J. Myanmar Acad. Arts Sci. 2026 **Vol. XXIII. No.8**

A BEST-FIT PROBABILITY DISTRIBUTION FOR THE ESTIMATION OF RAINFALL IN MYANMAR*

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Abstract

Climate change presents a global challenge, with varying effects across regions. Understanding these changes, particularly rainfall patterns, is essential for long-term agricultural planning, irrigation management, and watershed strategies. This study reviews the benefits of rainfall analysis, emphasizing its role in informing management systems and developing effective water allocation policies, especially in anticipation of drought conditions. Rainfall data in Myanmar from 1961 to 2022 were sourced from the World Bank. The main aim of the study is to find the best-fit probability distribution of rainfall in Myanmar using seven probability distributions: Normal, Log-Normal, Gumble, Generalized Extreme Value, Weibull, Log-Pearson Type-III, and Logistic (2-parameter) distributions. Based on the sources of goodness-of-fit tests, Gumbel Distribution was found to be the best-fit probability distribution of rainfall in Myanmar and probability analysis was used to evaluate rainfall trends. The findings indicate that there is a 15.87% probability of experiencing a minimum rainfall of 2193.397 mm with a 6.3-year return period whereas a maximum rainfall of 2483.941 mm has a 1.59% probability with a 63-year return period. This expected rainfall is useful for design engineers in planning hydrologic projects and designing soil conservation and drainage structures in Myanmar.

Keywords: Climate Change, Rainfall Analysis, Probability Distributions, Return Period.

Introduction

Myanmar experiences three distinct seasons: the hot season (mid-February to mid-May), the rainy southwest monsoon (mid-May to late October), and the cool northeast monsoon (late October to mid-February). As one of the most climate-vulnerable countries globally, Myanmar is significantly threatened by climate hazards, including floods, cyclones, extreme heat, and landslides. Coastal regions are especially at risk, affecting over 5 million people living in low-lying areas. According to the World Bank (2021), Myanmar's climate varies across its ecological zones, influenced by distance from the coast and altitude. The southern regions, such as the Ayeyarwady Delta and the coasts of Rakhine, Mon, and Tanintharyi, have a typical Southeast Asian climate, characterized by high temperatures and significant rainfall of 2,500 to 5,500 mm annually, making them prone to tropical cyclones. In contrast, the central region is drier, with annual rainfall between 500 and 1,000 mm and greater temperature fluctuations, occasionally exceeding 40°C. The northern and eastern mountainous areas are generally cooler, receiving moderate rainfall of 1,000 to 2,000 mm per year.

Rainfall is the primary water source for regions, significantly affecting water availability. Both excessive rainfall and prolonged drought can lead to serious issues like flooding and water shortages. Understanding precipitation patterns is crucial for grasping the global hydrological balance and for managing limited water resources, especially in semi-arid regions facing increased stress from population growth and economic development. Analyzing rainfall data is essential for addressing these challenges and promoting sustainable water management practices (Rawat, Rahman and Abdulla, 2018).

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*First Prize(2024)

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Understanding extreme rainfall patterns is vital for assessing risks linked to climate-related hazards. Analyzing these patterns enables stakeholders to devise long-term strategies to mitigate flooding and drought impacts, protecting lives and property while promoting soil and water conservation and effective irrigation planning. Establishing a comprehensive rainfall monitoring system enhances predictive capabilities, allowing farmers and policymakers to respond proactively to changing weather patterns. The probability analysis is crucial for building resilience in agricultural systems and ensuring sustainable food security amid climate change. By integrating scientific research with traditional knowledge, Myanmar can better adapt to extreme weather challenges and work toward a more sustainable agricultural future (Basak et al, 2019).

Therefore, this study was made to determine the statistical parameters and annual rainfall in Myanmar at various probability levels using seven probability distributions and to find the best-fit probability distribution of rainfall in Myanmar.

Literature Review

Vivekanandan (2014) studied the comparison of probability distributions for frequency analysis of annual maximum rainfall for Banswara and Visakhapatnam stations in Pune. The daily rainfall data were collected at the Banswara for the period 1969-2012 and Visakhapatnam for the period 1973-2012. The probability distributions (Exponential (EXP), Extreme Value Type 1 (EV1), Extreme Value Type 2 (EV2), Generalized Extreme Value (GEV), Generalized Pareto (GPA), and Normal (NOR)), Goodness-of-Fit (using χ^2 and KS) tests and diagnostic (using D-index) tests were utilized in this study. According to the results, the χ^2 -test showed that the GPA distribution is acceptable for estimation of rainfall for Banswara whereas the five distributions other than NOR was acceptable for Visakhapatnam. The KS test showed that the distributions other than EV2 (for Banswara) and GPA (for Visakhapatnam) are acceptable for estimation of rainfall. By considering the trend lines of the fitted curves by probability distributions in the tail regions, the study identified that the EV1 distribution is the most appropriate distribution for estimation of rainfall for Banswara whereas GEV for Visakhapatnam. Furthermore, the 1000-year return period rainfall of about 665 mm (using EV1) and 500 mm (using GEV) were considered for the design of hydraulic structures in Banswara and Visakhapatnam stations respectively.

Amin, Rizwan and Alazba (2016) designed the best-fit probability distribution for the estimation of rainfall in northern regions of Pakistan. Annual maximum rainfall data based on 24-hour duration at six rainfall-gauging stations such as Kalam, Oghi, Daggar, Mardan, Puran and Besham Qilla in northern Pakistan were used in this study. Rainfall data from northern Pakistan were evaluated with four probability models such as Normal, Log-Normal, Log-Pearson Type-III and Gumble (EVI) to find the best-fit model. As the result of this study, the normal distribution provided the best-fit probability distribution for Mardan rainfall gauging station and the Log-Pearson Type-III distribution was the best-fit probability distribution at the rest of the rainfall gauging stations based on the scores of the goodness-of-fit tests.

Basak et al. (2019) analyzed probability distribution of daily rainfall data for six different geographical locations in West Bengal-A case study. The daily rainfall data (0.5◦×0.5◦ resolution) of 37 years (1st January 1982 to 31st December 2018) for six different locations of West Bengal such as Kharagpur, Kolkata, Darjeeling, Bolpur, Balurghat and Berhampur. In this study, probability distribution viz Normal, Log-Normal, Exponential, Gumble, Generalized Extreme Value, Weibull, generalized gamma, Log-Pearson Type-III, Logistic distribution with two parameter and two-parameter Log-Logistic distribution for daily maximum rainfall data of 37 years for six different locations of West Bengal were utilized to find the best-fit distribution model among each location by using Goodness-of-Fit test, Kolmogorov-Smirnov test and Anderson Darling test. According to the results, Log-Pearson Type-III distribution is the best fitted for three geographical locations such as Kharagpur, Bolpur and Balurghat, followed by Gumble in Kolkata, Log-Logistic in Darjeeling and Generalized Extreme Value in Berhampur.

Babatunde and Olaomi (2022) investigated that modeling of rainfall and its probability distribution in Nigeria. The monthly rainfall data of 80 years were collected from the Nigeria Meteorological Agency Abuja, Nigeria. The data were from seven major synoptic stations in the Northern Nigeria such as Yola, Jos, Yelena, Kano, Maiduguri, Sokoto and Lokoja. It measured the trend of intensity in rainfall and obtained the best-fit trend on yearly rainfall. In this study, three statistical goodness-of-fit test, Anderson Darling test, Chi-squared test and Kolmogorov-Smirnov test, were carried out in order to select the best-fit probability distribution on the basis of highest rank with minimum value of the test statistic. As the result of this study, the trend increased exhibit exponential distributions at every point of change with high degree of skewness with a similar peak being at every year. And the Log-Normal and Gamma distribution were found that the best-fit probability distribution for the annual rainfall in seven synoptic stations.

Muniyan and Lallawmzuali (2024) examined that probability analysis of annual and monthly rainfall in Mizoram, India for 36 years : period (1980-2021). The objective of this study is to identify the best-fit probability distribution of annual and monthly rainfall of Mizoram using Kolmogorov-Smirnov, Anderson-Darling, and Chi-squared tests for each of 18 probability distributions. The results indicate that the General Extreme Value distribution was the best-fit for 5 out of the 12 months, while the Log-Pearson Type-III distribution was the best fit for 2 months. For annual rainfall in Mizoram, the Gamma (3P) distribution proved to be the most suitable. Notably, August recorded the highest percentage of annual rainfall at 16.8%, whereas January had the lowest at 0.4%. These findings can inform the selection of appropriate probability distribution functions for rainfall prediction across different months, considering factors such as linear trends, cyclic trends, and random components.

Materials and Methods

This study is based on time series data related to annual rainfall data (1961-2022) in Myanmar. The annual rainfall data of 62 years were collected from the World bank. The data are fed into the excel spreadsheet, where it is arranged in chronological order and Weibull plotting position formula is given by

$$p = \frac{m}{N+1}$$

where, m = rank number

N = number of years

The recurrence interval or return period is given by

$$T = \frac{1}{p} = \frac{N+1}{m}$$

The rainfall data in Myanmar are subjected to various probability distribution functions such as Normal, Log-Normal, Gumble, Generalized Extreme Value, Weibull, Log-Pearson Type-III, and Logistic (2-parameter). The probability density function for each distribution is shown below.

Normal Distribution (N)

The **Normal Distribution** is one of the most widely used probability distributions in statistics. It is symmetric and bell-shaped, characterized by its mean (μ) and standard deviation (σ). The probability density function of normal distribution is

$$f(x) = \frac{1}{\sigma\sqrt{2\pi}}\, e^{-\frac{1}{2}\left(\frac{x-\mu}{\sigma}\right)^2} \;;\; -\infty < x < \infty$$

where, $-\infty < \mu < \infty, \sigma > 0$.

Log-Normal Distribution (LN)

A **Log-Normal Distribution** arises when a variable is the product of many independent random variables. If the logarithm of a variable is normally distributed, then the variable itself follows its distribution. The probability density function of log-normal distribution is

$$f(x) = \frac{1}{x\sigma\sqrt{2\pi}}\, e^{-\frac{1}{2}\left(\frac{\ln(x)-\mu}{\sigma}\right)^2} \;;\; 0 < x < \infty$$

where, $0 < \mu < \infty, \sigma > 0$.

Gumbel Distribution (GUM)

The **Gumbel Distribution** is used to model extreme values, particularly the maximum or minimum values in a dataset (e.g., the maximum temperature of a given year, maximum rainfall). It is commonly applied in fields such as hydrology, engineering, and meteorology. The Gumbel distribution is asymmetrical and typically used in modeling the largest (or smallest) value from a set. The probability density function of Gumbel distribution is

$$f(x) = \frac{1}{\sigma}\, e^{(-z-e^{-z})}$$

where, $z = \frac{x-\mu}{\sigma}, -\infty < x < \infty, -\infty < \mu < \infty,\ \sigma > 0$

Generalized Extreme Value Distribution (GEV)

The **Generalized Extreme Value (GEV) Distribution** unifies three extreme value distributions: the Gumbel distribution, the Fréchet distribution, and the Weibull distribution. It is used to model the extreme values of datasets, such as the maximum or minimum of a series of observations. The probability density function of generalized extreme value distribution is

$$f(x) = \begin{cases} \frac{1}{\sigma}\exp\left(-(1+kz)^{\frac{1}{k}}\right)(1+kz)^{-1-\frac{1}{k}} & ;\ k \neq 0 \\ \frac{1}{\sigma}\exp(-z-\exp(-z)) & ;\ k = 0 \end{cases}$$

where, $z = \frac{x-\mu}{\sigma}, 0 < x < \infty, 0 < \mu < \infty, \sigma > 0$.

Weibull Distribution (W)

The **Weibull Distribution** is a versatile distribution that can model a variety of types of data, including life data, failure times, and extreme events. The probability density function of Weibull distribution is

$$f(x) = \frac{\alpha}{\beta}\left(\frac{x}{\beta}\right)^{\alpha-1} \exp\left[-\left(\frac{x}{\beta}\right)\right]^{\alpha} \; ; \; 0 \le x < \infty$$

where, $\alpha > 0, \beta > 0$.

Log-Pearson Type III Distribution (LP)

The **Log-Pearson Type III Distribution** is often used in hydrology to model the distribution of streamflow, rainfall, or flood data. It is a transformation of the Pearson Type III distribution, where the data is log-transformed before modeling. This distribution is used primarily for modeling skewed data and is part of the larger Pearson distribution family. The probability density function of log-Pearson type 3 distribution is

$$f(x) = \frac{1}{x|\beta|\Gamma(\alpha)}\left(\frac{\ln(x)-\gamma}{\beta}\right)^{\alpha-1} \exp\left(-\frac{\ln(x)-\gamma}{\beta}\right) ;$$

where, $\alpha > 0 , \beta \neq 0 ; 0 < x \le e^{\gamma},\ \beta < 0 ; e^{\gamma} \le x < \infty,\ \beta > 0$.

Logistic Distribution with two parameters (LG)

The **Logistic Distribution** is similar in shape to the normal distribution but has heavier tails. It is commonly used in logistic regression and in modeling growth processes. The logistic distribution is characterized by its location (mean) and scale parameters. It is often used to model the distribution of scores in social sciences, such as the probability of an event occurring. The probability density function of logistic distribution with two parameters is

$$f(x) = \frac{\exp(-z)}{\sigma(1+\exp(z))^2}$$

where, $z = \frac{x-\mu}{\sigma}$ $, -\infty < x < \infty, -\infty < \mu < \infty,\ \sigma > 0$.

The criteria of the best-fit probability distribution are tested by using Goodness-of-fit test (Chi-squared test), Kolmogorov-Smirnov test and Anderson Darling test. The descriptions of the tests are expressed below.

Goodness-of-fit Test (Chi-squared (χ^2) test)

The Goodness-of-fit (Chi-squared test) is a non-parametric test. It is used to determine whether a sample comes from a population with a specific distribution or not. It is used for continuous sample data only. The Chi-squared statistic is defined as

$$\chi^2 = \sum_{i=1}^{k} \frac{(O_i - E_i)^2}{E_i}$$

where, O_i is the observed frequency for class i and E_i is the expected frequency for class i.

H_0: The data follow the specified distribution.

H_1: The data do not follow the specified distribution.

H_0 is rejected at the level of significance if calculated $\chi^2 >$ tabulated ${\chi^2}_{\alpha,k-1}$ where α is the significance level and k is the number of classes. Otherwise, it is accepted.

Kolmogorov-Smirnov Test (K-S test)

It is also a popular non-parametric test. This test is used to decide if a sample comes from a hypothetical continuous distribution or not. It is based on the empirical cumulative distribution function. Assume that a random sample x_1, x_2, …, x_n from some distribution with cumulative distribution function (CDF) of X. The empirical CDF is denoted by

$$F_n(x) = \frac{1}{n}.[\text{Number of observations } \leq x]$$

Its statistic is denoted by D, is based on the maximum positive difference between the theoretical and the empirical cumulative distribution function:

$$D = \max[F_n(x_i) - F_0(x_i)]$$

where, F_0 is the hypothetical cumulative distribution function.

H_0: The data follow the specified distribution.

H_1: The data do not follow the specified distribution.

H_0 is rejected at the level of significance if calculated $D >$ tabulated $D_{\alpha,n}$ where α is the significance level and n is the number of observations. Otherwise, it is accepted.

Anderson Darling Test

The Anderson-Darling is also a distribution-free method or non-parametric method of the testing procedure to compare the fit of an observed cumulative distribution function to an expected cumulative distribution function. Its statistic is defined as

$$A^2 = -n - \frac{1}{n}\sum_{i=1}^{n}(2i-1)\,[\ln F(x_i) + \ln(1 - F(x_{n-i+1}))]$$

where, F denotes the cumulative distribution function.

H_0: The data follow the specified distribution.

H_1: The data do not follow the specified distribution.

The critical values for the Anderson-Darling test depend on the specific distribution that is being tested. The hypothesis regarding the specific distribution is rejected at the level of significance if the test statistic, A^2, is greater than the critical value obtained from a table.

Results and Findings

This study analyzes annual rainfall data from Myanmar spanning 1961 to 2022, using descriptive statistics to summarize overall rainfall patterns. It focuses on understanding rainfall distribution across various probability levels, which is essential for estimating the likelihood of specific rainfall events and assessing their variability. Selecting an appropriate probability distribution helps predict design rainfall for a given Annual Exceedance Probability (AEP). This analysis not only enhances the understanding of historical rainfall patterns but also supports future planning and risk assessment related to water resource management, agriculture, and infrastructure development. The descriptive statistics and graphical representation of the annual rainfall data are provided in Table 1 and Figure 1, respectively.

Table (1): Descriptive Statistics of Annual Rainfall in Myanmar

Statistic	Value	Percentile	Value
Sample Size	62	Min	1641.56
Range	714.15	5%	1814.55
Mean	2049.5568	10%	1838.93
Variance	24518.91	25% (Q1)	1942.36
Std. Deviation	156.58515	50% (Median)	2056.59
Coef. of Variation	0.07639952	75% (Q3)	2168.04
Std. Error	19.886334	90%	2248.95
Skewness	-0.22179898	95%	2282.7
Excess Kurtosis	-0.26742211	Max	2355.71

Source: Own Computation

According to the Table (1), the sample size of this analysis is based on 62 data points, which is a reasonable size for statistical analysis. The range is 714.15 shows that the difference between the maximum and minimum values in the dataset, suggesting there is a substantial spread in the rainfall amounts observed. The average rainfall over the sample period is approximately 2049.56 units, providing a central value for the data. The variance is 24518.91. This measures the dispersion of the rainfall data around the mean. A high variance indicates a wide spread of data points from the average. The standard deviation is the square root of variance, indicating that on average, individual rainfall measurements deviate from the mean by about 156.59 units. Coefficient of Variation is the ratio of the standard deviation to the mean, expressed as a percentage (approximately 7.64%). It provides a standardized measure of dispersion relative to the mean, suggesting relatively low variability in the data. Standard Error is 19.89. This estimates the accuracy of the sample mean as an estimate of the population mean. A smaller standard error suggests a more precise estimate. Skewness is -0.22. This indicates that the data is slightly negatively skewed, meaning there are a few lower values that pull the mean down, but the distribution is relatively symmetrical. Kurtosis is -0.27. This suggests that the distribution is slightly flatter than a normal distribution (platykurtic), indicating fewer extreme values (outliers) than expected in a normal distribution.

In summary of descriptive statistics, the rainfall data exhibits a significant range, varying from a minimum of 1641.56 to a maximum of 2355.71. While the median rainfall is 2056.59, the data is slightly skewed towards lower values, with most rainfall measurements falling between the 25^{th} and 95^{th} percentiles. This indicates that while there are occasional extreme high rainfall events, the majority of rainfall occurrences are clustered around the median. Understanding this variability is essential for informed decision-making in agriculture, water resource management, and environmental sustainability.

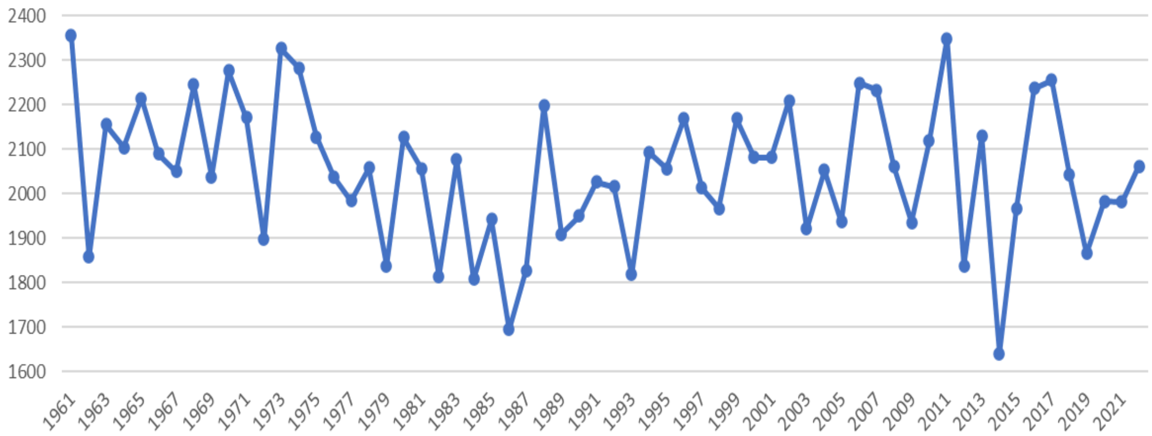

Figure (1): Annual Rainfall in Myanmar from 1961 to 2022

Source: Annual Rainfall in Myanmar (1961-2022)

According to Figure (1), it is presented an analysis of annual rainfall data in Myanmar over a comprehensive 62-year period, from 1961 to 2022. This visualization allows us to examine trends and patterns in rainfall across these years. The X-axis represents the range of years while the Y-axis quantifies the amount of rainfall, typically measured in millimeters or other relevant units. Notably, the year with the lowest recorded rainfall is 2014, highlighting a significant dry spell during this period, whereas the year with the highest rainfall is 1961, indicating an unusually wet year. This stark contrast underscores the variability in rainfall patterns and emphasizes the need for a deeper understanding of these fluctuations. By analyzing these data, valuable insights into the climatic trends affecting Myanmar can be gained, which are essential for effective water resource management, agricultural planning, and disaster preparedness strategies in response to potential droughts or flooding events. Such a long-term perspective is crucial for developing adaptive strategies that can mitigate the impacts of climate variability on local communities and ecosystems.

Probability Analysis of Annual Rainfall

Probability analysis can be used for prediction of occurrence of future events from available records of rainfall (Kumar and Kumar, 1989). Based on the theoretical probability distributions, it would be possible to forecast of various magnitudes with different return periods. Several distributions have been used for hydrological analysis (Mahale and Dhane, 2004).

In this study, the parameters of seven probability distributions (Normal, Log-Normal, Gumble, Generalized Extreme Value, Weibull, Log-Pearson Type-III, and Logistic (2-parameter)) were calculated using EasyFit Software and were organized in Table 2.

Table (2): Parameters of probability distributions at rainfall in Myanmar

Distribution	Parameters	Distribution	Parameters
Normal	$\mu = 2049.5568$	Log-Normal	$\mu = 2049.5568$
	$\sigma = 156.58515$		$\sigma = 156.58515$
Logistic	$\mu = 2049.5568$	Weibull	$\alpha = 14.691249$
	$\sigma = 86.32992$		$\beta = 2121.1226$
Gumble	$\mu = 1979.0852$		
	$\sigma = 122.08894$		

Distribution	Parameters	Distribution	Parameters
Generalized Extreme Value	k =-0.36495998	Log-Pearson Type III	α =22.130618
	μ = 2000.5156		β =-0.01649093
	σ = 162.32688		γ = 7.9873572

Source: Own Computation

The seven probability distributions were subjected to the Goodness-of-fit tests (Chi-squared test, Kolmogorov-Smirnov test and Anderson Darling test) to determine the best-fit probability distribution of rainfall in Myanmar from 1961 to 2022. It was ranked from one to seven for all probability distributions shown in the following Table 3.

Table (3): The goodness-of-fit tests on rainfall in Myanmar

Distribution Models	Kolmogorov Smirnov		Anderson Darling		Chi-Squared		Total Scores
	Statistic	Rank	Statistic	Rank	Statistic	Rank	
Normal	0.0634	4	0.2128	3	1.6682	2	9
Log-Normal	0.0790	5	0.3062	4	2.7809	4	13
Gumbel	**0.1320**	**7**	**1.8031**	**7**	**3.8004**	**7**	**21**
Generalized Extreme Value	0.0540	2	0.1875	2	**1.4797**	**1**	5
Weibull	0.0834	6	0.3914	6	3.6776	6	18
Log-Pearson Type III	**0.0509**	**1**	**0.1847**	**1**	2.0980	3	5
Logistic	0.0589	3	0.3296	5	3.2326	5	13

Source: Own Computation

According to the Table (3), the best-fit probability distribution of rainfall in Myanmar is chosen by using the total scores of goodness-of-fit tests. The results of the total scores indicate that Gumbel distribution provides the best-fit annual rainfall at Myanmar in this study. The annual rainfall for Gumbel distribution has also been graphically presented in Figure (2).

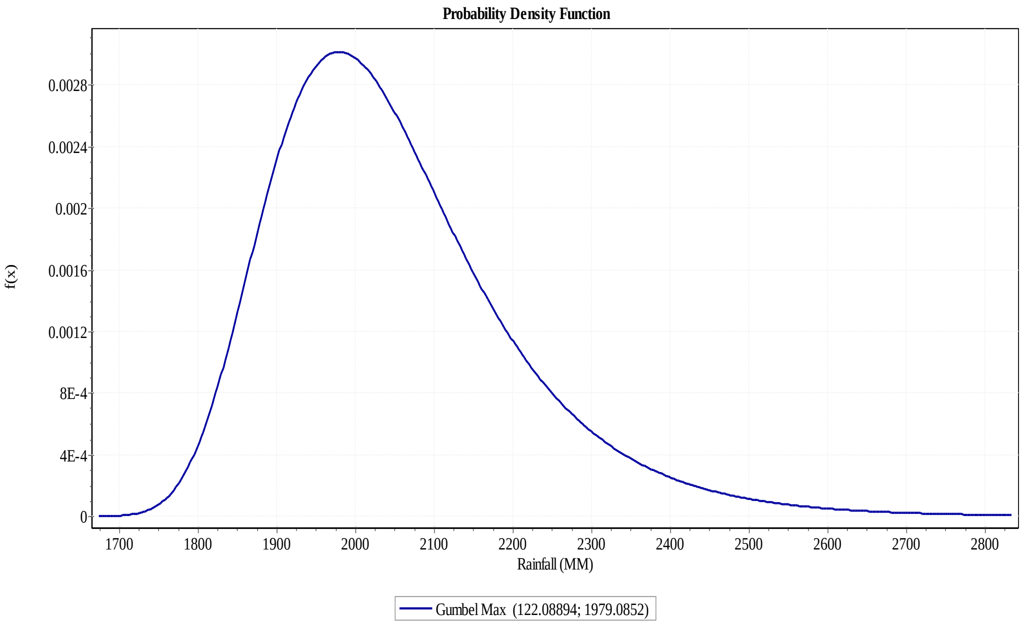

Figure (2): Probability Density Function of Rainfall for Gumbel distribution

Source: Annual Rainfall in Myanmar (1961-2022)

The rainfall data in Myanmar can be modeled using a mathematical expression to estimate rainfall amounts for different return periods:

$$x = \mu - \beta \ln(-\ln(p))$$

This expression involves parameters like location (μ) and scale (β), which are used to calculate the required rainfall (x) for a given return period (p). The return period of rainfall data represents the estimated time interval between events of a certain intensity or greater, commonly used in hydrology and meteorology to evaluate the likelihood of extreme rainfall occurrences. The return periods were calculated using the Weibull method, with the Gumbel distribution identified as the best-fit. Return periods analyzed included 6.3, 7, 7.875, 9, 10.5, 12.6, 15.75, 21, 31.5, and 63 years. Accordingly, rainfall estimates for 2, 5, 10, 25, 50, 100, and 200 years were also calculated using the best fit distribution, with the results presented in Table 4.

Table (4): Estimated rainfall in Myanmar using Gumbel distribution

Return Periods (Years)	Estimated Rainfall (mm)
2	2023.83
5	2162.21
10	2253.83
25	2369.59
50	2505.38
100	2540.71
200	2625.65

Source: Own Computation

According to the Table (4), the analysis shows a range of return periods for extreme rainfall events. This table shows estimated rainfall amounts in millimeters for various return periods, measured in years. A return period represents the average time interval between rainfall events of a certain magnitude. Higher return periods correspond to larger estimated rainfall amounts. The rainfall event of 2023.83 mm is expected to occur every 2 years, while a more extreme event of 2625.65 mm is estimated to happen once every 200 years. In other words, an extreme rainfall event to occur approximately once every 31 years on average can be expected. Therefore, engineers should use it to design drainage systems, dams, and other structures to withstand specific rainfall events, insurance companies should use this data to calculate risk, and planners should use this data to determine areas that are prone to flooding. And then the estimated rainfall amount can be calculated by using the return period with different probability levels. It is presented in the following Table (5).

Table (5): Estimated rainfall in Myanmar with different probability levels

Return Periods	Probability (%)	Estimated Rainfall (mm)
63	1.59	2483.94
31.5	3.17	2398.33
21	4.76	2347.82
15.75	6.35	2311.68
12.6	7.94	2283.41
10.5	9.52	2260.10
9	11.11	2240.22
7.875	12.70	2222.84
7	14.29	2207.37
6.3	15.87	2193.40

Source: Own Computation

According to Table (5), this table presents estimated rainfall amounts along with their corresponding return periods and probabilities. It shows that higher rainfall amounts are associated with longer return periods and lower probabilities, indicating less frequent occurrences. Conversely, lower rainfall amounts correspond to shorter return periods and higher probabilities, signifying more frequent events. The analysis indicates that a minimum rainfall of 2193.397 mm is expected to occur every 6.3 years, while a maximum of 2483.941 mm is projected to occur every 63 years. This information is crucial for engineers and planners to design infrastructure and systems that can withstand extreme weather events. It is generally recommended that 2 to 200 years is sufficient return period for soil and water conservation measures, construction of dams, irrigation and drainage works (Bhakar et al.,2006).

Conclusion

This study employed a statistical analysis of 62 years of rainfall data in Myanmar (1961-2022) to identify the most suitable probability distribution. Among seven distributions examined, the Gumbel distribution was found to provide the best-fit probability distribution for the rainfall data. By utilizing the estimated rainfall amounts derived from the Gumbel distribution, engineers and policy makers can make informed decisions to design safe and efficient soil conservation and drainage structures. Therefore, it is important to focus on improving weather forecasting, strengthening infrastructure, and promoting effective planning. Investing in better climate data collection, such as enhanced weather stations and satellite monitoring, can provide more accurate predictions. Developing early warning systems for floods and storms can help communities prepare in advance. Additionally, updating building codes and urban planning to account for extreme weather events, such as floods, will reduce the impact on cities and rural areas. It is also essential to implement climate-smart agricultural practices, protect natural ecosystems, and ensure that both local governments and communities are well-prepared to respond to changing weather patterns.

Acknowledgements

I'd like to express gratitude to Prof. Dr. Tin Tin Htwe, Rector at Yangon University of Economics and Prof. Dr. Aye Thida, Head of Department of Statistics at Yangon University of Economics who encouraged me to do research. Using their sustained support and guidance, I'm going to be study about the annual rainfall in Myanmar.

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