Ensemble short-term rainfall–runoff prediction and its application in urban flood risk mapping

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Abstract This paper describes the ensemble approach to account for the uncertainty in both rainfall and hydrological short-term prediction. The range of probabilistic products generated by ensemble prediction and their potential for obtaining flood risk estimates is demonstrated. An ensemble rainfall prediction is developed by perturbing the initial condition of the radar echo extrapolation model. The ensemble members are subsequently considered as uncertain input of the distributed hydrological model. Uncertainty in rainfall–runoff model parameters is assessed by the generalized likelihood uncertainty estimation (GLUE) method. The methodology is demonstrated through case studies in the Kofu urban river basin, Japan. The results reveal that plausible results can be achieved, thus indicating that this approach could serve as a reliable method for estimating the uncertainty range in short-term prediction of runoff dynamics. When utilized along with the flood damage model, we highlight the value of ensemble prediction for deriving flood risk information through risk mapping.

Key words ensemble prediction; flash flood; GLUE; parameter uncertainty; probabilistic prediction; risk