Jun 26th, 10:40 AM - 12:00 PM

Efficient and Robust Sensitivity Analysis of Complex Environmental Models: An Application for Water Productivity simulations using SWAT Model

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iEMSs International Congress on Environmental Modelling and Software

9th International Congress on Environmental Modelling and Software
Fort Collins, Colorado, USA, Mazdak Arabi, Olaf David, Jack Carlson, Daniel P. Ames (Eds.)
https://scholarsarchive.byu.edu/iemssconference/2018/

Paper Title: Efficient and Robust Sensitivity Analysis of Complex Hydrological Models: An Application for Water Productivity Simulations using SWAT Model

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Abstract: Complex agro-environmental models have a large number of parameters which are problematic during calibration. A sensitivity analysis can help identify the most sensitive parameters which should be included in the calibration process. Depending on the number of parameters being analysed and the method used, the required number of simulations varies from moderate to very large. Consequently, the number of simulations, number of years run and size of the model affect the computation power and thus, computer time required. This often limits the number of parameters and/or number of simulations, hence the robustness of the analysis. A possible solution is to conduct an initial screening of parameters using a method that requires fewer simulations and therefore can include more parameters. Subsequently, a more robust method can be performed on the obtained fewer sensitive parameters using substantially more simulation runs. Additionally, cloud computing and parallelisation can be used to reduce the computation time taken. SWAT, a complex hydrological model, has a large number of parameters that influence Water Productivity (WP) estimations, defined as the ratio of production (calculated as biomass increment or agricultural crop yield) over water consumption (calculated as evapotranspiration). To aid the calibration process, a sensitivity analyses for WP variables at the basin scale was conducted investigating the possible benefits of using: a two-step method with an initial screening (LH-OAT) prior to running a more advanced quantitative method (SOBOL); parallelisation and cloud computing. Initial results indicate substantial time benefits using the two-step method including parallelisation and cloud computing.

***Keywords**:* Water Productivity; Sensitivity Analysis; Parallelisation; Cloud Computing.