Perspective
Volume 11:3, 2022

Journal of Applied & Computational Mathematics

ISSN: 2168-9679 **Open Access**

Exponentiated Standardized Half Logistic Distribution

Hayashi Nakao*

Department of Mathematics, Osaka University, Toyonaka, Osaka, Japan

Introduction

Rainfall intensity prediction or forecast is vital in designing hydraulic structures and flood and erosion control structures. In this work, meteorological data were obtained from the National Aeronautics and Space Administration's (NASA) website. Models estimating maximum rainfall intensities were derived, and some meteorological factors' effects on the models were tested. The meteorological factors considered include annual relative humidity averages, specific humidity, temperature range at 2 m, maximum temperature, and minimum temperature. This research was aimed at developing a model for estimating maximum rainfall intensities, and the effects of various meteorological factors on the models were investigated. The exponentiated standardized half logistic distribution (ESLD) was used to model the effects of the factors and return periods on 35 years' (1984–2018) annual maxima monthly rainfall intensities for Port Harcourt metropolis, Nigeria. The model parameters were estimated using the maximum likelihood estimation method. Compared with the results from the five standard distributions, three criteria were used to determine the best-performed distribution. These indicated that the ESLD performed considerably better than the other five compared distributions. Only the return period had significant effects on the model for the rainfall intensity prediction since, while the effects of the meteorological factors are insignificant.

Description

Different meteorological conditions impact precipitation in three ways: (1) how intense it is, (2) how large it is, and (3) how long it lasts. The parameters such as minimum and maximum temperatures, specific humidity, and relative humidity may affect climatic conditions. Since the 1960s, the public has focused attention on how rapidly industrial and agricultural expansion is taking place and other things such as changes in climate and precipitation, climate change, and human activities on water resources management. The conclusion to be drawn from this research is that it is reasonable to say that precipitation and temperature are highly relevant factors in investigations related to climate change and hydrologic cycle change.

Extreme value studies are critical for engineering applications in determining extreme occurrences or loads. Examples of such events include the yearly maximum wind speed, the annual maximum daily streamflow, the annual maximum rainfall and runoff, and the annual maximum seismic motions. Various fields of study, including engineering, hydrology, water resources, water quality and quantity modelling, flood monitoring, drought forecast, soil erosion estimation, and a slew of others, benefit from analyzing rainfall data. An in-depth understanding of the rainfall's spatial and temporal distribution pattern is essential for practical water resource evaluation, planning, and management, as well as for agricultural planning and production. In addition, determining the probability and frequency of precipitation can assist policymakers in predicting floods, warning people about floods, and investigating the consequences of floods. Rainfall is a random occurrence that carries with it a certain amount of uncertainty. As a result, estimating rainfall is challenging due to its temporal and spatial unpredictability; yet, forecasting or reanalysis of rainfall is achievable through the use of historical meteorological data. As a result, the necessity of probabilistic analyses and explanations is justified. In this context, probabilistic analyses include probabilistic plotting positions, which estimate the frequencies and likelihoods that rainfall intensities will occur, and probability distributions, which are used to estimate reanalysis of forecast rainfall intensities.

Frequency analysis is done by analytically fitting selected probability distribution to data. It might involve graphical plotting for distribution evaluation and outliers' detection. Several distributions exist and are still being developed. However, choosing the best and appropriate distribution for hydrological data has always remained a subject of research in hydrology. Plotting positions are estimated as probabilities of cumulative density function. When probability distributions are being fitted to ranked data, several methods presently exist for positioning the ranked data on the cumulative distribution axis based on the distribution being considered. Most probability distributions can be modified for random hydrologic variables; however, choosing the best distribution for hydrologic analysis is a herculean task.

Several researchers in the past had concentrated efforts on using probability distributions to analyze long-term precipitation data for numerous areas of the world. Beskow et al. compared kappa and generalized extreme value multiparameter distributions (GEV) with the Gumbel and log-normal two-parameter distributions using Filliben, Anderson-Darling Kolmogorov-Smirnov, and chi-square tests for extreme rainfall in the Rio Grande do Sul state, Brazil. The researchers posited that kappa and GEV distributions gave the best performance. These implied that multiparameter probability distributions have better performances than 2-parameter distributions for precipitation data in the Brazilian state. Moccia et al. investigated the best fit probability distribution for two different climates in Italy by comparing light-tailed and heavy-tailed distributions. The Kolmogorov-Smirnov and ratio mean square error tests were used to assess the performances of the distributions. It was concluded from the study that heavy-tailed distributions give a better description of empirical data than light-tailed distributions. Amin et al. also analyzed annual maximum 24-hour rainfall for different rainfall gauging stations in the northern region of Pakistan using four different probability distributions. The researchers tested log Pearson type III, log normal, the normal, and Gumbel maximum distributions. Based on the goodness of fit, the normal and log Pearson type III distributions had the best performances for different rainfall gauging stations [1-5].

Conclusion

Despite these enormous studies, there is still a dearth of research on the existing relationships between annual maximum rainfall and other meteorological factors such as average annual relative humidity, average specific humidity, average maximum temperature, average minimum temperature, average range temperature, and average temperature (both at 2 m above the ground surface). In this research, the exponentiated half logistic is presented as an alternative distribution in modelling rainfall intensities. Furthermore, the contributions of some meteorological factors to maximum rainfall intensities were assessed. In conjunction with the frequency of annual maximum monthly rainfall of the Port Harcourt (PH) metropolis, these factors were subjected to six probability distributions. This comparison was made between the exponentiated standardized half logistic distribution and

***Address for Correspondence:** Hayashi Nakao, Department of Mathematics, Osaka University, Toyonaka, Osaka, Japan, E-mail: nhayashi@math.sci.osaka-u.ac.jp*

Received: 05 March, 2022, Manuscript No. jacm-22-65874; **Editor assigned:** 07 March, 2022, PreQC No. P-65874; **Reviewed:** 21 March, 2022, QC No. Q-65874; **Revised:** 22 March, 2022, Manuscript No. R-65874; **Published:** 29 March, 2022, DOI: 10.37421/ 2168-9679.2022.11.461

existing previously tested literature distributions. One of the appeals of the exponentiated half logistic distribution is its flexibility in fitting datasets due to the exponential power parameter. This parameter is the shape parameter that helps the distribution create shapes likened to the shape of the density of the dataset under study.

References

1. Zhang, Yu, Ping-an Zhong, Manlin Wang and Bin Xu, et al. "Changes identification of the Three Gorges reservoir inflow and the driving factors quantification." *Quat Int* 475 (2018): 28-41.
2. Aawar, Taha, Deepak Khare and Lakhwinder Singh. "Identification of the trend in precipitation and temperature over the Kabul River sub-basin: A case study of Afghanistan." *Model Earth Syst Environ* 5 (2019): 1377-1394.
3. Hong, H.P. and S.H. Li. "Discussion on "Plotting positions for fitting distributions and extreme value analysis." *Can J Civ Eng* 40 (2013): 1019-1021.
4. Sivakumar, Bellie, Fitsum M. Woldemeskel, Rajendran Vignesh and Vinayakam Jothiprakash. "A correlation-scale-threshold method for spatial variability of rainfall." *Hydrol* 6 (2019): 11.
5. Ozonur, Deniz, Ivana Pobocikova and Amaury de Souza. "Statistical analysis of monthly rainfall in Central West Brazil using probability distributions." *Model Earth Syst Environ* 7 (2021): 1979-1989.

How to cite this article: Nakao, Hayashi. "Exponentiated Standardized Half Logistic Distribution." J Appl Computat Math 11 (2022): 461.