Geophysical Research Abstracts
Vol. 13, EGU2011-9226-1, 2011
EGU General Assembly 2011

Stochastic generation of peak-to-volume ratio. Application to SCHADEX method for design flood estimation.

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EDF (Électricité de France) design floods of dam spillways are now computed using a probabilistic method named SCHADEX (Climatic-hydrological simulation of extreme floods, Paquet et al., 2006). This method aims at estimating extreme flood quantiles by the combination of a weather pattern based rainfall probabilistic model (Garavaglia et al. 2010, Garavaglia et al., 2011) and a conceptual rainfall-runoff model. Extreme flood quantiles are estimated through a runoff generation process that combines a stochastic generation of rainfall events and a continuous rainfall-runoff simulation.

Extreme flood volume are generally simulated at a broad time-step, depending on available data-sets, rather than on a time-step adapted to watershed time response properties. However, for hydrological design, instantaneous (i. e. hourly) flood values and design flood hydrographs (Mediero et al., 2010) are required. In the context of SCHADEX method, flood peak values are computed using a constant peak-to-volume ratio, identified on an observed hydrographs collection. Unfortunately, in most of the studied watersheds, a high variability of peak-to-volume ratio is observed. To take into account this variability, we propose an alternative model based on the relationship between peak-to-volume ratio and the dynamic of flood events.

In this paper, we present a stochastic generation model of peak-to-volume ratios introduced into the continuous rainfall-runoff simulation processes. This model allow to compute directly the cumulative distribution function of floods peaks. Then, this development is illustrated throughout several examples of watersheds located in the South-East of France and improvements of extreme instantaneous flood quantiles estimation are shown.

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