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An integrated simulation method for flash-flood risk assessment: 1. Frequency predictions in the Bisagno River by combining stochastic and deterministic methods

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Abstract. A stochastic rainfall generator and a deterministic rainfall-runoff model, both distributed in space and time, are combined to provide accurate flood frequency prediction in the Bisagno River basin (Thyrrenian Liguria, N.W. Italy). The inadequacy of streamflow records with respect to the return period of the required flow discharges makes the stochastic simulation methodology a useful operational alternative to a regionalisation procedure for flood frequency analysis and derived distribution techniques. The rainfall generator is the Generalized Neyman-Scott Rectangular Pulses (GNSRP) model. The rainfall-runoff model is the FEST98 model. The GNSRP generator was calibrated using a continuous 7-years' record of hourly precipitation measurements at five raingauges scattered over the Bisagno basin. The calibrated rainfall model was then used to generate a 1000 years' series of continuous rainfall data at the gauging sites and a flood-oriented model validation procedure was developed to evaluate the agreement between observed and simulated extreme values of rainfall at different scales of temporal aggregation. The synthetic precipitation series were input to the FEST98 model to provide flood hydrographs at selected cross-sections across the river network. Flood frequency analysis of the annual flood series (AFS) obtained from these simulations was undertaken using L-moment estimations of Generalized Extreme Value (GEV) distributions. The results are compared with those determined by applying a regional flood analysis in Thyrrhenian Liguria and the derived distribution techniques to the Bisagno river basin. This approach is also useful to assess the effects of changes in land use on flood frequency regime (see Rosso and Rulli, 2002).

Keywords: flood frequency, stochastic rainfall generator, distributed rainfall runoff model, derived distribution

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