IWRM2018-124
8th International Water Resources Management Conference of ICWRS

The possibility of calibrating SWAT hydrological model using streamflow data of a short period

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Nowadays physically based distributed hydrological model are prevailing for hydrological simulation in changing environment. Similar to conceptual models, in data-sparse basin, they also face the problem of lacking streamflow data for calibration. Short period of observations (less than one year) may be obtained from fragmentary historical record of past-existed gauging station or from temporary gauging during field surveys, which is possibly valuable for model calibration. In this study, we explored how using limited continuous daily streamflow data might support application of physically based distributed model in data-sparse basin. The influences of the length of observations on the calibration of the widely applied Soil and Water Assessment Tool (SWAT) model are evaluated in two Chinese basins with different climatic and geophysical characteristics. The evaluated are done by comparing calibration using short periods of data with calibrations using three year data, which are treated as benchmark calibration in the two basins respectively. To ensuring the differences of model simulations exclusively come from differences in calibration data, the Generalized Likelihood Uncertainty Analysis (GLUE) scheme is employed as the tool for automatic calibration and uncertainty analysis. In both basins, contrary to the common understanding of using data of several years, records with lengths less than one year can effectively calibrated the model, i.e. achieve similar performance as benchmark calibrations. And the wet Jinjiang Basin requires less data (one month) than the arid Heihe Basin (six months). Even the two basins are very different, they all demonstrate that data from wet season and wet year performs better that the one from dry season and dry year. And length of calibration data show minor influences on the rank of parameter sensitivity. The results of this study indicate that appealing to short period of observations is a promising solution to the calibration problem of physically based distributed model in ungauged basin and also more researches similar to be conducted in this study are required to gain more general understandings about how many observations are needed when applied to real world application to data-sparse basin.