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Analysis and stochastical modelling of extreme rainfall events. Application in the spanish mediterranean region

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In the context of hydrological engineering it is crucial to dispose of cuantitative methods which are, not only able to provide an estimation of the amount of rainfall on a certain geographical region or hydrographic basin occured during a past event, but also to simulate future episodes in order to check the reliability of the involved infrastructure and the water resource system as a whole. Due to the essentially chaotic nature of the rainfall process and its distribution in space-time, specially during convective extreme events, typical for coastal mediterranean regions, a stochasical multidimensional model for analysis and simulation purposes is proposed.
First, a detailed statistical analysis of the most important rainfall events of the last 20 years over the study area (Cape Nao - Spain), is presented. The precipitation data comes from an automated rain gauges system (S.A.I.H. Jucar) with high temporal resolution. The statistics calculated, such as normalized mean function, temporal autocorrelation or spatial covariance, are used to estimate the parameters of the RAINGEN model (Salson and Garcia-Bartual, 2003) via the method of moments. The RAINGEN model is an event based, stochastic model, distributed in space and time oriented to the simulation of extreme rainfall events of convective nature, as the rain cell is the central element of the synthetic generation. Having a set of characteristic parameters obtained from the observed events, a wide range of storms are generated obtainig a variety of artificial episodes, which have similar statistical properties to the analysed ones, but an amazingly huge variability in event magnitude and spatiotemporal distribution. The generated extreme events have to be in the first place filtered, in order to discard storms presenting unrealisticly high rainfall intensities, due essentially to the posible rain cell clustering, inherent to the 2-dimensional Poisson process wich governs their birth. The episodes are then sorted and clasified according to their convectivity (spatial concentration) and magnitude, assigning to each storm and each subcatchment in the generation region a return period, based on a regional frequency analysis of the rainfall records. Each event is introduced then as input for a spatially distributed rainfall-runoff model in order to infer, amog others, an statistical analysis on flows, flood plain areas or the relationship between convectivity of the rainfall event with the magnitude of the flood.