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Stochastic modeling of hourly rainfall times series in Campania (Italy)

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Occurrence of flowslides and floods in small catchments is uneasy to predict, since it is affected by a number of variables, such as mechanical and hydraulic soil properties, slope morphology, vegetation coverage, rainfall spatial and temporal variability. Consequently, landslide risk assessment procedures and early warning systems still rely on simple empirical models based on correlation between recorded rainfall data and observed landslides and/or river discharges. Effectiveness of such systems could be improved by reliable quantitative rainfall prediction, which can allow gaining larger lead-times. Analysis of on-site recorded rainfall height time series represents the most effective approach for a reliable prediction of local temporal evolution of rainfall.
Hydrological time series analysis is a widely studied field in hydrology, often carried out by means of autoregressive models, such as AR, ARMA, ARX, ARMAX (e.g. Salas [1992]). Such models gave the best results when applied to the analysis of autocorrelated hydrological time series, like river flow or level time series. Conversely, they are not able to model the behaviour of intermittent time series, like point rainfall height series usually are, especially when recorded with short sampling time intervals. More useful for this issue are the so-called DRIP (Disaggregated Rectangular Intensity Pulse) and NSRP (Neymann-Scott Rectangular Pulse) model [Heneker et al., 2001; Cowpertwait et al., 2002], usually adopted to generate synthetic point rainfall series.
In this paper, the DRIP model approach is adopted, in which the sequence of rain storms and dry intervals constituting the structure of rainfall time series is modeled as an alternating renewal process. Final aim of the study is to provide a useful tool to implement an early warning system for hydrogeological risk management. Model calibration has been carried out with hourly rainfall hieght data provided by the rain gauges of Campania Region civil protection agency meteorological warning network.

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