water
Special Issue

Uncertainty Analysis and Modeling in Hydrological Forecasting

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Dear Colleagues,

Hydrological extreme events are at the origin of a range of natural hazards, such as destructive inundation disasters caused by floods or famine due to water and food scarcity caused by prolonged drought conditions. Assessing future scenarios to enable decision-makers to implement mitigating structural or non-structural actions requires forecasting water levels and/or discharges and/or water volumes with sufficient lead time, as well as predicting the probabilities of occurrences of critical hydrological events.

Accurate, deterministic forecasts of relevant variables, such as flood levels, discharges, and water volumes, are near-impossible to be achieved. Simulated hydrological responses of river basins remain highly uncertain, due to the presence of a broad variety of schematizations, erroneous measurements, and prior assumptions.

Although great improvements have been achieved in the last decades in hydrological modeling, today, it has been recognized that the most important source of uncertainty remains with the meteorological forcing due to the high, uncertain spatial distribution and intensity of precipitation. Errors in either conceptual or physically-based models' representations of watershed processes and the lack of knowledge of initial and boundary conditions (such as, for instance, the antecedent soil moisture conditions or non-monitored lateral inflows) also strongly affect the quality of forecasts.

Systematic uncertainty analysis aims at quantifying these sources of uncertainty in order to improve model structures and parameterizations. Alternatively, Bayesian approaches aim at assessing predictive probability distributions for quantities of interest, thus providing quantitative tools for decision-makers in assessing the likelihood of an event and the most appropriate alleviation measure.

Contributors are encouraged to present state-of-the art research to help the wider user community to include uncertainty in hydrological forecasts and to use such forecasts in supporting the decision-making process.

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