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Regional Frequency Analysis of Drought Events By L-Moments in Telangana State

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ABSTRACT

This examination researched the recurrence of dry seasons and create the quantile work for the time frame January 1988 to December 2015 in territory Telangana state, in view of month to month precipitation information from 132 downpour checks disseminated across the express The point of this investigation is to investigation the dry spell in the Telangana dry season inclined districts with the assistance of Standardized Precipitation Index (SPI) in light of a drawn out month to month precipitation of 132 meteorological stations to likewise complete provincial recurrence investigation utilizing the list flood system combined with the L-minutes technique dependent on recorded precipitation information of the most dry spell month for every year procured from Standardized Precipitation Index strategy for each station The SPI upsides of each station for 3, 6, 9 and year time scales were determined. In view of the SPI time scale arrangement a local recurrence examination of dry spell extents was attempted by picking limit upsides of precipitation for additional investigation of L-second technique. As indicated by the outcomes, The L-minutes strategy was utilized to characterize homogenous districts for 6 and 9-month time scales least precipitation arrangement couldn't be acquired while homogenous areas for half year time scale least precipitation arrangement were gotten exclusively by isolating the entire bowl into two sections. The initial segment follows the Pearson type 3 circulations while other follows the overall typical conveyance. The entire bowl is homogenous for a 3-month time scale and least precipitation arrangement follows the overall Pareto circulation. For 9-month time arrangement locale is separated into three sub-area and their base precipitation arrangement follows general limit esteems, Pearson type 3 and general ordinary dispersion individually. Least precipitation arrangement for a year couldn't discover as their decency of fit measure is out of reach for all the given dissemination.

***Keywords:* Drought prone region; Standardized precipitation index (SPI); L-moments; Regional Analysis; Rainfall**

1. INTRODUCTION

1.1 General

Drought is below average moisture supply or complete precipitation climate features. Drought is one of the most severe and unstoppable occurrences of climate, such as floods and hurricanes. Taking meteorological, agricultural and hydrological drought into consideration, there are usually three kinds of droughts. Weather circumstances are entirely applicable to meteorological drought. It is described as a reduction in ordinary precipitation over at least 30 years of rainfall sequence recorded. Agricultural drought shows the absence of soil humidity that contributes to droop and plant expiry in the farmland, although if there are enough rainfall water sources, agricultural drought may happen due to excessive water use and may be unnecessary economic activity.

Hydrological drought happens when there is sufficient precipitation and water in the reservoirs, but either the population is so big to make use of water or may be the rural operations and watering activities are so excessive. Therefore, whenever hydrological drought occurs, urban life will surely encounter issues and the making and irrigation of hydroelectric power will be adversely impacted.

1.2 The Problem

The serious circumstances of drought will not only hit the agricultural sector but will also cause a number of social issues. Migration of individuals from rural fields to urban fields will take place on a large scale. There were instances earlier of increased crime rates where drought migrants had settled because of poverty and unemployment. The roads and highways surrounding villages and interior areas witness a high number of theft cases with travelers on roads being attacked for money and other valuable items, the ongoing drought is fueling distress migration from districts in Telangana state, a trend observed in the early 2000s.

For the second successive year, serious drought circumstances have been made to crop destruction, increasing loans, unemployment, and failure of The NREGA system, particularly in the region of Nalgonda, Mahbubnagar, medak and Adilabad, exodus of people from villages. The state government now fears that the crime rate will rise as previous experiences indicate that the crime rate in the state has risen every time there have been droughts, particularly in rural and indoor fields.

1.3 Significance of the Study

The drought-prone areas form a significant proportion of the country's area. These areas are characterized by low productivity which is a major cause of regional imbalances. These areas are a strain on the country's financial resources. By doing study analysis, we could have an idea about when it will occur accordingly to that we can arrange or find another way of resources so that minimum humanity would affect.

1.4 Objectives

The desire of the investigation is to complete the local recurrence examination of dry season district utilizing the L-moments technique with assistance of SPI upsides of each station for various time scales.
L moment strategy examination did comprise of three factual measures are Discordancy measure (Di), heterogeneity measure (H) and integrity of fit measure (Z). So that for the homogenous locale we can build up a quantile work for dry season assessment for those districts**.**

2. LITERATURE REVIEW

In order to define and monitor drought, McKee et al. (1993) first define the Standardized Precipitation Index (SPI). Due to easy and quick outcomes, the Standardized Precipitation Index (SPI) technique is widely used to monitor drought and flood. This gives the general idea about drought category but not as good because it has more error when increases number of observations.

B Clausen and C.P Pearson et al (1995) conducted information screening by creating the mean of two truncation levels and 75% of the average for choosing the highest annual flood in terms of severity or complete deficit, but the SPI technique is more accurate for information screening for drought assessment than for truncation levels.

Nielsen-Gammon (2012) created a high-resolution drought surveillance tool that uses the regional SPI frequency to evaluate drought on various time scales. The theory of probability weighted moments is presented by Amit Dubey et al. [1] (2014) estimates L moments for generalized extreme value distribution parameter estimation and develops a regional flood frequency connection for the selected basin. Conventional moments are difficult due to data quality issues such as brief records and outliers. Hosking (1990) created L-Moments that are linear order statistics combinations. L-Moments primary benefit over standard moments is that they can bear less from the impacts of variation in sampling. For tiny samples, they are more powerful to outliers and nearly impartial. The technique of Regional Flood Frequency Analysis based on L-Moments is discussed in this research and Narmada Basin is regarded as a case. The L-Moments were used for generalized extreme value (GEV) distribution parameter estimation.

By Using General Extreme Value distribution, regional flood frequency relationships are created for the selected basin. A connection is established between mean annual flood and catchment area, which is also used to produce Regional Flood Formula for Narmada Basin's ungauged catchment. The advanced Regional flood formula is used for the assessment of the T-Year flood return period, knowing only 1 parameter that is catchment area of the ungauged station. The important work of this study is to develop a regional frequency relationship using L-moment based on GEV distribution, here they particularly took GEV distribution because generally precipitation follows GEV distribution and it also depends upon the others factor like location and climate variation. In the same way they have calculated probability weighted moment and after that L moment and their ratios. The probability distribution function for GEV was given by N.E.R.C in 1975 and the relation between L-moment ratios and parameter of this distribution was also given by N.I.H, Roorkee (1997-98). The regional growth curve can be express in term of calculated parameter then compare with empirical formula.

3. STUDY AREA AND METHODOLOGY

3.1 Study Area

Figure 1. Telangana state region

The state of Andhra Pradesh is situated between latitude 12 ° 41' and 22 ° N and longitudes 77 ° and 84 ° 40'E. Geographically, there are three regions that divide Andhra Pradesh. The North-west portion of the plateau is selected as the study area for the Telangana region. The region of Telangana has an area of 114,840 square kilometers and a population of 35,286,757 (by census of 2011). According to the 2011 census, Telangana has 41.6% of the Andhra Pradesh government population. The region lies west of the Eastern Ghats range on the Deccan plateau and contains the Telangana state's northwestern interior districts. Separated Telangana from Andhra Pradesh in 2014. Now there are 10 districts in the Telangana region. Telangana region has 457 Mandal's and 10258 Villages. I am doing analysis of precipitation data from 1988 to 2013 of most drought prone Mandal.

3.2 Methodology

The L-Moment Regional Frequency Analysis (RFA-LM) method used in this research was based on the techniques suggested by Hosking and Wallis (1997) and the concept that L-moments Ratio's L-Cv and L-skewness, respectively, were identified as L-coefficient of variation and L-coefficient of skewness. The five steps in the process of assessment are:

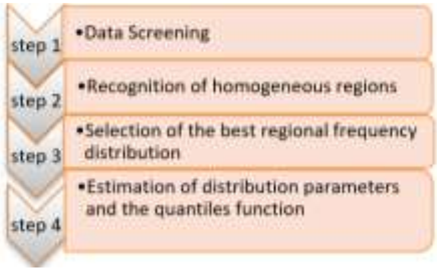

Figure 2. Sequential steps for Analysis

3.2.1 Data screening

Standard precipitation list (SPI) technique Dry spells and floods are the predominant subject of pressure driven designers and researchers. This technique is oftentimes used to screen dry season because of the basic calculation and quick reaction. In 1993, McKee built up the SPI to give occasional (3, 6-month time arrangement) or long (9, 12, 24, four year X) dry season data .

Drought can be analyze even underwater impacts all kinds of water resources. Soil moisture is immediately impacted by abrupt changes in precipitation. Thus, surveillance of the time scale of 3 or 6 months is preferred. Underground water, rivers, and reservoirs, on the other side, do not react quickly to rapid changes in precipitation. Therefore, surveillance is selected on a long-term scale (12, 24, 48, 72-month).

$$\textbf{SPI} = \frac{Xi-\bar{X}}{\sigma}$$

Calculation of SPI**,** To get SPI values we must need to

- Mean of the precipitation value should be moved to 0
- The standard deviation of the precipitation is moved to 1.0
- The skewness of data kept same to zero

When these things are fulfilled the SPI index can be interpreted as mean 0 and standard deviation of 1.0

- Mean of the precipitation can be calculated as

$$\text{Mean}=\bar{X}=\frac{\sum X}{N} \qquad (1)$$

Where N is the number of precipitation observations in excel

- The standard deviation for the rainfall is calculate as

$$S= \sqrt[2]{\frac{\sum(X-\bar{X})^2}{N}} \qquad (2)$$

- The skewness of rainfall is calculated as

$$\text{Skewness} = \frac{N}{(N-1)(N-2)}\sum\left(\frac{X-\bar{X}}{s}\right)^3 \qquad (3)$$

- The rainfall data is converted to lognormal values and the statistics U, shape and scale parameter of gamma distribution is calculated.

$$\text{Log mean}= X\text{-}\bar{X}\text{ln}=\text{ln}(X\text{-}\bar{X}) \qquad (4)$$

$$U= X\text{-}\bar{X}ln\text{-}\frac{\sum\ln(X)}{N} \qquad (5)$$

$$\text{Shape parameter}=\beta=\frac{1+\sqrt{1+\frac{4U}{3}}}{4U} \qquad (6)$$

$$\text{Scale parameter}=\alpha=\frac{\bar{X}}{\beta} \qquad (7)$$

Equation 1 to 8 is calculated using built function in excel.

The resulting parameter is help to find the cumulative probability of an observed precipitation event. The cumulative probability is given by:

$$G(X) = \frac{\int_0^x x^{\alpha-1} e^{-\frac{x}{\beta}} dx}{\beta^{\alpha}\Gamma(\alpha)} \quad (8)$$

Since the gamma function is undefined for x=0 and a precipitation distribution may contain zeros, the cumulative probability becomes:

$$H(x) = q + (1-q)\, G(x) \qquad (9)$$

Where q is the probability of zero

The aggregate probability H(x) is then changed to the standard typical arbitrary variable Z with mean zero and fluctuation of one, which is the worth of the SPI following Edwards and Mc kee (1997), we utilize the proper transformation gave by abromowitz and stegun as another option

$$Z=SPI= -\left(t-\frac{C_0+C_1t+c_2t^2}{1+d_1t+d_2t^2+d_3t^3}\right), \quad 0<H(x)>0.5$$

$$Z=SPI= +\left(t-\frac{C_0+C_1t+c_2t^2}{1+d_1t+d_2t^2+d_3t^3}\right), \quad 0.5<H(x)>1 \qquad (10)$$

Where,

$$t= \sqrt{ln\left(\frac{1}{H(x)^2}\right)} \quad , 0<H(x)>0.5$$

$$t= \sqrt{ln\left(\frac{1}{(1-H(x))^2}\right)} \quad , 0.5<H(x)>1 \qquad (11)$$

c_0 =2.515517
c_1=0.802583
c_2=0.010328 (12)
d_1=1.432788
d_2=.0189269
d_3=0.001308

For SPI computing (Abramowitz and Stegun 1965), the values of c0, c1, c2, d1, d2, d3 provided in Equation (12) are constants used frequently. This is the theoretical technique for discovering SPI for varying time scale, but I'm using Drinc software for their huge computation where I have to provide the monthly information October to September for the whole year, in a specific format to get the value month basis of the SPI for a specified station, so we have to do the same for all stations. Drought categorization is as follows:

Table 1 drought categories

SPI indices	Drought behavior
➢ 2.00	Extreme wet
1.5- 1.99	Severe wet
1.0- 1.49	Moderate wet
0.0-0.99	Mild wet
0.0 -(-.99)	Mild drought
(-1)- (-1.49)	Moderate drought
(-1.50)- (-1.99)	Severe drought
< (-2)	Extreme drought

3.2.2 L Moment Method

L-moments are a series of statistics used in statistics to summarize the shape of a distribution of probability. They are linear combinations of order statistics (L-statistics) similar to conventional moments and can be used to calculate amounts similar to standard deviation, skewness, and kurtosis, respectively called L-scale, L-skewness, and L-kurtosis. Standardized L-moments are called ratios of L-moment and are similar to standardized moments. Just like in standard moments, there is a collection of population L-moments in a theoretical distribution. For a population sample, sample L-moments can be described and can be used as population L-moments estimators.

Hosking created the L-moments technique. This technique is commonly used to determine regionalization, estimate parameters and quantiles.it state that the L-moments technique is the linear function of the weighted likelihood moments (PWM). L moments for generalized extreme value distribution parameter estimation and the development of a regional flood frequency connection for the selected basin.

The precursors of L-Moments are Greenwood defining the Probability Weighted Moments. For sample data values x1, x2, x3..... xn arrange in ascending order as shown below where, b_{00}, b_{10}, b_{20}, b_{30} is the sample probability weighted moments, xj is the minimum monthly SPI value at jth observation, n is no. record length of observations. The four first L-Moments are as follows:

$L_1 = b_{00}$ ----------------------------------- (13)
$L_2 = 2b_{10} – b_{00}$ ------------------------------ (14)
$L_3 = 6b_{20} – 6b_{10} + b_{00}$ --------------------- (15)
$L_4 = 20b_{30} – 30b_{20} + 12b_{10} –b_{00}$--------- (16)

The first L-Moment (L_1) is the measure of mean and second L-Moment (L_2) is a measure of dispersion. Third and Fourth L-Moments are L_3 and L_4respectively. L-Moment ratios such as L-CV, L-Skewness, and L-Kurtosis are defined as the following:

L-Coefficient of Variation (L-CV), (τ_2) = L_2/ L_1

L-Coefficient of Skewness (L-Skewness), (τ_3) = L_3/ L_2

L-Coefficient of Kurtosis (L-Kurtosis), (τ_4) = L_4 / L_2

τ3 is L-Skewness, is a proportion of the level of evenness of an example. Symmetric circulations have τ3 = 0 and its worth lies between - 1 and +1. τ4 is L-Kurtosis, is a proportion of peakness or the levelness of the recurrence conveyance close to its middle.

After the computation of L-Moments for each measuring site, Regional L-Moments are assessed. Territorial L-Moments is assessed by taking the weighted normal of the L-Moments of the gathering of checking locales. Where n (I) is the record length of the ith site, N is the all out number of destinations
Software using for L moment: L-RAP

Test 1: Discordancy measure (Di)- This test is performed to check the information if the chosen locations are not sufficiently discordant. It is used to calculate the locations by using L-moments ratios. Measurement of disagreement relies on the number of locations. If the measurement discordant value is higher than the critical value, discordant sites should be removed from the analysis. Hosking & Wallis provided a table showing critical discord statistical values corresponding to a number of locations as shown in the table below. The site is accepted to be harmonious when site discord is lower than the critical value of the statistic discordance.

Table 2 Discordancy measure

NO. OF STATIONS IN REGION	CRITICAL VALUE OF (D_i)	NO. OF STATION IN REGION	CRITICAL VALUE OF (D_i)
5	1.33	11	2.632
6	1.648	12	2.757
7	1.917	13	2.869
8	2.14	14	2.971
9	2.329	≥15	3
10	2.491		

$$D_i = \frac{1}{3}(u_i-\bar{u})^T . S^{-1} . (u_i-\bar{u})$$

$$\bar{u} = N^{-1}\sum_{i=1}^{N} u_i \quad \text{------ (17)}$$

$$S= \sum_{i=1}^{N}(u_i - \bar{u})\, T\, (u_i - \bar{u})$$

Were,
u_i vector of Lcv, Lcs, Lck for a site i; S, covariance matrix of u_i; $\bar{u}$ mean of vector u_i

TEST-2 Heterogeneity measure (H)- The measure of heterogeneity (H) is suggested to identify the degree of heterogeneity for site group and H can be given as:

$$H=\frac{V-\mu_v}{\sigma v}$$

$$\tau_S^R=\frac{\sum_{i=1}^{N} (n_i \tau_S{}^i)}{\sum_{i=1}^{N} n_i} \quad (s=2, 3, 4) \text{ -------- (18)}$$

Where; V, weighted normal deviation of L-coefficient of variation values; μ_v and σ_v, the mean and standard deviation of a number of V simulations. Suppose the suggested area has N locations, with the site I record length n_i and sample L-moment ratios $\tau_2{}^{(i)}$, $\tau_3{}^{(i)}$, $\tau_4{}^{(i)}$. Notation of the regional average L-Cv, L-Skewness, and L-Kurtosis by $\tau_2{}^{(R)}$, $\tau_3{}^{(R)}$, $\tau_4{}^{(R}$. V_1, weighted standard deviation of the variation coefficient L can be expressed as

$$V_1=\frac{\sum_{i=1}^{N} n_i\left[\left\{\tau_2^i-\tau_2^R\right\}^2\right]^{\frac{1}{2}}}{\sum_{i=1}^{N} n_i} \quad \text{----------- (19)}$$

Heterogeneity measurements can be built in which V is replaced by other sample L-moments dispersion measurements between locations in the above equation. One of the procedures is L-Cv based and can be expressed as L-Skewness (V_2)

$$V_2=\frac{\sum_{i=1}^{N} n_i\left[\left\{\tau_2^i-\tau_2^R\right\}^2+\left(\tau_3^i-\tau_3^R\right)^2\right]^{\frac{1}{2}}}{\sum_{i=1}^{N} n_i} \quad \text{---------- (20)}$$

(V_3) (Parameter based on L-skewness and L-kurtosis) is given as

$$V_3=\frac{\sum_{i=1}^{N} n_i\left[\left\{\tau_3^i-\tau_3^R\right\}^2+\left(\tau_4^i-\tau_4^R\right)^2\right]^{\frac{1}{2}}}{\sum_{i=1}^{N} n_i} \quad \text{----- (21)}$$

If heterogeneity of a region
For homogeneous region H<1

For heterogeneous region $H \geq 2$,
$1 \leq H < 2$ then it is possible heterogeneous

TEST-3 The goodness of fit measure (Z)- Hosking & Wallis has suggested a well-matched fit-dependent measure for L-kurtosis. For a group of sites, the ZDIST fit test goodness is used to select the appropriate regional frequency distribution function. Good fit measurement (Z) compares the relation between L-kurtosis sample and L-kurtosis population. The fitness measure for each distribution denoted by the ZDIST statistics shown below in Equation:

$$Z^{DIST} = \frac{\tau_4^{DIST} - \bar{t}_4 + \beta_4}{\sigma_4} \qquad \text{------ (22)}$$

Continuing, $\bar{t}_4$is the average of L-Ck values computed from an observed sample series in a given region β_4 is the bias of t_4, τ_4^{Dist} is the average L-Ck values computed from simulation for a fitted distribution, and σ_4 is the standard deviation of L-Ck values (from simulation), and β_4 and σ_4 are given below

$$\beta_4 = N_{sim}^{-1} \sum_{m=1}^{N_{sim}} (t_4^m - \bar{t}_4)$$

$$\sigma_4 = [(N_{sim}-1)^{-1}\{\sum_{m=1}^{N_{sim}} (t_4^m - \bar{t}_4)^2 - N_{sim}\beta_4^2\}]^{1/2} \text{-- (23)}$$

The above equation explains that Nsim was generated using a Kappa distribution and m is the simulated region denoting index. The fit is deemed suitable if Z^{DIST} is close enough to zero. A reasonable criteria example would be considered by Equation.

$$|\, Z^{DIST} \,| \leq 1.64 \qquad \text{---- (24)}$$

But for best fit distribution it should be close to zero From the heterogeneity measure (H) a maximum of three areas will be chosen after each area consists of a set of stations with the assistance of L moment ratio diagram for normal distribution with help of the fitness measure (Z).

To discover the reduction variable for best fit distribution and for Gumbel distribution by assuming distinct time periods. By using L moments, we get all distribution parameters. We can discover the quantile precipitation for a region by

$$Q_T/Q_{avg} = U + \alpha . Y_T \qquad \text{---- (25)}$$

Where;
U: Location parameter of the best fit distribution
α: Scale parameter of the best fit distribution
Y_T: Reduced variate in term of T time period and shape factor accordingly with best fit distribution

3.3 For 6months time series analysis

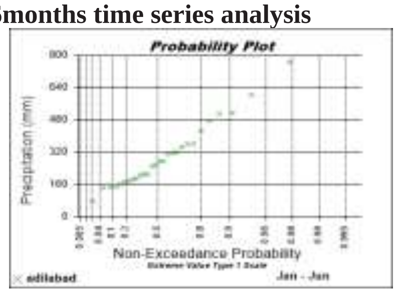

Figure 3. 6 months probability plot

Figure 6. 6 months station L moment diagram

Figure 4. 6months station seasonality bar chart

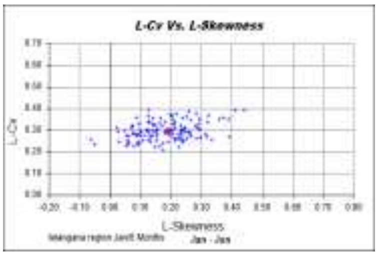

Figure 7 6months regional L-cv Vs. L-Skewness

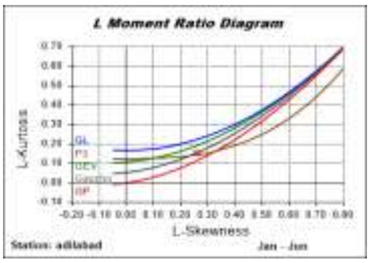

Figure 5. 6 months station L moment diagram

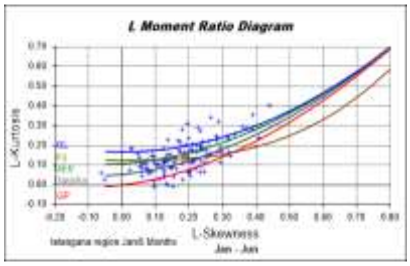

Figure 8 6 months whole region L-moment diagram

3.4 Heterogeneity Measure H1
500 Simulations
SITES =132 # DATA VALUES = 3407.
OBSERVED S.D. OF GROUP L-CV = 0.0425
SIM. MEAN OF S.D. OF GROUP L-CV = 0.0398SIM. S.D. OF S.D. OF GROUP L-CV = 0.0024
STANDARDIZED TEST VALUE = 1.08 Accept *

3.5 Heterogeneity Measure H2
500 Simulations
SITES =132 # DATA VALUES = 3407.
OBSERVED AVE. OF L-CV / L-SKEW DISTANCE = 0.0857
SIM. MEAN OF AVE. L-CV / L-SKEW DISTANCE = 0.0881
SIM. S.D. OF AVE. L-CV / L-SKEW DISTANCE = 0.0047
STANDARDIZED TEST VALUE = -0.53 Accept

3.6 Heterogeneity Measure H3
500 Simulations
SITES =132 # DATA VALUES = 3407.
OBSERVED AVE. OF L-SKEW/L-KURT DISTANCE = 0.1031
SIM. MEAN OF AVE. L-SKEW/L-KURT DISTANCE = 0.1083
SIM. S.D. OF AVE. L-SKEW/L-KURT DISTANCE = 0.0055
STANDARDIZED TEST VALUE = -0.93 Accept

3.7 Goodness-of-Fit Measures
500 Simulations

Table 3 -6 months' time series goodness of fit measure

Distribution	L-KURTOSIS	Z VALUE
GEN. NORMAL	0.150	1.22 Accept
GEN. EXTREME VALUE	0.157	2.17 Reject
PEARSON TYPE III	0.134	-0.97Accept
GEN. LOGISTIC	0.196	7.42 Reject
GAUCHO	0.115	-3.52 Reject
GEN. PARETO	0.071	-9.59 Reject

3.8 Parameter Estimates For Distributions Accepted At 90% Level
500 Simulations

LOCATION	SCALE	SHAPE1	SHAPE2
PEARSON TYPE III	1.000	0.5427	1.139
GEN. NORMAL	0.9014	0.4895	-0.3881

4. RESULT AND DISCUSSION, CONCLUSION, AND SCOPE FOR FURTHER STUDIES

Case 1: For 12-month time scale

DISTRIBUTION	L-KURTOSIS	Z VALUE
GEN. NORMAL	0.136	-2.42 Reject
GEN.EXTREME VALUE	0.135	-2.48 Reject
PEARSON TYPE III	0.128	-3.59 Reject
GEN. LOGISTIC	0.181	3.98 Reject
GAUCHO	0.090	-9.04 Reject
GEN. PARETO	0.042	15.86 Reject

Case 2: For 9-month time scale

Distribution	L-KURTOSIS	Z VALUE
GEN. EXTREME VALUE	0.124	-0.91 Accept
GEN.NORMAL	0.120	0.24 Accept
PEARSON TYPE III	0.127	1.43 Accept
GEN. LOGISTIC	0.071	-8.03 Reject
GAUCHO	0.171	8.83 Reject
GEN. PARETO	0.021	16.86 Reject

5.1 Conclusions

India is in the tropical zone of the world. Due to this its geographical change in a very short distance and changing of seasons throughout the year. Some of the months cover the wet and some are cover dry season due to this circumstance no doubt the whole country effect agriculturally, socially, culturally and economically. So here we are implementing the L-moment method to find out minimum precipitation series which create drought. We can easily find out minimum precipitation using regional growth factor values multiplied by mean precipitation by giving return period as input. This data can be given to government and water resources management, so they could possibly find out alternative way to fulfill the need of water when the minimum precipitation occurs in region. Eventually, it can be useful for welfare farmer and people. Rising of temperature accelerate the evaporation rate there is continue declining of amount of precipitation. Due to which more drought event is occurring. It has main impact on mankind as more suicides, exodus, crop devastation etc. Needless to say, global warming is also increasing due to rise of temperature that relates with the drought occurrence. Serious precaution should be taken for whatever reserves of water we have to escape of disastrous collapse.

5.2 Scope for Further Studies and Recommendations

L-RAP (Linear-Regional Analysis Program) is easy and good tool for conducting regional frequency analysis by using L-moments statistical method. However, L-RAP may generally be used for regional analyses of any datasets for a common phenomenon that are observed at multiple sites. The capabilities of the software will be expanded over time as interest in other applications warrant upgrades for phenomenon-specific applications. In this Analysis parameter Accepted by taking only 90%level which can be also increases to get best assured way of minimum precipitation distribution.

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