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Verification of probabilistic forecasts applied to the validation of a hydrologic model

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A methodology to validate probabilistic forecasts is proposed in this paper, quantifying its application as a decision-making tool for flash food early warning in real-time. Most validation methodologies applied in practice only check for the coincidence of the event that really occurred with the prediction of maximum probability value. Under this approach, a large portion of the information contained in the probabilistic forecast is ignored. In the methodology presented here, the full set of probabilistic results is used. The methodology is based on an analysis of the joint distribution of the forecasts made by the model and the events that really occurred. The probabilistic forecast quality is defined through ten attributes, quantified by different measures and graphics that evaluate the 'predictive probability distribution function'. Every attribute is quantified by at least one measure or graphic. The new methodology has been applied to the probabilistic results of a hydrologic model based on Bayesian networks developed for the Guadalhorce basin (Spain). In this model, the most important hydrological concepts are represented by discrete random variables and the links between them are represented by their direct causal influence, quantified by conditional probabilities. Since the real data set available for the test basin is too short for the verification of probabilistic forecasts, measured values have been extended with simulated results through a Monte Carlo experiment, coupling a stochastic rainfall generator and a deterministic hydrologic model, in order to generate a data set that can be used to test the validation methodology.