Improving probabilistic flood forecasting through a data assimilation scheme based on genetic programming

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RESUMEN:

Opportunities offered by high performance computing provide a significant degree of promise in the enhancement of the performance of real-time flood forecasting systems. In this paper, a real-time framework for probabilistic flood forecasting through data assimilation is presented. The distributed rainfall-runoff real-time interactive basin simulator (RIBS) model is selected to simulate the hydrological process in the basin. Although the RIBS model is deterministic, it is run in a probabilistic way through the results of calibration developed in a previous work performed by the authors that identifies the probability distribution functions that best characterise the most relevant model parameters. Adaptive techniques improve the result of flood forecasts because the model can be adapted to observations in real time as new information is available. The new adaptive forecast model based on genetic programming as a data assimilation technique is compared with the previously developed flood forecast model based on the calibration results. Both models are probabilistic as they generate an ensemble of hydrographs, taking the different uncertainties inherent in any forecast process into account. The Manzanares River basin was selected as a case study, with the process being computationally intensive as it requires simulation of many replicas of the ensemble in real time.

Key words:

Adaptive management; calibration; computer simulation; ensemble forecasting; flood forecasting; numerical model; probability.