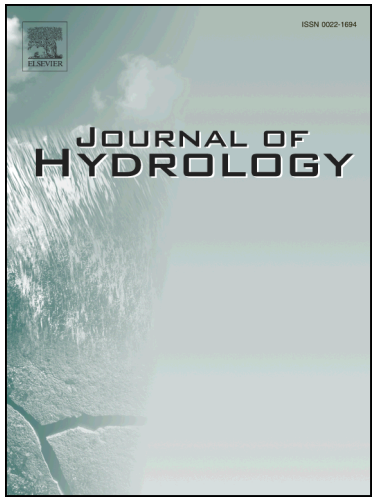

Research papers

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Joint modelling of annual maximum drought severity and corresponding duration

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ABSTRACT

In recent years, the joint distribution properties of drought characteristics (e.g. severity, duration and intensity) have been widely evaluated using copulas. However, history of copulas in modelling drought characteristics obtained from streamflow data is still short, especially in semi-arid regions, such as Turkey. In this study, unlike previous studies, drought events are characterized by annual maximum severity (AMS) and corresponding duration (CD) which are extracted from daily streamflow of the seven gauge stations located in Çoruh Basin, Turkey. On evaluation of the various univariate distributions, the Exponential, Weibull and Logistic distributions are identified as marginal distributions for the AMS and CD series. Archimedean copulas, namely Ali-Mikhail-Haq, Clayton, Frank and Gumbel-Hougaard, are then employed to model joint distribution of the AMS and CD series. With respect to the Anderson Darling and Cramér-von Mises statistical tests and the tail dependence assessment, Gumbel-Hougaard copula is identified as the most suitable model for joint modelling of the AMS and CD series at each station. Furthermore, the developed Gumbel-Hougaard copulas are used to derive the conditional and joint return periods which can be useful for designing and management of reservoirs in the basin.

Keywords: Drought, Annual maximum severity, Corresponding duration, Archimedean copulas, Çoruh Basin, Turkey