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Evaluation of prediction uncertainty for modeling processes using RIBS hydrologic distributed model: the Besos river basin case study (Spain)

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This paper describes an automated parameter estimation, a multiple-objective global optimization and evaluation of prediction uncertainty for the RIBS (Real-time Interactive Basin Simulator) model, applied to the Besos river basin. The estimation of quantitative precipitation from meteorological radar or satellite can improve the results of hydrological models, thanks to an indirect estimation at high spatial and temporal resolution. In this work, radar data, with 15-minute temporal resolution, are used to feed the distributed hydrological model RIBS. This ensemble of rainfall data is used to calibrate the RIBS model by means of a probabilistic methodology. The Besos river catchment has an area of 1020 km2. It is located in Barcelona area, and it is a typical example of Mediterranean complex catchment. After a serious flood in 1962, great investments have been done in order to monitor the catchment for hydraulic risk mitigation purposes. The river basin is now instrumented by several telemetric rain and streamflow gauges, and the area is also well covered by the National Weather Service radar system. A sensitivity analysis has been done by comparing the different results obtained with the model with measured values in streamflow stations. Manual and automated parameter estimation and evaluation of prediction uncertainty for the process modeling of the Besos River watershed is described. Simulated streamflow is strongly sensitive to 5 parameters: hydraulic conductivity, initial soil moisture, soil anisotropy coefficient, velocity of stream flow and velocity of overland flow. Furthermore parameter sensitivity is dependent on site-specific climate and soil conditions. A Global Sensitivity Analysis (GSA) is used to compare simulated stream flow with observed stream flow. The uncertainty associated with all model parameters, including those not estimated by calibration, is considered in the evaluation of prediction uncertainties.