Stochastic simulation based on copula model for intermittent monthly streamflows in arid regions

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Abstract

Intermittent streamflow is common phenomenon in arid and semi-arid regions. To manage water resources of intermittent streamflows, stochactic simulation data is essential; however the seasonally stochastic modeling for intermittent streamflow is a difficult task. In this study, using the periodic Markov chain model, we simulate intermittent monthly streamflow for occurrence and the periodic gamma autoregressive and copula models for amount. The copula models were tested in a previous study for the simulation of yearly streamflow, resulting in successful replication of the key and operational statistics of historical data; however, the copula models have never been tested on a monthly time scale. The intermittent models were applied to the Colorado River system in the present study. A few drawbacks of the PGAR model were identified, such as significant underestimation of minimum values on an aggregated yearly time scale and restrictions of the parameter boundaries. Conversely, the copula models do not present such drawbacks but show feasible reproduction of key and operational statistics. We concluded that the periodic Markov chain based the copula models is a practicable method to simulate intermittent monthly streamflow time series.

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Key words : Copula, Drought, Intermittency, Periodic Markov chain, Seasonal streamflow, Stochastic simulation

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