

EGU2020-13444

<https://doi.org/10.5194/egusphere-egu2020-13444>

EGU General Assembly 2020

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Parameter uncertainty analysis for streamflow prediction in a cascade hydropower basin of southwest China

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Semi-distributed model of SWAT based on physical-chemical spatial information has been an effective tool for simulating hydrological cycle in the basin whereas it can't completely restore all natural processes. Therefore, uncertainty analysis is needed to be conducted in order to achieve the reliability of the model. Yalong River Basin (YLRB), which is listed as the top ten hydropower bases in China, contains abundant water resources with plentiful runoff. Here a case study in YLRB was conducted to explore the parameter uncertainties of the SWAT model to runoff simulations based on multiple optimization algorithms. The following results were obtained: 1) setting the same objective function of Nash-Sutcliffe Efficiency, three optimization methods including Sequential Uncertainty Fitting version 2 (SUFI-2), Generalized Likelihood Uncertainty Estimation (GLUE) and Particle Swarm Optimization (PSO) all performed satisfactory fitting results and produced similar parameter ranges in YLRB, while SUFI-2 achieved better uncertainty analysis, followed by PSO and the last GLUE; 2) five general sensitive parameters to model output were ALPHA_BF, CH_K2, SOL_K(1), GW_REVAP and ESCO based on above three algorithms; 3) from the contribution network analysis in economics, the positive correlation between ALPHA_BF and CH_K2 exhibited the highest weight among all parameter relationships; and 4) the much lower sensitivity of parameter CN2 to streamflow in YLRB revealed that most commonly modified parameter CN2 was less applicable to land with adequate surface water than dry land. This work will be conducive to further hydrological analysis based on a reliable fitting model for this hydropower watershed. Additionally, this work will provide references and insights for sensitive parameter modification and prediction uncertainty reduction of streamflow simulation furthermore contributing to an optimal water resource management.