Heri Sulistiyono <h.sulistiyono@unram.ac.id>

Manuscript Status Update On (ID: 14829972): Current Status – Under Peer Review- The Modification of Chi-Square Tests for the Identification of Hydrological Data Distribution

1 pesan

Chloe Crawford <preview.hrpub@gmail.com> 18 November 2022 pukul 17.12
Kepada: h.sulistiyono@unram.ac.id

Dear Heri Sulistiyono,

Thank you very much for submitting your manuscript to HRPUB.
In order to expedite the publication process, your manuscript entitled "The Modification of Chi-Square Tests for the Identification of Hydrological Data Distribution" has been sent out to evaluate.
But some problems need to be addressed.
We would be grateful to you if you could revise your manuscript according to the following comments:
1. Figure 1 is unclear. Please provide us the figures with high resolution to allow for reading the details of them. And make sure that all lines and lettering within the figures are legible at final size.

2. **Please check all references for completeness and accuracy, including author names, paper title, journal heading, Volume, Number., pages for journal citations, Year, DOI** (or URL if possible). (Please note that the DOI should be placed after the URL and end with a period.)
Journals
All author names, "Title," Journal title, vol., no., pp. xxx–xxx., Year, DOI (or URL)
e.g.
[1] Clarke A., Mike F., S. Mary, "The Use of Technology in Education," Universal Journal of Educational Research, vol. 1, no. 1, pp. 1–10, 2015. DOI: 10.13189/ujer.2015.010829
Books
All author names, "Title of chapter in the book," in Title of the Published Book, (xth ed. if possible), Abbrev. of Publisher, Year, pp. xxx–xxx.
e.g.
[1] Tom B, Jack E, R. Voss, "The Current Situation of Education," in Current Situation and Development of Contemporary Education, 1st ed, HRPUB, 2013, pp. 1-200.
Conference Papers
All author names, "Title," Conference title, (location of conference is optional), (Month and day(s) if provided) Year, pp., (DOI or URL, if possible)
e.g.
[1] David H., Tim P., "The Use of Technology in Teaching," The Third International Conference, LA, USA, Jul., 2013, pp. 19-23. (The year may be omitted if it has been given in the conference title) (DOI or URL, if possible).
Websites
All author names, "Page Title." Website Title. Web Address (retrieved Date Accessed).
e.g.
[1] Partson K., Joe L., "The Use of Technology in Teaching", US News, http://www.hrpub.com (accessed Jan. 1, 2013).

Please find the following paper for your reference.
https://www.hrpub.org/download/20210330/SAJ22-19922645.pdf

***Please highlight the changes you have made.**

Kindly respond to the evaluation and send your revised manuscript to preview.hrpub@gmail.com as soon as possible.
Please track status of your manuscript through the Online Manuscript Tracking System.

We will contact you again once a new decision is made on your manuscript. You will expect a review report from Anthony Robinson (revision.hrpub@gmail.com) in the following 45 days. Peer review reports are also downloadable in Online Manuscript Tracking System (http://www.hrpub.org/submission/login.php) once the review process is completed.

The author will be requested to pay the Article Processing Charges after the manuscript is accepted for publication.
For the charging standard, please refer to http://www.hrpub.org/journals/jour_charge.php?id=48

Please feel free to contact us if you have any questions. Besides, could you please leave us an alternate Email Address in case?

For more information, please visit the journal's homepage.
Guidelines: http://www.hrpub.org/journals/jour_guidelines.php?id=48

Please acknowledge receipt of this email.

Best Regards

Chloe Crawford
Editorial Assistant
preview.hrpub@gmail.com
Horizon Research Publishing, USA
http://www.hrpub.org

Heri Sulistiyono <h.sulistiyono@unram.ac.id>

The revision of manuscript

2 pesan

Heri Sulistiyono <h.sulistiyono@unram.ac.id> 19 November 2022 pukul 00.46
Kepada: preview.hrpub@gmail.com

Dear Chloe Crawford,
Editorial Assistant

Thank you very much for the first review.
Here we attach the revised manuscript. As for it, we highlight the changes as follows:
1. Comment #1 from Review: Figure 1 is unclear. Please provide us with the figures in high resolution to allow for reading their details of them. And make sure that all lines and lettering within the figures are legible at the final size.

Response to Comment #1: Figure 1 has been replaced with another similar figure with a higher resolution to allow for detailed reading. All lines and letterings within figures have been resized for legible at the final size.
2. **Comment #2 from Review**: Please check all references for completeness and accuracy, including author names, paper titles, journal heading, Volume, Number., pages for journal citations, Year, DOI (or URL if possible). (Please note that the DOI should be placed after the URL and end with a period).

Response to Comment #2: All references have been rewritten for completeness and accuracy, including author names, paper titles, journal heading, Volume, Number., pages for journal citations, Year, DOI, or URL. The DOI has been placed after the URL and ended with a period.

Best Regards,
Heri Sulistiyono

The Article-Chi2V2.docx
332K

Chloe Crawford <preview.hrpub@gmail.com> 22 November 2022 pukul 14.39
Kepada: Heri Sulistiyono <h.sulistiyono@unram.ac.id>

Dear Heri Sulistiyono,

Thanks for your kind email.
We have received your paper. If further revision is required, we will contact you again.

Best Regards

Chloe Crawford
Editorial Assistant
preview.hrpub@gmail.com
Horizon Research Publishing, USA
http://www.hrpub.org

[Kutipan teks disembunyikan]

Heri Sulistiyono <h.sulistiyono@unram.ac.id>

Revision after Peer Review - 2nd Review Report (ID:14829972)-The Modification of Chi-Square Tests for the Identification of Hydrological Data Distribution

1 pesan

Anthony Robinson <revision.hrpub@gmail.com> 20 Desember 2022 pukul 16.17
Kepada: h.sulistiyono@unram.ac.id

Dear Heri Sulistiyono,

Thank you for your interest in publishing your work in HRPUB.
Herewith attached is another review report. Usually, we invite 2 peer reviewers for one manuscript. This is a review report from another reviewer.
Compared with the first review report, the overlapped parts can be ignored.
Please confirm all comments from the two reviewers have been effected in your paper.
We would be grateful if you could address the comments of the reviewers in a revised manuscript and answer all questions raised by reviewers in a cover letter.

Please acknowledge receipt of this email.

Best Regards

Anthony Robinson
Editorial Assistant
revision.hrpub@gmail.com
Horizon Research Publishing, USA
http://www.hrpub.org

Peer_Review_Report-14829972_1220.pdf
291K

Peer Review Report

Notes

Please return the completed report by email within 21 days;

About HRPUB

Horizon Research Publishing, USA (HRPUB) is a worldwide open access publisher serving the academic research and scientific communities by launching peer-reviewed journals covering a wide range of academic disciplines. As an international academic organization for researchers & scientists, we aim to provide researchers, writers, academic professors and students the most advanced research achievements in a broad range of areas, and to facilitate the academic exchange between them.

Manuscript Information

Manuscript ID:	**14829972**
Manuscript Title:	**The Modification of Chi-Square Tests for the Identification of Hydrological Data Distribution**

Evaluation Report

General Comments	**Statistical analysis is made in the study.**
Advantage & Disadvantage	**Statistical improvements are important in terms of the assessment of hydrological data.**
How to improve	**1. Discussions part is missing in the paper.** **2. Give last updated examples from literature about statistical analysis.** **3. Conclusions part can be improved in the paper. Here is presented in a general concept.**

Please rate the following: (1 = Excellent) (2 = Good) (3 = Fair) (4 = Poor)

Originality:	3
Contribution to the Field:	**4**
Technical Quality:	**4**
Clarity of Presentation :	**3**
Depth of Research:	**3**

Recommendation

Kindly mark with a ■

☐ Accept As It Is	
☐ Requires Minor Revision	
■ Requires Major Revision	
☐ Reject	

Return Date:

Heri Sulistiyono <h.sulistiyono@unram.ac.id>

Revision after Peer Review (ID:14829972)-The Modification of Chi-Square Tests for the Identification of Hydrological Data Distribution

10 pesan

Anthony Robinson <revision.hrpub@gmail.com> 19 Desember 2022 pukul 10.12
Kepada: h.sulistiyono@unram.ac.id

Dear Heri Sulistiyono,

Thank you for your interest in publishing your work in HRPUB.

Your manuscript has now been peer reviewed and the comments are accessible in Word format. Peer review reports are also downloadable in Online Manuscript Tracking System (http://www.hrpub.org/submission/login.php).

We would be grateful if you could address the comments of the reviewers in a revised manuscript and answer all questions raised by reviewers in a cover letter. Any revision should be made on the attached manuscript.

In addition to necessary revisions, please note that the similarity index of the revised version should be lower than 18% and similarity from a single source should not exceed 5%.

Please download the publication agreement (http://www.hrpub.org/download/HRPUB_Publication_Agreement2022.pdf) and fill in the authors' names, manuscript title, manuscript ID and signature, then send a scanned version to us.

Please submit the revised paper to us by email in MS Word or LaTex format within two weeks and do not submit it into the Online Manuscript Tracking System.

The author will be requested to pay the Article Processing Charges after the manuscript is accepted for publication. For the charging standard, please refer to http://www.hrpub.org/journals/jour_charge.php?id=48

Look forward to receiving your revised manuscript as soon as possible.

Please acknowledge receipt of this email.

Best Regards

Anthony Robinson
Editorial Assistant
revision.hrpub@gmail.com
Horizon Research Publishing, USA
http://www.hrpub.org

3 lampiran

Peer_Review_Report-14829972.docx
60K

CEA-14829972_checked by referee.pdf
532K

CEA-14829972.docx
382K

Heri Sulistiyono <h.sulistiyono@unram.ac.id> 20 Desember 2022 pukul 17.54
Kepada: Anthony Robinson <revision.hrpub@gmail.com>

Dear Anthony Robinson
Editorial Assistant

Thank you very much. I will revise and provide answers to all reviewers' questions as soon as possible.

Best Regards
Heri
[Kutipan teks disembunyikan]

Anthony Robinson <revision.hrpub@gmail.com> 21 Desember 2022 pukul 12.33
Kepada: Heri Sulistiyono <h.sulistiyono@unram.ac.id>

Dear Heri Sulistiyono,

Thank you for your reply.
Please send the revised paper and cover letter to us via email after you finish it.

Best Regards

Anthony Robinson
Editorial Assistant
revision.hrpub@gmail.com
Horizon Research Publishing, USA
http://www.hrpub.org

[Kutipan teks disembunyikan]

Heri Sulistiyono <h.sulistiyono@unram.ac.id> 26 Desember 2022 pukul 23.06
Kepada: Anthony Robinson <revision.hrpub@gmail.com>

Dear Anthony Robinson,
The Editorial Assistant.

Please accept the revised article and the cover letter in the attachment.
Thank very much
Best regards
Heri
[Kutipan teks disembunyikan]

---

2 lampiran

8. Cover Letter.docx
71K

The Article-Chi2V3.docx
540K

Anthony Robinson <revision.hrpub@gmail.com> 27 Desember 2022 pukul 09.58
Kepada: Heri Sulistiyono <h.sulistiyono@unram.ac.id>

Dear Heri Sulistiyono,

Thank you for your kind email.
We have received your revised paper and the cover letter. If further revision is not required, you will expect an Acceptance Letter from us in 2 weeks.

Best Regards

Anthony Robinson
Editorial Assistant
revision.hrpub@gmail.com
Horizon Research Publishing, USA
http://www.hrpub.org

[Kutipan teks disembunyikan]

Heri Sulistiyono <h.sulistiyono@unram.ac.id> 27 Desember 2022 pukul 13.05
Kepada: Anthony Robinson <revision.hrpub@gmail.com>

Dear Mr. Anthony Robinson,

Thank you very much

Best regards
Heri
[Kutipan teks disembunyikan]

Anthony Robinson <revision.hrpub@gmail.com> 29 Desember 2022 pukul 16.57
Kepada: Heri Sulistiyono <h.sulistiyono@unram.ac.id>

Dear Heri Sulistiyono,

We have received your revised paper.
Please check the table and figure numbering. There are two "Table 3" and two "Figure 5".

Best Regards

Anthony Robinson
Editorial Assistant
revision.hrpub@gmail.com
Horizon Research Publishing, USA
http://www.hrpub.org

[Kutipan teks disembunyikan]

Heri Sulistiyono <h.sulistiyono@unram.ac.id> 29 Desember 2022 pukul 18.55
Kepada: Anthony Robinson <revision.hrpub@gmail.com>

Dear Mr. Anthony Robinson
Edotorial Assistant

Thank you very much for the correction. We will revise as soon as possible

Best regards
Heri
[Kutipan teks disembunyikan]

Heri Sulistiyono <h.sulistiyono@unram.ac.id> 30 Desember 2022 pukul 20.29
Kepada: Anthony Robinson <revision.hrpub@gmail.com>

Dear Mr. Anthony Robinson

Please find the revised manuscript in the attachment.
Thank you very much.

Best regards,
Heri
[Kutipan teks disembunyikan]

The Article-Chi2V4.docx
538K

Anthony Robinson <revision.hrpub@gmail.com> 4 Januari 2023 pukul 09.22
Kepada: Heri Sulistiyono <h.sulistiyono@unram.ac.id>

Dear Heri Sulistiyono,

Thank you for your email.

We have received the revised manuscript.

Best Regards

Anthony Robinson
Editorial Assistant
revision.hrpub@gmail.com
Horizon Research Publishing, USA
http://www.hrpub.org

[Kutipan teks disembunyikan]

Peer Review Report

Notes

Please return the completed report by email within 21 days;

About HRPUB

Horizon Research Publishing, USA (HRPUB) is a worldwide open access publisher serving the academic research and scientific communities by launching peer-reviewed journals covering a wide range of academic disciplines. As an international academic organization for researchers & scientists, we aim to provide researchers, writers, academic professors and students the most advanced research achievements in a broad range of areas, and to facilitate the academic exchange between them.

Manuscript Information

Manuscript ID:	**14829972**
Manuscript Title:	**The Modification of Chi-Square Tests for the Identification of Hydrological Data Distribution**

Evaluation Report

General Comments	**This paper includes technique to identify distribution of hydrological data, however the method is new and looks like created by the author. Therefor in such a case, the method needs to be tested on many data sets, not only 1 data set, to proof the accuracy of the method. Also hydrological data not only rainfall data, the method should be tested on other types of hydrological data such as runoff, streamflow, evaporation…..etc.**
Advantage & Disadvantage	**The paper claims a new method to find distribution of hydrological data, which is good a approach, however the paper only tested this method on a small set of rainfall data which is not guarantee the correctness of the provided new method. Also the title mentioned hydrological data, whereas the analysis only done on rainfall data, there are so many hydrological data types (e.g. runoff, evaporation, flow rate, …etc.) left without any test.**
How to improve	**The author needs to proof the accuracy of the provided new method by testing it on many data sets, the data should be at least 100 points. Also the method should be tested on other hydrological data types, otherwise the title should be updated to be only for precipitation data. For more details, the author can refer to the attached pdf file.**

Please rate the following: (1 = Excellent) (2 = Good) (3 = Fair) (4 = Poor)

Originality:	2
Contribution to the Field:	**2**
Technical Quality:	**4**
Clarity of Presentation :	**4**
Depth of Research:	**4**

Recommendation	
Kindly mark with a ■	
☐ Accept As It Is	
☐ Requires Minor Revision	
■ Requires Major Revision	
☐ Reject	

Return Date:_______________

The Modification of Chi-Square Tests for the Identification of Hydrological Data Distribution

Abstract The growing population in the community has led to an increase in the need for community infrastructure. Civil engineers have to provide secure community infrastructures. The infrastructures must resist the load caused by extreme events, such as rainstorms. Therefore, civil engineers must design the water infrastructure based on the exact parameters of the hydrological data. Engineers obtain the precise parameters of a return period through frequency analysis. Good data distribution will lead to obtaining the parameters. Civil engineers can use the Chi-Square method to test the fitness of the data distribution type. However, the original way to get the Expected Frequency is complicated because it uses the integral solving method. This weakness causes the engineers to linger to test the distribution suitability. This article proposes a modification to ease obtaining the expected frequency in the Chi-Square test. This article demonstrated the proposal using rainfall data from 1997 to 2021 from the Semongkat station, Sumbawa Regency, Indonesia. The demonstration results show that the proposal is easy to implement. The Maximum Daily Rain data from Semongkat Station follows the Lognormal Distribution.

Keywords Rainstorms, Data distribution, Return Period, Chi-Square Test

1. Introduction

Design discharge is essential information in water construction design [1-3]. Researchers and civil engineers use design discharges to obtain the dimensions of water structures. Unrealistic design discharge can lead to the failure or the over-budget of construction [4]. Researchers and engineers derive discharge designs based on an acceptable type of discharge data distribution in the frequency analysis [5-8]. However, there are difficulties in recognizing the distribution. The problem is such as obtaining the parameters of data distribution. So far, the well-known methods for estimating the parameters of distribution data are the Method of Moments, the Method of Maximum Likelihood Estimation, the Method of Probability Weighted Moment, and the Richardson Method [9-11]. Those methods have some weaknesses [12], including: (1) an iterative procedure for maximum likelihood estimation is based only on a complete sample of various population parameters; (2) the solution is only based on a linear system; (3) the method cannot find the precise parameter if the system has more than one peak (4), the method cannot find the parameter if the distribution members are infinite, (5) the solution requires complex mathematical solving skills, such as integral approach [13-16].

To anticipate the weaknesses above, engineers utilize the statistical parameters of distribution to understand the type of distribution [17,18]. The distribution parameters are the skewness coefficient and the kurtosis coefficient. However, engineers have to compare the frequency of the observed data to the expected frequency to ensure the type of distribution [19,20]. The expected frequency in the Chi-Square Test is the theoretical frequency that we expect to occur in the data according to the type of distribution. Generally, researchers and engineers calculate the expected frequency based on the equation of the data distribution curve or the Probability Density Function (PDF) plot. Researchers and engineers can draw PDF plots using a mathematical solution approach to the theoretical distribution function [13-16]. Fig. 1 shows the PDFs of several distribution functions.

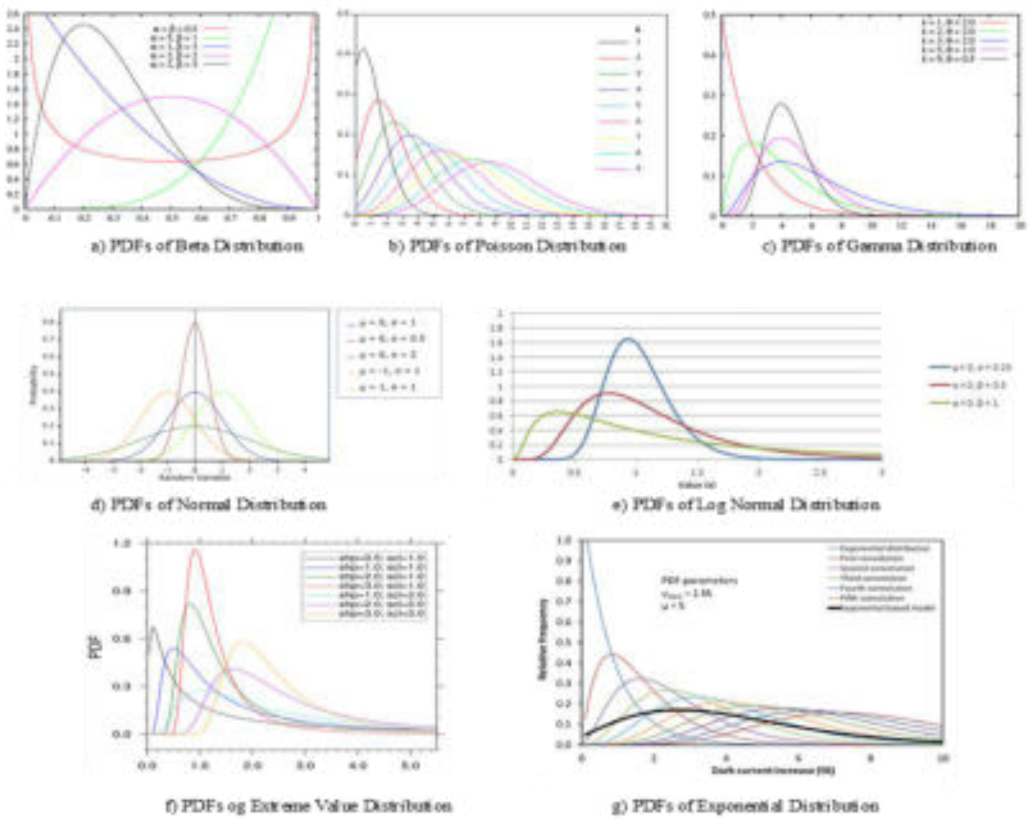


Figure 1. The Plots of Probability Density Function

Statisticians and mathematicians use an integration approach to calculate the area under the PDF curve as the estimate of expected frequency [13-16]. However, this integration approach is complicated; consequently, the chi-square test has become unpopular among engineers.

This paper proposes a modification of Chi-Square Tests to identify the data distribution. This technique helps engineers obtain the type of hydrological data distribution without having a problem.

2. Materials and Methods

2.1 Chi-Square

Pearson [19] developed the method of Chi-Square for the goodness of fit test. The Chi-Square tests the similarity between observational data and theory using the sum of squares of the difference based on data classes. Pearson gave the equation below [21, 22].

$$\chi^2 = \Sigma\,(OF - EF)^2 / \Sigma\,(EF) \qquad (1)$$

where: χ is Pearson's cumulative test statistic, OF is the number of observation Frequencies, EF is the expected (theoretical) frequency.

A calculated Pearson's Chi-square smaller than the critical Chi-square from the table indicates the observed data follow the expected distribution. Table 1 presents critical Chi-square. Fig. 2 shows the technique of using the Chi-square method for the identification of hydrological data distribution types.

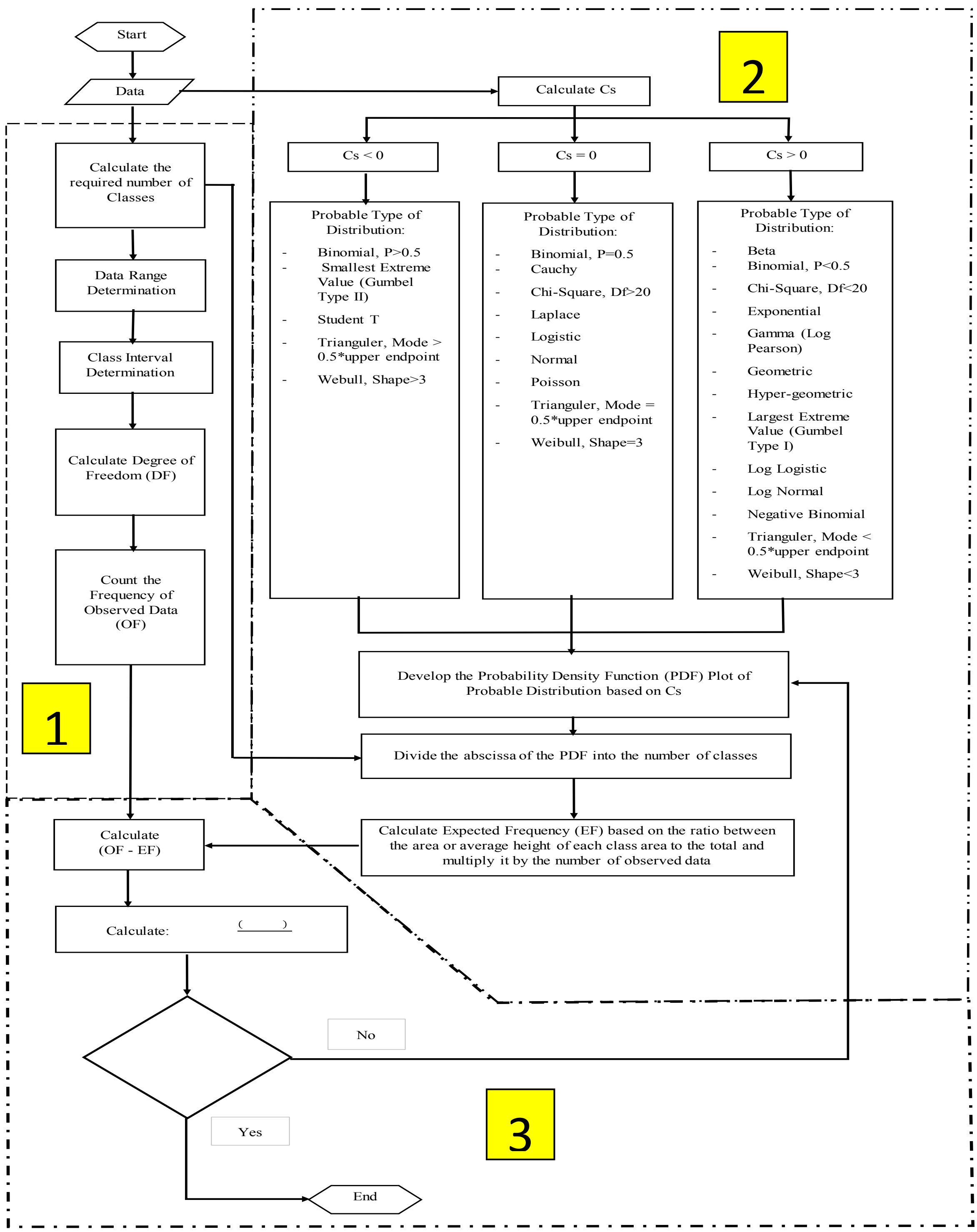


Figure 2. The Proposed Process Diagram

Fig. 2 shows the Chi-square test technique to identify the distribution type of hydrological data. This technique contains three parts of analysis. The first part is to prepare data into classes according to the number of data. The second part is to obtain the expected frequency and the modification. Finally, the third part examines the acceptability of the data distribution.

Table 1. Percentage Points of the Chi-Square Distribution

Degree of Freedom	Probability of a Larger Value of χ^2								
	0.99	0.95	0.90	0.75	0.50	0.25	0.10	0.05	0.01
1	0.00	0.00	0.01	0.10	0.45	1.32	2.71	3.84	6.63
2	0.02	0.10	0.21	0.57	1.38	2.77	4.61	5.99	9.21
3	0.11	0.35	0.58	1.21	2.36	4.11	6.25	7.81	11.34
4	0.29	0.71	1.06	1.92	3.35	5.39	7.78	9.49	13.34
5	0.55	1.14	1.61	2.67	4.35	6.63	9.24	11.07	15.09
6	0.87	1.63	2.20	3.45	5.34	7.84	10.64	12.59	16.81
7	1.23	2.16	2.83	4.25	6.34	9.04	12.02	14.07	18.48
8	1.64	2.73	3.49	5.07	7.34	10.22	13.36	15.51	20.09
9	2.08	3.32	4.16	5.89	8.34	11.39	14.68	16.92	21.67
10	2.55	3.32	4.16	5.89	8.34	11.39	14.68	16.92	21.67

(Source: Devore, 1995)

2.2 Calculations

2.2.1 The Number of Class

In calculating Chi-Square using tables, engineers need to group the data based on an interval to count the frequency of occurrence. Therefore, Engineers have to divide data into several classes using the equation of Sturges ~~as follows~~ [23,24,20].

$$k = 1 + 3.322 (\log10 (n)) \quad (2)$$

where k is the number of class, n is the number of data

2.2.2 The Range of Data

The range of data shows how the data spreads from the smallest to the largest. Equation (3) obtains the range

$$R = H - L \quad (3)$$

where R is the range of data, H is the largest value of data, L is the smallest value of data.

2.2.3 The Interval of Class

Equation (4) obtains the interval of class

$$I = R / k \quad (4)$$

where I is the interval of class, R is the range of data, k is the number of class.

2.2.4 The Degree of Freedom

The degree of freedom (DF) is the number of independent variables in the data set, which still independently maintain fixed parameters [25,26]. The equation of the degree of freedom for the Chi-Square calculation is

$$DF = k - 1 \quad (5)$$

where DF is the Degree of Freedom, k is the number of classes.

2.2.5 Coefficient of Skewness

Some researchers and civil engineers use the Coefficient of Skewness (Cs) to identify whether the data follow a symmetrical distribution. Symmetrical distributions have Cs equal to zero. Otherwise, the distribution is asymmetrical. The two types of asymmetrical distributions are positive and negative asymmetrical distributions. Pearson gave an equation to calculate the Coefficient of Skewness (Cs) below [27-30].

$$Cs = [n/(n-1)(n-2)]\ \Sigma\ [(xi-\mu)/\sigma)^3] \tag{6}$$

where Cs is the Coefficient of Skewness, n is the number of data, xi is the individual data, μ is the average of data, and σ is the standard deviation of data.

2.2.6 The Modification of the Expected Frequency Calculation

The modification is replacing the original method of calculating the area of a PDF curve based on an integration [19,13-16] with the technique of measuring the height of the curve. The solution becomes simpler. The following steps explain how to obtain the expected frequency using the new approach

Step 1: Get the PDF curve,
Step 2: Divide the abscissa of the curve according to the number of classes,
Step 3: Obtain the height of each class,
Step 4: Sum all of the heights of the class,
Step 5: Determine the Expected Frequency of each class by the height line of each class divided by the total height, then multiplied by the number of data

2.3 Case Study

The following section presents several case studies to demonstrate the application of the proposed technique. This paper performs a Chi-Square test to identify the distribution type of hydrological data. This study analyzes the following two sample data: Rainfall Data and Flow Data.

Table 2 presents the Historical Rainfall Data from the Semongkat Station, Sumbawa – Indonesia.

Table 2. The Maximum Daily Rainfall Data from the Semongkat Station

No	Year	Xi	No	Year	Xi
1	1997	145.2	14	2010	86.2
2	1998	92	15	2011	62.3
3	1999	162.3	16	2012	122.3
4	2000	96.6	17	2013	100
5	2001	115.3	18	2014	113.5
6	2002	146.2	19	2015	117.5
7	2003	98.7	20	2016	92
8	2004	145.7	21	2017	145
9	2005	86.4	22	2018	67.5
10	2006	76.8	23	2019	78.3
11	2007	87.8	24	2020	221.1
12	2008	82.4	25	2021	56.4
13	2009	189.3			

2.3.1 The Classes

Using Equations (2), (3), and (4), the classes will be as shown in Table 3

Table 3. The Classes

No	Lower Bond	Upper Bond	Classes
1	-	83.85	$0 < X \leq 83.85$
2	83.85	111.3	$83.85 < X \leq 111.3$
3	111.3	138.75	$111.3 < X \leq 138.75$
4	138.75	166.2	$138.75 < X \leq 166.2$
5	166.2	193.65	$166.2 < X \leq 193.65$
6	193.65	221.1	$193.65 < X \leq 221.1$

2.3.2 Degree of Freedom

Using Equation (5), the Degree of Freedom (DF) is

$$DF = k - 1 = 6 - 1 = 5$$

2.3.3 Coefficient of Skewness

Using Eq. (6), the Coefficient of Skewness is

$$Cs = [25/(25-1)(25-2)]\ \Sigma\ [((xi-111.47)/40.37)^3] = 1.06$$

As the Cs is close to one (1), the expected distribution is a Log Normal.

2.3.4 The Modification of the Expected Frequency Calculation

This paper proposes a method for calculating the Expected Frequency based on the ratio of the heights of each data class interval instead of calculating the area using integration operations. The following is a detailed description of the expected frequency calculation for the case in this paper.

Step 1: The PDF of a Log Normal Distribution. Figure 3 shows a PDF Plot of Lognormal Distribution.

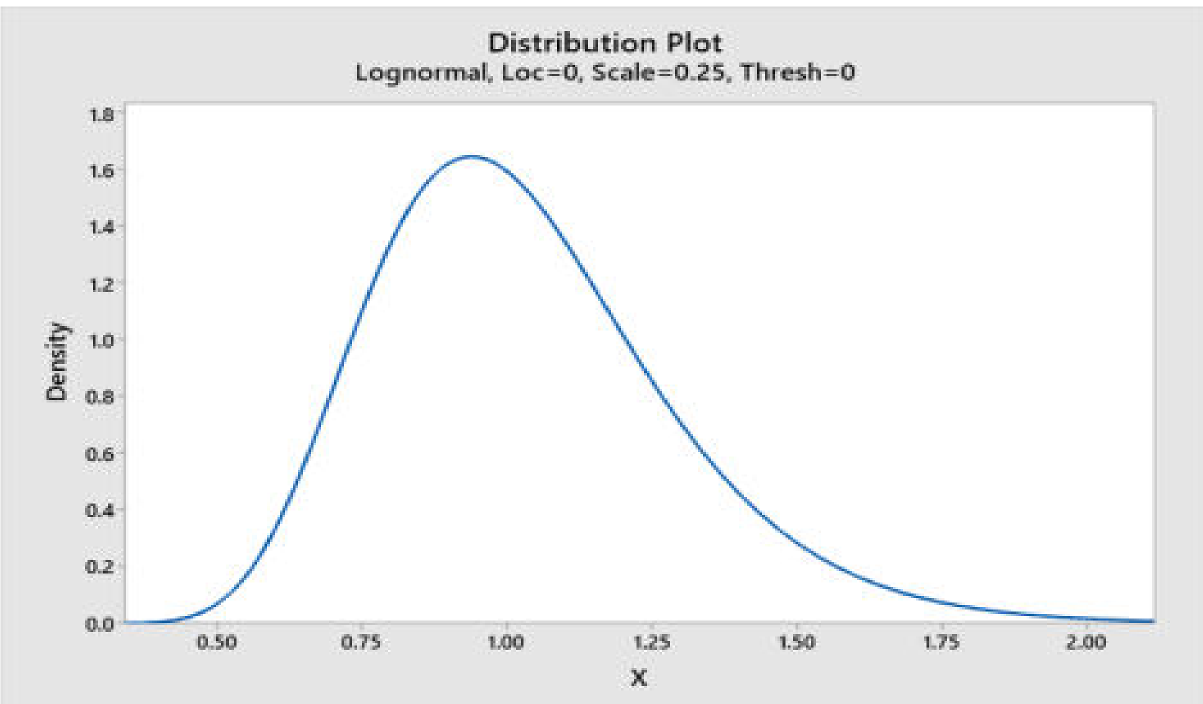


Figure 3. A PDF Plot of Lognormal Distribution

Step 2: The Division of the abscissa. Figure 4 shows the abscissa of the PDF Plot divided into six parts.

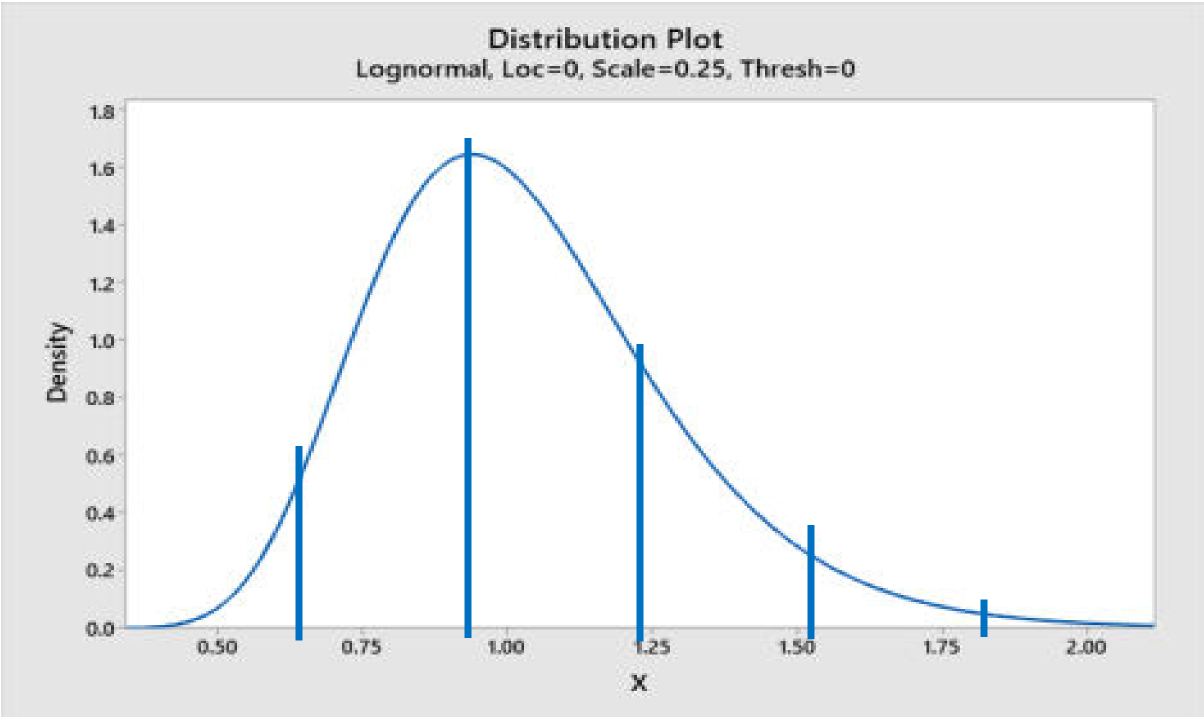


Figure 4. The six parts of PDF Plot

Step 3: The high line of each class. The red lines in Figure 5 represent the high lines

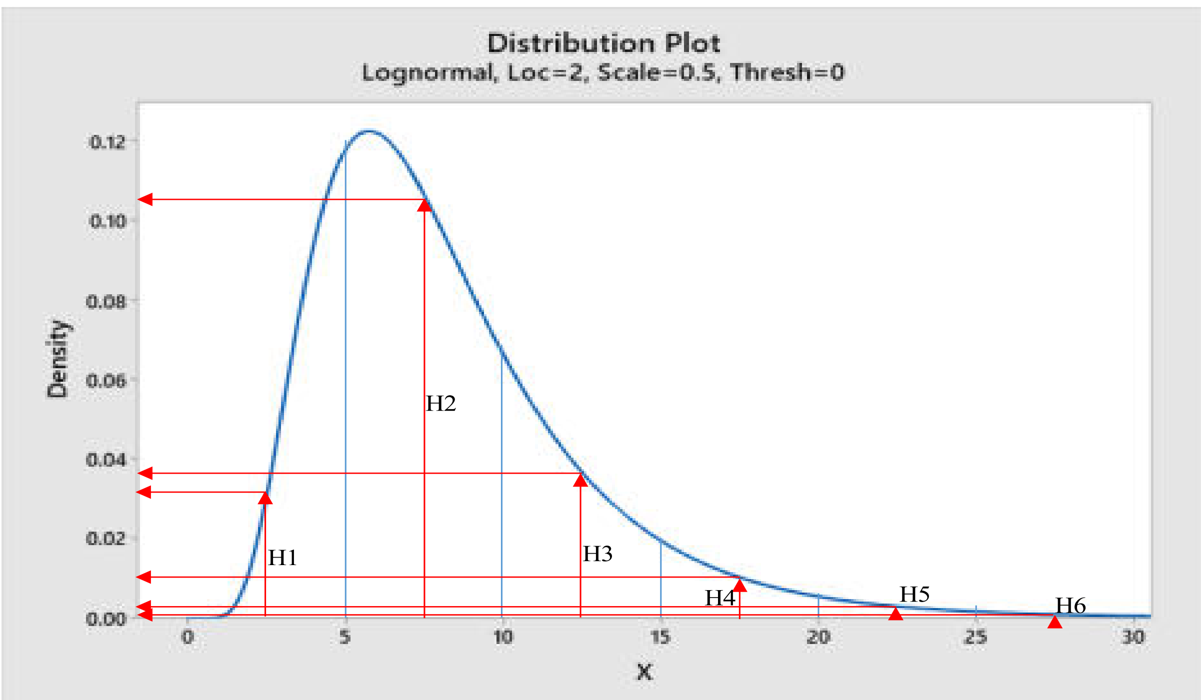


Figure 5. The height lines

Figure 5 shows H1 is 0.031, H2 is 0.105, H3 is 0.039, H4 is 0.010, H5 is 0.001, and H6 is 0.000.
Step 4: The total of all high lines. The sum of high lines is 0.186
Step 5: The Expected Frequency. Table 4 shows the calculation of the Expected Frequency

Table 4 The Calculation of Expected Frequency

Classes	Calculation of EF	EF
0 < X ≤83.85	=(0.031/0.186)*25 = 4.16	4
83.85 < X ≤ 111.3	=(0.105/0.186)*25 =14.11	14
111.3 < X ≤138.75	=(0.039/0.186)*25 =5.24	5
138.75 < X ≤ 166.2	=(0.010/0.186)*25 =1.34	2
166.2 < X ≤193.65	=(0.001/0.186)*25 =0.13	0
193.65 < X ≤ 221.1	=(0.000/0.186)*25 =0.00	0
Total		25

2.3.5 The Examination of Distribution Acceptability

The examination uses Equation (1). Table 5 shows the calculation

Table 5 The Calculation

No	Class	OF	EF	OF-OF	$(OF-EF)^2$ /EF
1	0 < X ≤83.85	6	4	2	1
2	83.85 < X ≤ 111.3	8	14	-6	2.57
3	111.3 < X ≤138.75	4	5	-1	0.2
4	138.75 < X ≤ 166.2	5	2	3	4.5
5	166.2 < X ≤193.65	1	0	1	0
6	193.65 < X ≤ 221.1	1	0	1	0
	Total	25	25		8.27

Table 5 shows the calculated Chi-Square is 8.27. While Table 1 shows the critical Chi-Square value based on the degree of freedom of 5 and a significant error of 5% of 11.70. So, the calculated Chi-Square is smaller than the critical Chi-Square. The calculation shows that the data follows the Lognormal Distribution. Furthermore, data frequency analysis can use the parameters and conditions of the Lognormal Distribution to obtain a return period for rainstorms.

3. Conclusion

The right type of hydrological data distribution is essential in water resources analyses. Imprecise data distribution will cause inaccuracies in the calculation of the return period. The modification of the Chi-Square test simplifies the determination of the precise distribution of hydrological data. This paper has demonstrated the modification technique to test the maximum daily rainfall data from the Semongkat rain station, Sumbawa Regency, Indonesia. The results show that the data follow a Lognormal Distribution. The demonstration also shows that the proposed technique is easy to understand.

REFERENCES

[1] Z. Şen. Flood Design Discharge and Case Studies. In: Flood Modeling, Prediction and Mitigation. Springer, Cham, 2018. Extra Materials Archive Search (springer.com)

[2] D. M. Amatya, S. Tian, D. A. Marion, P. Caldwell, S. Laseter, M. A. Youssef, J. M. Grace, G. M. Chescheir, S. Panda, Y. Ouyang, G. Sun, J. M. Vose. Estimates of precipitation IDF curves and design discharges for road-crossing drainage structures: Case study

in four small-forested watersheds in the southeastern US. Journal of Hydrologic Engineering /Volume 26 Issue 4 - April 2021. https://www.srs.fs.usda.gov/pubs/ja/2021/ja_2021_amatya_001.pdf.

[3] A. Flammini, J. Dari, C. Corradini, C. Saltalippi, and R. Morbidelli. Chapter 10 - Areal reduction factor estimate for extreme rainfall events. Rainfall. Modeling, Measurement and Applications. Elsevier, 2022, Pages 285-306, ISBN 9780128225448, https://doi.org/10.1016/B978-0-12-822544-8.00014-7

[4] L. Shi, Q. Yi, L. Yixiu, S. Xiaoyu, L. Qiang, and L. Ziwen. Estimating the Design Flood under the Influence of Check Dams by Removing Nonstationarity from the Flood Peak Discharge Series. Hydrology Research (2020) 51 (6): 1261–1273. https://doi.org/10.2166/nh.2020.050

[5] J. A. R. Villaseñor. Frequency Analyses of Natural Extreme Events: A Spreadsheets Approach. E-Book. Springer, 2021. https://link.springer.com/book/10.1007/978-3-030-86390-6

[6] M. Sharifi, M. R. M. Tabatabai, S. H. G. Najafabadi. Determination of river design discharge (Tar River case study). Journal Of Water And Climate Change (Mar 2021). Vol. 12, no. 2. pp. 612 – 626. https://doi.org/10.2166/wcc.2020.278

[7] N. K. Mangukiya, D. J. Mehta, and R. Jariwala. Flood frequency analysis and inundation mapping for lower Narmada basin, India. Water Practice and Technology (2022) 17 (2): 612–622. https://doi.org/10.2166/wpt.2022.009

[8] D. V. D. Spuy and J. D. Plessis. Flood frequency analysis – Part 1: Review of the statistical approach in South Africa. Water SA. Vol. 48 No. 2 April (2022). https://doi.org/10.17159/wsa/2022.v48.i2.3848.1

[9] D. Kurniasari, Warsono, Widiarti, S. U. Nabila, N. Indryani, M. Usman, and S. Hadi. The Comparison of the Efficiency of the Methods of Parameters Estimation for Generalized Beta of the Second Kind (Gb2) Distribution. ARPN Journal of Engineering and Applied Sciences. Vol. 17, No. 4, February 2022. http://www.arpnjournals.org/jeas/research_papers/rp_2022/jeas_0222_8867.pdf

[10] A. Elhassanein. On Statistical Properties of a New Bivariate Modified Lindley Distribution with an Application to Financial Data. Complexity, vol. 2022, Article ID 2328831, 19 pages, 2022. https://doi.org/10.1155/2022/2328831

[11] M. M. Buzaridah, D. A. Ramadan, B. S. El-Desouky. Estimation of Some Lifetime Parameters of Flexible Reduced Logarithmic-Inverse Lomax Distribution under Progressive Type-II Censored Data. Journal of Mathematics, vol. 2022, Article ID 1690458, 13 pages. https://doi.org/10.1155/2022/1690458

[12] H. L. Harter. Some Optimization Problems In Parameter Estimation, Optimizing Methods in Statistics, Academic Press, 1971, Pages 33-62, ISBN 9780126045505, https://doi.org/10.1016/B978-0-12-604550-5.50007-9

[13] Y. Wu and P. Chen. Statistical Modeling in Biomedical Engineering. Encyclopedia of Biomedical Engineering. Elsevier, Pages 164-176, 2019. ISBN 978012805 1443. https://doi.org/10.1016/B978-0-12-801238-3.99970-7

[14] X. S. He, Q. W. Fan, and X. S. Yang. Probability theory for analyzing nature-inspired algorithms. Nature-Inspired Computation and Swarm Intelligence. Academic Press, Pages 77-88, 2020. ISBN 9780128197141. https://doi.org/10.1016/B978-0-12-819714-1.00016-6

[15] A. Ramadan, M. Ebeed, S. Kamel, and L. Nasrat. Optimal power flow for distribution systems with uncertainty. Uncertainties in Modern Power Systems. Academic Press, Science Direct, Pages 145-162, 2021. ISBN 9780128204917, https://doi.org/10.1016/B978-0-12-820491-7.00005-0

[16] L. Fang and Y. Zhang. Probability density function analysis based on logistic regression model. International Journal of Circuits. Systems and Signal Processing. Vol. 16. Pp: 60 – 69, 2022. DOI: 10.46300/9106.2022.16.9. https://npublications.com/journals/circuitssystemssignal/2022/a182005-009(2022).pdf

[17] T. A. Cohn, N. A. Barth, J. F. England, B. A. Faber, R. R. Mason, and J. R. Stedinger. Evaluation of recommended revisions to Bulletin 17B. USGS Report. 2019. USGS Publications Warehouse. DOI: 10.3133/ofr20171064

[18] J. F. England Jr., T. A. Cohn, B. A. Faber, J. R. Stedinger, W. O. Thomas Jr., A. G. Veilleux, J. E. Kiang, and R. R. Mason Jr. Guidelines for determining flood flow frequency — Bulletin 17C (ver. 1.1, May 2019): U.S. Geological Survey Techniques and Methods, book 4, chap. B5, 148 p., 2019. https://doi.org/10.3133/tm4B5

[19] K. Pearson. On the criterion that a given system of deviations from the probable in the case of a correlated system of variables is such that it can be reasonably supposed to have arisen from random sampling (PDF). Philosophical Magazine. Series 5. 50 (302): 157–175, 1900. doi:10.1080/1478644000946 3897

[20] B. D. Evita. Retention Pool Planning As an Alternative Flood Control In The Ranjok River (*Perencanaan Kolam Retensi Sebagai Alternatif Pengendali Banjir Di Sungai Ranjok*). Thesis. Civil Engineering Bachelor Degree Program. Faculty of Engineering. University of Mataram, 2022.

[21] P. Schober and T. Vetter. Chi-square Tests in Medical Research. Statistical Minute: Statistical Minute. Anesthesia & Analgesia: November 2019 - Volume 129 - Issue 5 – page 1193, 2019. doi: 10.1213/ANE.0000000000004410. https://journals.lww.com/anesthesia-analgesia/fulltext/2019/11000/chi_square_tests_in_medical_research.3.aspx

[22] N. S. Turhan. Karl Pearson's Chi-Square Tests. Academic Journals. Article Number - 72074A964789. Vol.15(9), pp. 575-580 , September 2020. acfc8be54516124e51d45e0bf559812f8b66.pdf (semanticscholar.org)

[23] H. A. Sturges. The choice of a class interval. Journal of the American Statistical Association. 21 (153): 65–66, 1926. doi:10.1080/0162145 9.1926.10502161. JSTOR2965501. https://doi.org/10.1080/01621459.1926.10502161

[24] D. W. Scott. Sturges' rule. Wiley Interdisciplinary Reviews: Computational Statistics 1(3):303 – 306, 2009. DOI: 10.1002/wics.35. https://www.deepdyve.com/lp/wiley/sturges-rule-XlDTDSe4IQ

[25] R. G. Brereton. Determining the significance of individual factors for orthogonal designs, Journal of Chemometrics, 10.1002/cem.3124, 33, 6, 2019. https://analyticalsciencejournals.onlinelibrary.wiley.com/doi/epdf/10.1002/cem.3124

[26] D. L. Mohr, W. J. Wilson, and R. J. Freund. Inferences for Two Populations, Statistical Methods (Fourth Edition), Academic Press, Pages 201-241, 2022. ISBN 9780128230435. https://www.coursehero.com/file/85444717/Inferences-for-Two-Populationspdf/

[27] J. L. Devore. Probability and Statistics for Engineering and the Sciences. Duxbury Press. USA. 1995. https://www.amazon.com/Probability-Statistics-Engineering-Sciences-Devore/dp/0538733527?asin =0538733527&revisionId=&format=4&depth=1

[28] R. Rousseau. Skewness for journal citation curves. Conference: STI-Conference at Leiden, the Netherlands. 2014. Researchgate. https://www.researchgate.net/publication/292404753_Skewness_for_journal_citation_curves

[29] H. Gatfaoui, I. Nagot, and P. D. Peretti. Are Critical Slowing Down Indicators Useful to Detect Financial Crises? Systemic Risk Tomography, Elsevier, Pages 73-93, 2017. ISBN 9781785480850, https://doi.org/10.1016/B978-1-78548-085-0.50003-0

[30] G. Romeo. Elements of Numerical Mathematical Economics with Excel, Academic Press, Science Direct, Pages 763-795, 2020. ISBN 9780128176481, https://www.amazon.com/Elements-Numerical-Mathematical-Economics-Excel/dp/0128176482

Civil Engineering and Architecture
Cover Letter

Name of Corresponding Author : Heri Sulistiyono

Title of Manuscript : The Modification of Chi-Square Tests for the Identification of Rainfall and River Flow Data Distribution

Dear Prof. Jorge M. Tavares Ribeiro

Editor-in-Chief

On behalf of all authors, I submit the attached manuscript for possible publication in the Civil Engineering and Architecture. I hereby declare that this manuscript has not been submitted for publication or published in whole or in part elsewhere.

This paper describes the modification of the Chi-Square Test for the Identification of Rainfall and River Flow Data Distribution. The paper has demonstrated the proposed modified technique for testing maximum daily rainfall and river flow data from several stations to represent regions worldwide.

I guarantee that no intentional or unintentional plagiarism has occurred in the manuscript and all original references have been read, studied, and quoted.

I confirm that all figures and tables were originally created by the author of this manuscript unless otherwise stated and permission has been obtained from the original author or publisher.

I confirm that all authors listed on the title page have read the manuscript, proving the validity and legitimacy of the data, analysis, and interpretation thereof. All authors have approved their submission to the Civil Engineering and Architecture.

I confirm that the instructions for the authors of this journal have been read carefully and all points have been complied with for the entire manuscript.

All information about possible conflicts of interest, sources of financial support, company involvement, patent ownership, etc. for each author have been disclosed.

Responses to the reviewers:

In response to reviewer #1 regarding the title.

The title has been adjusted. The title adjustment is to ensure a more specific topic analysis.

In response to reviewer #1 regarding rewording.

Rewording has been done to avoid ambiguities.

In response to reviewer #1 regarding moving table 1 before Figure 2.

Table 1 has been moved to the place before Figure 2.

Response to reviewer #1 regarding the sign of each equation

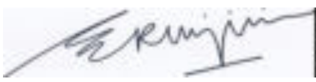
Each equation has been assigned a number.

In response to reviewer#1 and reviewer#2 about additional testing on multiple data sets.

More tests have been performed on the maximum daily rainfall and the river flow data from seven stations to represent the wide world.

December 26th, 2022

Yours Sincerely,



Heri Sulistiyono

Heri Sulistiyono <h.sulistiyono@unram.ac.id>

Acceptance Letter & Advice of Payment (ID:14829972)-The Modification of Chi-Square Tests for the Identification of Hydrological Data Distribution

6 pesan

Anthony Robinson <revision.hrpub@gmail.com> 13 Januari 2023 pukul 09.54
Kepada: Heri Sulistiyono <h.sulistiyono@unram.ac.id>

Dear Heri Sulistiyono,

Your paper has been accepted for publication. Herewith attached is the Acceptance Letter.

Please download the publication agreement (http://www.hrpub.org/download/HRPUB_Publication_Agreement2023.pdf) and fill in the authors' names, manuscript title, manuscript ID and signature, then send a scanned version to us.

The publication fee is $480. Below are Wire Transfer instructions.

Beneficiary name: HORIZON RESEARCH PUBLISHING CO., LTD
Beneficiary account number: 33113742
Banking Swift code for international wires: CATHUS6L
Beneficiary bank name: Cathay Bank
Beneficiary bank address: 4128 Temple City Blvd, Rosemead, CA 91770 United States
Note: Please add $35.00 for wire transfer fee.

The bank charge would be deducted prior to the receipt of the payment. To avoid a shortfall on the net amount received and request for repayment, authors shall pay the commission charge while making the payment.

Once the payment is finished, please inform us or send the remittance bill to us.

Best Regards

Anthony Robinson
Editorial Assistant
revision.hrpub@gmail.com
Horizon Research Publishing, USA
http://www.hrpub.org

Acceptance Letter_14829972.jpg
421K

Heri Sulistiyono <h.sulistiyono@unram.ac.id> 13 Januari 2023 pukul 15.08
Kepada: Anthony Robinson <revision.hrpub@gmail.com>

Dear Mr. Anthony Robinson

Here, I would like to confirm that I have paid the Journal Publication Payment to the Cathay Bank. Please find the tranfer receipt in the attachment.

[Kutipan teks disembunyikan]

IMG-20230113-WA0007.jpg
63K

Anthony Robinson <revision.hrpub@gmail.com> 14 Januari 2023 pukul 11.26
Kepada: Heri Sulistiyono <h.sulistiyono@unram.ac.id>

Dear Heri Sulistiyono,

Thank you for your email.

Could you please tell us the name of the payer?

Best Regards

Anthony Robinson
Editorial Assistant
revision.hrpub@gmail.com
Horizon Research Publishing, USA
http://www.hrpub.org

[Kutipan teks disembunyikan]

Heri Sulistiyono <h.sulistiyono@unram.ac.id> 14 Januari 2023 pukul 13.49
Kepada: Anthony Robinson <revision.hrpub@gmail.com>

Dear Mr. ANTHONY Robinson
The Editorial Assistant

The name of my journal payer is Vivin Marlina

Best regards
Heri
[Kutipan teks disembunyikan]

Heri Sulistiyono <h.sulistiyono@unram.ac.id> 14 Januari 2023 pukul 13.52
Kepada: Anthony Robinson <revision.hrpub@gmail.com>

Dear Mr Anthony Robinson

Please find the attachment
Thank you very much

Best regards
Heri
[Kutipan teks disembunyikan]

Screenshot_20230114-135026_Gmail.jpg
419K

Anthony Robinson <revision.hrpub@gmail.com> 14 Januari 2023 pukul 16.05
Kepada: Heri Sulistiyono <h.sulistiyono@unram.ac.id>

Dear Heri Sulistiyono,

Thank you for the information.

We have received your payment.

Best Regards

Anthony Robinson
Editorial Assistant
revision.hrpub@gmail.com
Horizon Research Publishing, USA
http://www.hrpub.org

[Kutipan teks disembunyikan]

Heri Sulistiyono <h.sulistiyono@unram.ac.id>

Proof Reading before Publication (ID:14829972)-The Modification of Chi-Square Tests for the Identification of Hydrological Data Distribution

6 pesan

Anthony Robinson <revision.hrpub@gmail.com> 25 Februari 2023 pukul 13.50
Kepada: Heri Sulistiyono <h.sulistiyono@unram.ac.id>

Dear Heri Sulistiyono,

Your manuscript has been accepted for publication. Authors are given a chance of checking the attached manuscript before publication. If we don't receive any confirmation or feedback of the manuscript before 02/28/2023, it will be regarded as the final version.

Please carefully check the whole manuscript to ensure consistency and accuracy in grammar, spelling, punctuation and formatting.

All revisions should be made and highlighted on the attached manuscript.

Kindly note that the paper title, author names and affiliations shall not be modified once the paper is published.

Best Regards

Anthony Robinson
Editorial Assistant
revision.hrpub@gmail.com
Horizon Research Publishing, USA
http://www.hrpub.org

14829972.docx
619K

Heri Sulistiyono <h.sulistiyono@unram.ac.id> 25 Februari 2023 pukul 17.19
Kepada: Anthony Robinson <revision.hrpub@gmail.com>

Dear Mr. Anthony Robinson
Editorial Assistant Horizon Research Publishing, USA.

I have attached the final version of the manuscript "The Modification of Chi-Square Tests for the Identification of Rainfall and River Flow Data Distribution". The final revision was deleting the sentence " The total of all high lines." on page 15.
Thank you very much.
Best regards,
Heri.

[Kutipan teks disembunyikan]

14829972-Final.docx
618K

Anthony Robinson <revision.hrpub@gmail.com> 27 Februari 2023 pukul 09.30
Kepada: Heri Sulistiyono <h.sulistiyono@unram.ac.id>

Dear Heri Sulistiyono,

Thank you for your email.
We have received the final version of your paper.

Best Regards

Anthony Robinson
Editorial Assistant
revision.hrpub@gmail.com
Horizon Research Publishing, USA
http://www.hrpub.org

[Kutipan teks disembunyikan]

Anthony Robinson <revision.hrpub@gmail.com> 23 Maret 2023 pukul 09.51
Kepada: Heri Sulistiyono <h.sulistiyono@unram.ac.id>

Dear Heri Sulistiyono,

Hope you are doing well.
We haven't received the signed publication agreement yet. Please download the publication agreement (http://www.hrpub.org/download/HRPUB_Publication_Agreement2023.pdf) and fill in the authors' names, manuscript title, manuscript ID and signature, then send a scanned version to us.

Best Regards

Anthony Robinson
Editorial Assistant
revision.hrpub@gmail.com
Horizon Research Publishing, USA
http://www.hrpub.org

[Kutipan teks disembunyikan]

Heri Sulistiyono <h.sulistiyono@unram.ac.id> 23 Maret 2023 pukul 13.45
Kepada: Anthony Robinson <revision.hrpub@gmail.com>

Dear Mr. Anthony Robinson

Please accept my apology and find the Publication Agreement in the attachment.
Thank you very much.

Best regards,
Heri Sulistiyono
[Kutipan teks disembunyikan]

HRPUB_Publication_Agreement2023.pdf
162K

Anthony Robinson <revision.hrpub@gmail.com> 23 Maret 2023 pukul 14.26
Kepada: Heri Sulistiyono <h.sulistiyono@unram.ac.id>

Dear Heri Sulistiyono,

We have received the signed publication agreement. Thank you.

Best Regards

Anthony Robinson
Editorial Assistant
revision.hrpub@gmail.com

Horizon Research Publishing, USA
http://www.hrpub.org

[Kutipan teks disembunyikan]