Geophysical Research Abstracts,
Vol. 11, EGU2009-10256, 2009
EGU General Assembly 2009

The Return Periods of Hydro-Meteorological Extremes: Comparison of two Stochastic Models of Heavy Rains

I. Tchiguirinskaia (1,2), P. Arnaud (2), D. Schertzer (1,3), and J. Lavabre (2)

(1) Univ. Paris-Est, Cereve ENPC-UPVM-ENGREF, 6-8 avenue Blaise Pascal, Champs sur Marne, F 77455 Marne-la-Vallee cedex 2, France; (ioulia@cereve.enpc.fr), (2) CEMAGREF, 3275 route de Cezanne CS 40061, 13182 Aix-en-Provence, Cedex 5, France, (3) Meteo-France, 2, Avenue Rapp, 75007 Paris, France

The estimation of return periods for rainfall extremes requires a model that undertake the natural (unperturbed) statistical behaviour of the probability tails and the possible clustering (including possible long-range dependencies) of the extremes. Appropriate stochastic approaches for handling such non classical variability over wide ranges of time and space scale do exist.
We discuss and compare two stochastic methods to model heavy rainfalls for accumulation durations ranging from 1 hour to 72 hours. The SHYPRE method (Simulation d'Hydrogramme pour la PREdétermination des crues) is developed by CEMAGREF and uses stochastic simulations to reconstruct the high resolution time series of strong rainfall episodes. The MultiFractal Method (MFM) is based on the analytical results obtained from the theory of stochastic processes. Both methods use a given primary statistical analysis of a limited length rainfall time series to estimate the model's parameters. Then the stochastic type modeling is used to infer the quantiles for the return periods ranging from 1 to 1000 years.
Based on the quantile estimations for different return periods, we have performed a detailed comparison of SHYPRE and MFM results for 252 French meteorological stations. A particular attention was given to Pyrenees, Rhone Valley, Cevennes and Alps - the four south France areas with homogeneous precipitation regimes. It is often the case that for larger return periods the empirical quantiles obtained from long hydro-meteorological records are much more important than those inferred from Gumbel law. It can be shown theoretically that MFM yields a power-law probability of the extremes, often called the 'fat tail' distribution. The SHYPRE model generally leads to a hyper-exponential asymptotic behavior. The comparison of the quantile estimations has demonstrated that both models yield quite comparable results, in particular for the larger return periods (100-1000 years).
It is important to mention that the spatial distributions of the rainfall quantiles corresponding to 252 French meteorological stations illustrate strong space variability for all durations and return periods. Thus, in conclusion we discuss the consequences of such variability for the return periods of regional floods, in particular flashfloods in south France areas.