EXTENDING THE LEAD-TIME OF REAL-TIME FLOOD FORECASTS BY USING A STOCHASTIC RAINFALL GENERATOR

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The problem of extending the lead-time of flood forecasts on small catchments has been tackled by linking a stochastic rainfall generator to a lumped rainfall-runoff model - "Topmodel". This linked system was applied to the Mediterranean catchment of the Gardon d'Anduze (area 545 km^2), which is a mountainous region famous for very intense rainfall and flash-floods. This work formed part of the CEC-EPOCH-AFORISM study of flood mitigation, which focuses on integrated forecasting systems. Parameters of the stochastic rainfall generator, which is based on renewal processes, were determined by fitting CDFs of physical variables, such as storm duration, volume, inter-storm duration etc. The generator was then used in real-time and its ability to take into account past rainfall made it possible to generate realistic future scenarios for the 12 forthcoming hours. Thus, the linked system - rainfall generator to rainfall-runoff model "Topmodel" - provided future discharge scenarios conditioned by past observed rainfall. A confidence interval for the flood forecasts was fitted and showed that the system was reliable 4 hours ahead but could be useful for decision-making beyond theis period - up to 12 hours ahead. Futhermore, it was shown that the system would be greatly improved if better rainfall forecasts were available.

THE OBSERVER'S PROBLEM IN MULTIFRACTALS: RAINFALL MODELS AND SPURIOUS SCALE BREAKS

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Detector limitations present fundamental problems in the observation of multifractals. First, establishing the scaling behaviour demands a that a wide range of scales be investigated, while the highly intermittent nature of most multifractals requires a wide dynamic range in detector response. This double requirement places large demands on the detector's capabilities. The typical case will be that the detector cannot record all of the available information, missing either the extreme events or the small input signal. It is of fundamental importance to understand what multifractals "look like" when viewed through a detector with finite dynamic range and finite range of scales.

A new framework and (theoretical) techniques are developed for handling these fundamental difficulties. The most common situation, a non-zero minimum detectable signal level that "thresholds" out the low amplitude signal information, is developed and solved theoretically. This framework provides exact formulae for predicting the errors and biased estimates resulting from thresholding. The results will be discussed in the context of rainfall measurements.

PDS-MODELLING AND REGIONAL BAYESIAN ESTIMATION OF EXTREME RAINFALLS

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The Partial Duration Series method is employed in the modelling of extreme rainfall data from a country-wide system of raingauges in Denmark. The method is applied to two variables: the total precipitation depth and the maximum 10 minutes rain intensity of individual storms. On basis of the at-site modelling a regional analysis is carried out. It is shown that the previous assumption of spatial homogeneity of extreme rainfalls in Denmark cannot be justified. In order to obtain an estimation procedure at non-monitored sites and to improve at-site estimates a regional Bayesian approach is adopted. The empirical regional distributions of the parameters in the Partial Duration Series model are used as prior information. The application of the Bayesian approach is derived in case of both exponential and generalized Pareto distributed exceedances.

APPLICATION OF THE ANALOGUES METHOD TO CATALONIA: PRELIMINARY ASPECTS.

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In order to test the analogues method developped by Electricité de France (EDF), its application to Catalonia is being attempted. A rainfall database from 1950 has been compiled and different events have been selected. They must all fulfill the condition that a threshold of a 100 mm/24 h has been exceeded, wich means they belong essentially to convective situations of torrential character. The analogues for the corresponding dates have been identified and the sufficiently representative sample of these has been analysed from the meteorological standpoint. The main elements to be consider are the distributions of both temperature and moisture in the lower an middle troposphere as well as the advection of several parameters. The purpose of this paper is to discuss the goodness of the method under test in these situations and to define the main discriminant elements.

RAINFALL CLASSIFICATION TO IMPROVE THE THRESHOLD METHOD FOR ESTIMATING MEAN AREAL RAINFALL

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An objective classification technique is proposed to build homogeneous rainfall samples to which areal rainfall algorithms can be applied. This technique is an extension to the rainfall spatial distribution of a crossing method applied earlier to characterise rainfall temporal distributions. A profile curve for the spatial distribution is defined and the area under this curve is shown to allow for a classification of rainfall events in the Sahel, based on their spatial intermittency. The relevance of this classification is then tested for estimating areal rainfall over a GCM grid mesh sized area, using the so-called threshold method. Comparing the results of the estimation before and after classification, one can conclude that, at least for Sahelian rainfields, a proper classification is able to reduce rainfall estimation errors based on radar or satellite data.

STOCHASTIC RAINFALL FORECASTING BY CONDITIONAL SIMULATION USING A SCALING STORM MODEL

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Based on the recently developed Scaling Model of Storm Hyetograph, a conditional simulation scheme is presented, which can be used for stochastic forecasting of the temporal evolution of rainfall. The scaling model is fitted to hourly rainfall data of Greece and Italy. In addition, the model is tested for capturing statistical properties that are not explicitly used for the fitting. The scheme is formulated so as to use any information known for the rainfall event, as a condition for the simulation. The conditional simulation scheme is applied in two steps: first we generate the duration and total depth of the event and then we disaggregate the total depth into sequential hourly depths. Two different types of conditions are examined. The first one concerns the incorporation of preceding hourly rainfall depths. The second is related to information given by meteorological forecasts from which we can approximately estimate the duration and total depth of the event.