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A practical flood warning system based on rainfall threshold in ungauged basins

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Flood warning systems frequently use flow or water level measurements at given river sections, which obviously is not the case of ungauged catchments. A methodology is proposed based on quantitative precipitation forecast related to critical rainfall threshold values, resulting in a straight forward alert system applicable by non-specialists or stakeholders. Rainfall thresholds are defined from cumulative storm rainfall which can generate a critical water stage (or discharge) at specific river sections producing significant damages. Previous estimation of such threshold followed several modelling steps. Firstly, the stochastic rainfall model Bartlett-Lewis was calibrated from hourly rainfall data. Then, temperature series were model with a simple autoregressive model accounting for monthly and daily cycles. Temperature and rainfall hourly synthetic series were used as inputs for TOPKAPI distributed physically based rainfall-runoff model, whose parameters were estimated from physical characteristics of the basin (basically types of soils present and land uses). Synthetic continuous simulation was performed using such stochastic inputs, achieving a realistic hydrological representation of the basin response along time, with continuous account for soil humidity conditions. An identification criterion to select independent storm events was applied over the series, providing values of initial water content, total cumulative rainfall and duration, maximum rainfall intensity, peak flow, and time-to-peak. Such set of values basically provide a good description of the most relevant properties of the given rainfall-runoff event. Further simplification was obtained reducing it to a reduce number of classes (i.e. soil moisture conditions were included in AMC I, II and III states). The final analysis yields to simple rules allowing the application of a practical flood warning system, which are easily applied from only antecedent precipitation and meteorological forecasts, without requiring the running of any hydrological model.