Rainfall thresholds for flood forecasting in Italy: a Bayesian and Copula based methdology

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The aim of this work is present how to determine the rainfall thresholds for flood forecast and show their operative use. The computation of the rainfall thresholds is based on the minimization of a Bayesian Loss Function of the discharge conditional upon the state of saturation of the catchment. Rainfall thresholds are here defined as the cumulated volume of rainfall during a storm event which can generate a critical water stage (or discharge) at a specific river section. When the rainfall threshold value is exceeded, the likelihood that the critical river level (or discharge) will be reached is high and consequently it becomes appropriate to issue a flood alert; alternatively, no flood alert is going to be issued when the threshold level is not reached. In other words the rainfall thresholds must incorporate a "convenient" dependence between the cumulated rainfall volume during the storm duration and the possible consequences on the water level or discharge in a river section. The term "convenient" is here used according to the meaning of the decision theory under uncertainty conditions, namely the decision which corresponds to the minimum (or the maximum) expected value of a Bayesian cost utility function. There are described two possible approaches for the same methodology: (a) using Copula Transform or (2) using the Normal Quantile Transform. The main difference of the two is the requirements in terms of data, i.e. the timeseries of rainfall and discharge. Application of the methodology and comparison with other methodologies are provided for a catchment in Italy.