



Received: 2019.12.24
Accepted: 2020.10.12

Predicting the Effects of Land-Use Changes on the Monthly Flow Using the Hydrological Model and Remote Sensing in the Kouzetopraghi Watershed, Ardabil

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1-Introduction

Land use change has significant effects on hydrological and ecological processes at different temporal and spatial scales. Many hydrological models have been developed based on the characteristics of the basin, available data and purpose of the study. To predict the characteristics of river flow, we need to develop the rainfall-runoff model to predict the flow for a long period of time. This study has been carried out for the modeling of monthly runoff using Temez model and then the effects of the different land use change scenarios on runoff components have been assessed.

2-Methodology

In this study the OLI-Landsat 8 satellite imageries, a digital elevation model (DEM) as well as meteorological and hydrological data were used for the modelling purpose. The land use classification was carried out using a support vector machine (SVM) method to create a map with 6 land use classes: dry farming, forest land, water body, pasture, built-up and irrigated agriculture. Then, the 10 management scenarios have been developed based on the field observations and taking into account the field characteristics, changes trend in the land use pattern, and the suitability of the study area for different land uses. In order to simulate the runoff, the Temez monthly hydrological model was employed. A 10-year (2002 to 2012) daily precipitation, temperature and runoff data were aggregated to monthly time scales. The calibration and validation steps were performed based on observed data. For calibration of the model, the first 6 years data and for model validation 4 years data were used. The parameters of the Temez model were calibrated based on the values obtained from the literature. First, the appropriate coefficients were found for each land use in the watershed and then the area of land uses in all scenarios were computed. Finally, the weighted average was calculated for the coefficients and appointment in Temez model.

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3-Results and Discussion

The accuracy of the land use map was quite high. A Kappa coefficient of 0.95 and an overall accuracy of 0.975 was obtained. The accuracy of the modeled runoff was presented using R^2 coefficient, which was 0.77 and 0.65, for calibration and validation stages, respectively. The results of considering the land use change scenarios on the monthly runoff showed that land use reclamation scenarios of 3, 4 and 5 had a decreasing effect on the runoff by 3.4, 3.3, and 4.1 percent, respectively. Also the land use scenarios of degradation condition, 9 and 10 scenarios, caused an increasing effect on the monthly runoff to 15.24 and 4.5 percent, respectively.

4- Conclusion

The monthly hydrological Temez model showed relatively good performance in estimating monthly runoff values based on the data used. The results can be considered in predicting the development and degradation conditions in the study area.

Keywords: Land Reclamation, Land Degradation, Kouzehtopraghi Watershed, Land use Change Scenario, Monthly Runoff Feature, Temez Model

5-References

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