EGU2020-3038
https://doi.org/10.5194/egusphere-egu2020-3038
EGU General Assembly 2020

Structural noise analysis in the simulation of hydrological models using a synthetically defined output variable

Andrej Vidmar and Mitja Brilly
University of Ljubljana, FGG, KSH, Ljubljana, Slovenia (avidmar@fgg.uni-lj.si)

The calibration of the parameters of the conceptual model based on the Gauss-Marquardt-Levenberg (GLM) procedure in combination with singular value decomposition and Andrey Tikhonov regularization allows the calculation of the exact parameter values by synthetically determined flows. With this procedure, the calibration noise is practically eliminated in simulating phenomena based on the measured values of the output variable. The noise in the calculation results is practically the same when calibrating and validating the results. The residual noise in the results is due to the noise of the concept of the model, the design of the model, and the accuracy of the measurements themselves.

An analysis based on synthetically determined discharges is selected for the study. Instead of measurements, we calibrated the model by calculated discharges with known parameters and performed the calibration procedure. Thus, we eliminated measurement noise, model conception noise, and model design noise from the results. From a mathematical standpoint, perfect calibration can be expected in the calibration process, or the deviations are due to the noise contained in a particular calibration procedure. The differences between the calculation and the synthetic result contain only the noise of the calibration process.

For the hydrological model, we have chosen a version of the HBV program called HBV-light. The model is partially distributed since it allows the basin to be divided into smaller sub-basin units. Each sub-basin can be further subdivided into smaller areas based on land use and altitude. The model includes the following computational procedures that describe hydrological processes: snow accumulation and melting, evapotranspiration assessment and soil moisture calculation, subsoil runoff, and water flow transformation in a riverbed (Bergström, 1995; IHMS, 1999).

The calculations were performed on the HBV-Light software on the test model, Dreta river model, and the Savinja river basin model, a tributary of the Sava River in Slovenia. The test model has 16 parameters, and we have achieved full calibration accuracy with the GLM calibration process. The Dreta River model on the head part of the Savinja River Basin contains 34 parameters. The results of the calculations revealed weaknesses in the concept of the model. The Savinja River Basin subdivided into 77 sub-basins and results of the calculations showed the benefits of using regularization when calibrating the model.