



University of Zabol  
Graduate school  
Faculty of Engineering  
Department of Civil Engineering

**The Thesis Submitted for the Degree of M. Sc (in the field of Civil  
Engineering -Water Engineering)**

**Determining an Effective Calibration Method for  
Estimating Runoff Using SWAT (Case Study: Karkheh  
Basin)**

**Supervisors:**

Dr. M. Mollainia

Dr. A. Mostafaie

**By:**

M. Safavi

October 2020

## **Abstract**

Hydrological models are a useful tool in water resources management by providing simulations of hydrological properties. Due to the uncertainty of model parameters, calibration of such models is a major challenge. In this study, Karkheh River basin model was created using SWAT during 1993 to 2013 period with the aim of simulating runoff. Model calibration is used to improve the performance of the model. Observed runoff at six hydrometric stations, i.e., Polechehr, Ghorbaghistan, Doab Visian, Pol- Dokhtar, Pai-Pol and Seymareh are used in calibration process to determine model parameters. These parameters are selected through sensitivity analysis. Four uncertainty analysis methods including GLUE, Parasol, PSO and SUFI-2 have been used to perform uncertainty analysis, calibration and runoff simulation in this basin. Uncertainty, performance and computational efficiency of these methods have been compared. The results showed that the SUFI-2 method has the advantages of model analysis and uncertainty analysis and this method can be implemented with the smallest simulation results to achieve predictive uncertainty bands and proper model performance. Also, in none of used methods, acceptable evaluation criteria were obtained in the Pai-Pol station. The reason for not obtaining the evaluation criteria and the appropriate uncertainty band in this station, is the existence of Karkheh dam upstream of this station and lack of water data stored in dam reservoir and its amount of water output. In addition to the calibration algorithm, the type of objective function can also affect the calibration results. Therefore, the effect of selecting three different objective functions NSE, KGE and R2 on the simulation results was also investigated. The results of this study showed that change of the objective function did not lead to a significant variation in the runoff simulation results.

**Keywords:** Karkheh Basin, SWAT, PSO, Parasol, GLUE, SUFI2.