

INVESTIGATION ON GENERALIZED LAMBDA DISTRIBUTION AND A MODEL TO PREDICT WIND SPEED IN PUTTALAM, DISTRICT

A.L.A.P.M. Athapaththu

Postgraduate Institute of Science, University of Peradeniya, Peradeniya, Sri Lanka

Identify a proper statistical distribution and model to forecast wind speed (m/s) are important in utilization of renewable energy. The daily average wind speed (m/s) measured by the Department of Metrology during the years 2007 and 2008 in ten weather stations in Sri Lanka were used to fit monthly distributions. The weather stations considered in this analysis are Colombo, Anuradhapura, Hambanthota, Bandarawela, Puttalam, Batticaloa, Jaffna, Rathnapura, Maha-Illuppallama and Kurunegala.

The Generalized Lambda Distribution (GLD) is a four parameter distribution which can be used to fit a wide variety of curve shapes. The GLDEX and gldpackages in R software were used to fit the Generalized Lambda Distribution to empirical data using the maximum likelihood method. The Root Mean Square Error (RMSE) and the Kolmogorov Smirnov test were used to select the best statistical probability distributions for each month for each location. The fitted GLD was compared with the wind speed distributions in the literature, namely Weibull, Gamma, lognormal, logistic distribution, normal, Gumbel and Rayleigh. At least one month for each location tend to have GLD as the best distribution. The Cumulative Distribution Functions (cdf) were also fitted for each month which can be used to find the chance that the wind speed is above a threshold value.

The Other objective of this research is to find a model to predict daily average wind speed (m/s) at Puttalam. A non-linear regression model, based on Marquardt's procedure, was developed using measured daily average wind speed (m/s) for the period 2006-2011 while data for the period 2012-2014 were used for validating the model.

The daily average wind speed (m/s) greater than 17.9 m/s were identified as outliers by using Box-plot. Thus removing the outliers a non-linear models were developed. And the best fitted model was identified using the minimum values of RMSE, Press statistics, AIC and BIC. The pseudo- R^2 is 82 % for the fitted model while it is 84% for the validation data set. Thus, the fitted model could be used to predict daily average wind speed (m/s) in Puttalam, Sri Lanka.