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Joint probability distribution of daily maximum and minimum temperature data: A copula based approach

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The analysis of extreme daily temperature is crucial for crop production, public health development, weather predictions and decision making processes. This study examines the joint distribution of daily maximum (Tmax) and daily minimum (Tmin) temperature. For this study, daily Tmax and Tmin temperature data, measured at the Hambantota Meteorological station from January 2012 to December 2017 are used. To test the correlation, Kendall's tau rank correlation test is used and a significant correlation (p-value < 0.05) is observed between daily Tmax and Tmin. Copula method is then used to model the dependence between Tmax and Tmin. Five candidates of univariate distributions are employed to model Tmax and Tmin separately. The parameters are estimated using the maximum likelihood method, consequently the best fitted distributions are identified based on Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC). It is identified that Normal distribution ($\mu=31$, $\sigma=1.5$) is the best fitted univariate distribution for daily Tmax and Weibull distribution (Shape=23.3, Scale=25.6) is the best fitted univariate distribution for daily Tmin. The best fitted univariate distributions are then used to fit Frank, Clayton, Gaussian, and Gumbel Copulas. The best fitted Copula is identified based on the minimum values of AIC and BIC. To validate the best fitted Copula model, cross validation Copula Information Criterion is used. It is determined that Gaussian Copula is the best to model the dependence between daily Tmax and Tmin in Hambantota.

Keywords: AIC, BIC, Copula method, Cross Validation Copula Information Criterion, Kendall's tau