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Rainfall continuous time stochastic simulation for a wet climate in the Cantabric Coast

JUAN P REBOLE (1,,), JOSE J LOPEZ (,), ADELA GARCIA-GUZMAN (,)

(1) Departamento de Proyectos e Ingeniería Rural. Universidad Pública de Navarra. Campus de Arrosadía, 31006-PAMPLONA (jreboler@navarra.es), () Departamento de Proyectos e Ingeniería Rural. Universidad Pública de Navarra. Campus de Arrosadía, 31006-PAMPLONA (jjlr@unavarra.es)

Rain is the result of a series of complex atmospheric processes which are influenced by numerous factors. This complexity makes its simulation practically unfeasible from a physical basis, advising the use of stochastic diagrams. These diagrams, which are based on observed characteristics (Todorovic and Woolhiser, 1975), allow the introduction of renewal alternating processes, that account for the occurrence of rainfall at different time lapses (Markov chains are a particular case, where lapses can be described by exponential distributions). Thus, a sequential rainfall process can be defined as a temporal series in which rainfall events (periods in which rainfall is recorded) alternate with non rain events (periods in which no rainfall is recorded).

The variables of a temporal rain sequence have been characterized (duration of the rainfall event, duration of the non rainfall event, average intensity of the rain in the rain event, and a temporal distribution of the amount of rain in the rain event) in a wet climate such as that of the coastal area of Guipúzcoa. The study has been performed from two series recorded at the meteorological stations of Igueldo-San Sebastián and Fuenterrabia / Airport (data every ten minutes and for its hourly aggregation). As a result of this work, the variables satisfactorily fitted the following distribution functions: the duration of the rain event to a exponential function; the duration of the dry event to a truncated exponential mixed distribution; the average intensity to a Weibull distribution; and the distribution of the rain fallen to the Beta distribution. The characterization was made for an hourly aggregation of the recorded interval of ten minutes. The parameters of the fitting functions were better obtained by means of the maximum likelihood method than the moment method.

The parameters obtained from the characterization were used to develop a stochastic rainfall process simulation model by means of a three states Markov chain (Hutchinson, 1990), performed in an hourly basis by García-Guzmán (1993) and Castro et al. (1997, 2005).

Simulation process results were valid in the hourly case for all the four described variables, with a slightly better response in Fuenterrabia than in Igueldo.

In summary, all the variables were better simulated in Fuenterrabia than in Igueldo. Fuenterrabia data series is shorter and with longer sequences without missing data, compared to Igueldo. The latter shows higher number of missing data events, whereas its mean duration is longer in Fuenterrabia.