JOINT DISTRIBUTION OF RAINFALL AND TEMPERATURE IN ANURADHAPURA, SRI LANKA USING COPULAS

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This study aims at deriving the best joint distribution between rainfall and temperature for monsoon seasons and months using the copula method. Copulas are joint distributions of unit uniform variables. The advantage of the copula is that no need the data to be normally distributed, independent or having same type of marginal distributions. In this study, Frank, Gaussian and Student-t copulas were examined since there was a negative relationship between the variables. Best fitted marginal distributions and the copulas were selected using Akaike Information Criteria (AIC) and the Bayesian Information Criteria (BIC) to obtain the joint distribution. The parameters of the marginal distributions were estimated using the maximum likelihood method and copula parameters were calculated using itau method. The daily rainfall (mm) and temperature (°C) data for Anuradhapura district from 1951 to 2012 from Meteorological Department, Sri Lanka were used for this study. The Kendall's tau rank correlation, τ was used to detect the correlation between rainfall and temperature. The correlations were negative and significant (p-value < 0.05) for the First Inter Monsoon Season (FIMS), South West Monsoon Season (SWMS) and for the months February, April, May, June, July, August and September. For the rest of the months, the correlation was insignificant. Thus the distributions Gamma, Lognormal, Weibull and Exponential were used to obtain the marginal distributions for both variables in monsoon seasons and monthly temperature data. The Exponential, Logistic and t distributions were used for monthly rainfall data, since there was zero rainfall in some months. The Gamma distribution for rainfall and the Weibull distribution for temperature were identified as the best marginal distributions for the FIMS, while the Weibull distribution for both variables in SWMS. The Exponential distribution for rainfall and the Weibull distribution for temperature were the best distributions for the above mentioned months. The Frank copula was identified as the best copula for both monsoon seasons and the months. The joint distributions between the two variables were fitted using the identified marginal distributions and the Frank copula. Using the fitted joint distributions, the return periods were calculated for maximum rainfall and corresponding temperature values and the maximum temperature and corresponding rainfall values for both seasons and months.