Research Paper

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Comparing Optimization Methods of SIMHYD Model Parameters to Simulate Daily Flow Discharge in the Kouzetopraghi Watershed, Ardabil

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1-Introduction

Daily flow data are a prerequisite for water resources management, but it is not possible to measure it in many upstream watersheds. Accordingly, hydrological modeling is one of the important tools in estimating flow characteristics in ungauged watersheds. The discharge data and river flow regime are important as basic information for water resources management. Therefore, many indirect methods have been developed to simulate natural systems, complete and more accurate estimation and more complex calculations using computer models. Estimation of input parameters of hydrological models often requires optimization.

2-Methodology

In this study, different optimization algorithms have been used to evaluate the efficiency of the SIMHYD model. Therefore, the discharge data of Kouzetopraghi rive gauge station was selected as the study data (805 km2) located in Ardabil province. The daily data of rainfall, evapotranspiration of the meteorological stations in the study area were used to simulate the daily river flow data. According to the available river flow time series of the Kouzetopraghi river gauge station, a 10-years has been given to flow simulation procedure. A short period of data has been considered for the warmup period, seven years for calibration (2002 to 2008) and 3-years for the model validation process (2009 to 2011). Optimization methods including genetic algorithm, comprehensive competitive evolution, search pattern, multi-start search pattern, uniform random sampling,

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Rosenbrook, multi-start Rosenbrook optimization were evaluated based on statistical efficiency criteria.

3-Results and Discussion

The mean value of discharge values by genetic algorithms, multi-year pattern search, uniform random sampling, multi-start Rosenbark, Rosenbork, comprehensive competitive evolution, search pattern were 0.031, 0.023, 0.085, 0.032, 0.024, 0.032, 0.031, respectively. The results showed that the change of optimization algorithms has a significant effect on the calibration accuracy of the model, so that the values of the Nash-Sutcliffe efficiency criteria for the employed algorithms were 0.42, 0.31, -8.55, 0.38, 0.56, 0.023, and 0.24, respectively. The Rosenbrook algorithm had higher accuracy in calibrating the SIMHYD hydrological model compared to other algorithms used.

4-Conclusion

A part of simulation errors can be attributed to cases such as the higher extent of the study area. It should be noted that due to the existence of multiple precipitation and evapotranspiration stations, different modes of data entry combined from different stations were tested. In addition, the contributing area of different available stations was determined using the Thiessen method to determine the mean values of input parameters. Therefore, part of the modeling error can be related to the inconsistency of precipitation and runoff data due to the multiplicity of stations. In addition, it can be said that a part of the flow is diverted by the farmers in low flow periods, which causes errors in data recording and will affect modeling results.

Keywords: Calibration, Flow hydrograph, Rainfall-runoff, Kouzetopraghi watershed, Ardabil province.

5-References

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