square error (RMSE), relative percentage error (ε), mean absolute error (MAE), Coefficient of residual mass (CRM), and model efficiency (EF) were calculated 40.75, 52.12, 0.52, 0.92 and 0.62 respectively. Cross-validation diagrams showed that all models were partially underestimated and the scatter of points around the one by one axis was very suitable for the whole return periods. According to the paired t-test of the difference between predicted and actual values in different return periods in the level confidence of 1% are not significant.

4- Conclusions

The results of this study show that the model has good accuracy for estimating floods in sub-basins of Ardabil province.

Keywords: Regression, Physiographic characteristics, Watershed, WMS, GIS, Flooding, Darrehrood, Ardabil Province

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