ISSN: 1391-8796
Proceedings of
2nd Ruhuna International Science & Technology Conference
University of Ruhuna, Matara, Sri Lanka
January 22-23, 2015

Joint probability distribution for drought duration and drought severity based on copula methods for Hambantota District, Sri Lanka

E.M.R.S.B. Ekanayake* and Kanthi Perera

Department of Engineering Mathematics, Faculty of Engineering, University of Peradeniya

Hambantota district is known as one of the areas in Sri Lanka which experience severe drought conditions. Therefore, it is vital to study the drought conditions in Hambantota to get a thorough understanding of the drought situation. Monthly rainfall data collected by the Metrological Department for the years from 1951 to 2013 in Hambantota were used for the analysis. In this study, drought characteristics are defined using monthly standard precipitation index (SPI). Drought severity and drought duration were commonly used to describe droughts. Since these variables are dependent, the copula method was used to find the joint distribution. Kendall's rank correlation was calculated between two variables and found that it is significant ($p<0.01$). The best marginal distributions of drought severity and drought duration were found as gamma and exponential distributions respectively. Significant correlation allowed to use, selected four Achemedian (Gumbel-Haugaard, Frank, Joe and Clayton) and one meta-elliptical (Normal) copulas. Parameters of the copulas were estimated by inverting the Kendall's tau. It was found that Gumbel-Haugaard is the best copula for the drought severity and drought duration with lowest AIC and BIC among the selected copulas. The joint probability distribution was fitted using Gumbel-Haugaard copula and univariate marginal distributions. The return periods were calculated using the identified joint probability distribution function and when the drought duration is 2 and drought severity is 2, the return period is about 7 months. That is, we can expect drought duration of two months and drought severity of 2 once in every seven months.

Key words: Copula, Return periods, SPI, Joint distribution

*rukmanek@gmail.com