INVESTIGATION OF INTERDEPENDENCE BETWEEN RAINFALL AND WIND SPEED IN COLOMBO, SRI LANKA USING COPULA METHOD

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The study of the interdependence between wind speed and rainfall is useful to understand the interaction impact of the two random variables for providing information using the joint probability distribution to assess the feasibility of structural and non structural flood and storm control measures in Colombo. The daily average wind speed (ms^{-1}) and rainfall (mm) data in Colombo obtained from the department of meteorology was used for this analysis. The aim of this study is to derive the joint distribution of the two random variables using copula method. The copula method is a powerful and flexible tool to model multivariate distributions capturing the dependence structure among random variables. The advantage of the copula method is that no assumptions to be made for the two variables to be independent or normal or having same type of marginal distributions.

The correlations of the two random variables relating to the daily, monthly and monsoon averages were calculated using the Kendall's rank correlation and these three correlations were significant. The Gamma, Weibull, Exponential, Normal, and Lognormal distributions were used for selecting the best marginal distributions for the two variables. The Weibull and Exponential, Normal and Gamma, Weibull and Gamma distributions were identified as the best marginal distributions for the daily, monthly and monsoon averages of wind speed and rainfall respectively using the Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), and Kolmogorov-Smirnov Test (K-S Statistic).The three commonly used copulas, Frank, Gaussian and Student-t were considered due to the negative correlations between two random variables. The Frank one parameter Archimedean copula was selected as the best copula based on the minimum values of AIC and BIC for all three cases. Using the identified best marginal distributions and the best copula for three cases, the joint distributions were obtained. The relatively lower return periods were shown for the average wind speed and rainfall. The joint return periods for the pairs of maximum rainfall with corresponding wind speed and maximum wind speed with corresponding rainfall were calculated using the joint probability distributions fitted and the results show that the observed pairs corresponding to the highest rainfall (440.2 mm, 6.4 ms^{-1}) and the corresponding to the highest wind speed (16 mm, 11.2 ms^{-1}) have 7 and 15 months return periods respectively.