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Continuous and Binary Hydrological Uncertainty Processors

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When dealing with flood emergency management, operational decisions may lead to dramatic consequences (economical losses, casualties, etc.) and the emergency managers are supposed to take decisions under the stress of their uncertainty on the evolution of future events. In this context, the knowledge and the proper use of the predictive uncertainty helps in improving the rate of success of decisions.
The prediction problem can be tackled with two different approaches, depending on the nature of the decision problem to be solved. The first approach relates to continuous processes, which require the estimation of the entire predictive probability function: for instance when dealing with flood damages, which vary with the water level reached, the expected value of these damages can only be estimated if the full probability density of water levels is available. There are other cases where only the integral above or below a threshold of the predictive density is required. This is the case for instance when one has to decide, based on model forecasts, whether the flood event will exceed an alert threshold or not; these cases can be described in discrete probability terms.
The paper presents a the results obtainable with the continuous Model Conditional Processor (MCP) as well as with the Bayesian Univariate Binary Processor (BUBP) in the assessment of their effectiveness at deciding if an alert threshold will be overtopped in the Po River in Italy.