

Input Data: Systematic Data and Volume Duration DLS-114, Module 1.5



U.S. ARMY



**US Army Corps
of Engineers®**

Dam and Levee
Safety Programs

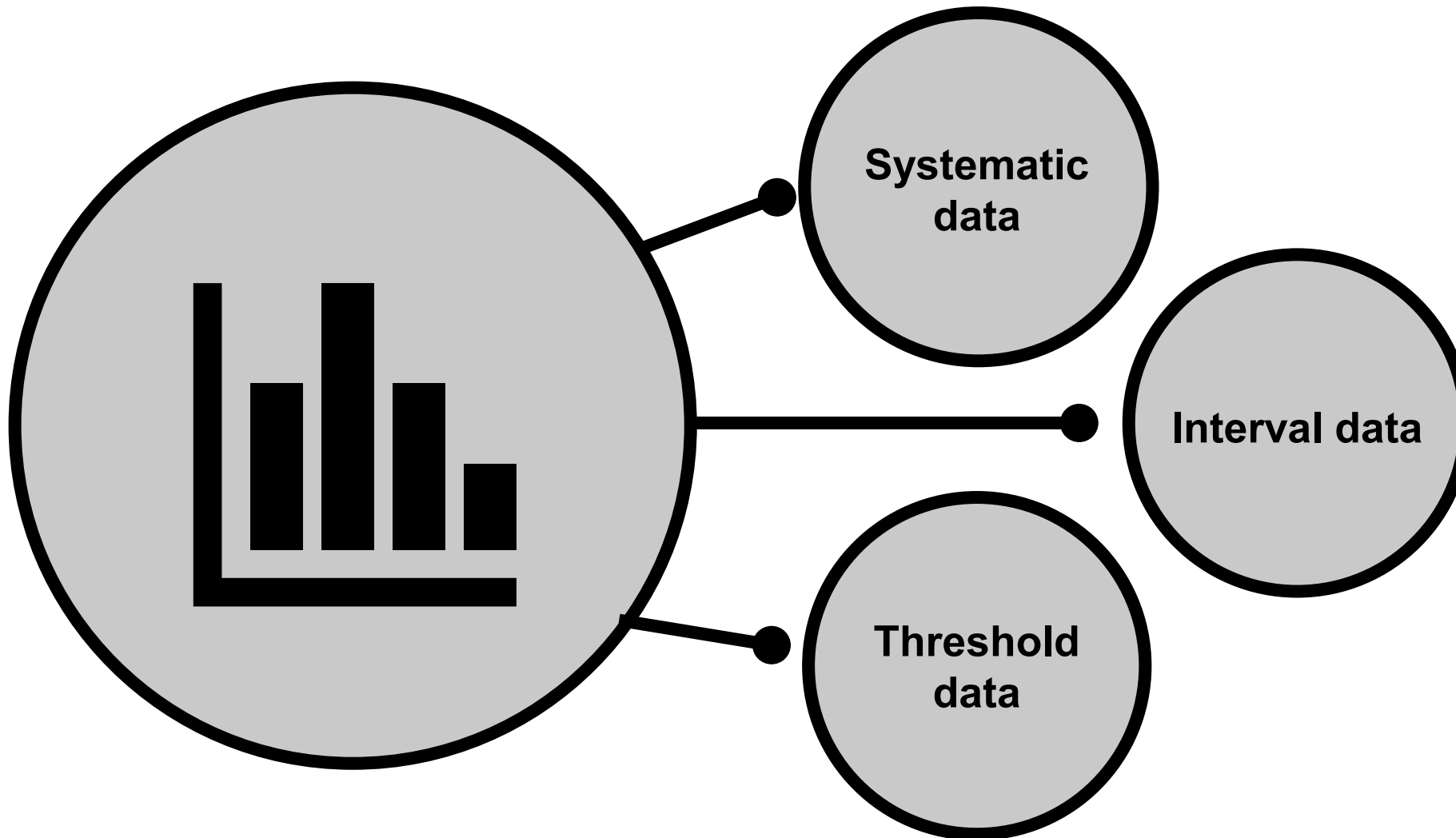
March 2026 / Version 1

BUFORD, GA (SOURCE: USACE)

Learning Objectives

- Develop systematic, annual max inflow volume data
- Demonstrate entering data into RMC-BestFit
- Describe the use of plotting positions and low outliers test for reviewing and validating systemic data
- Review updated input tabs for information on input data
 - Summary statistics
 - Hypothesis tests
 - Seasonality

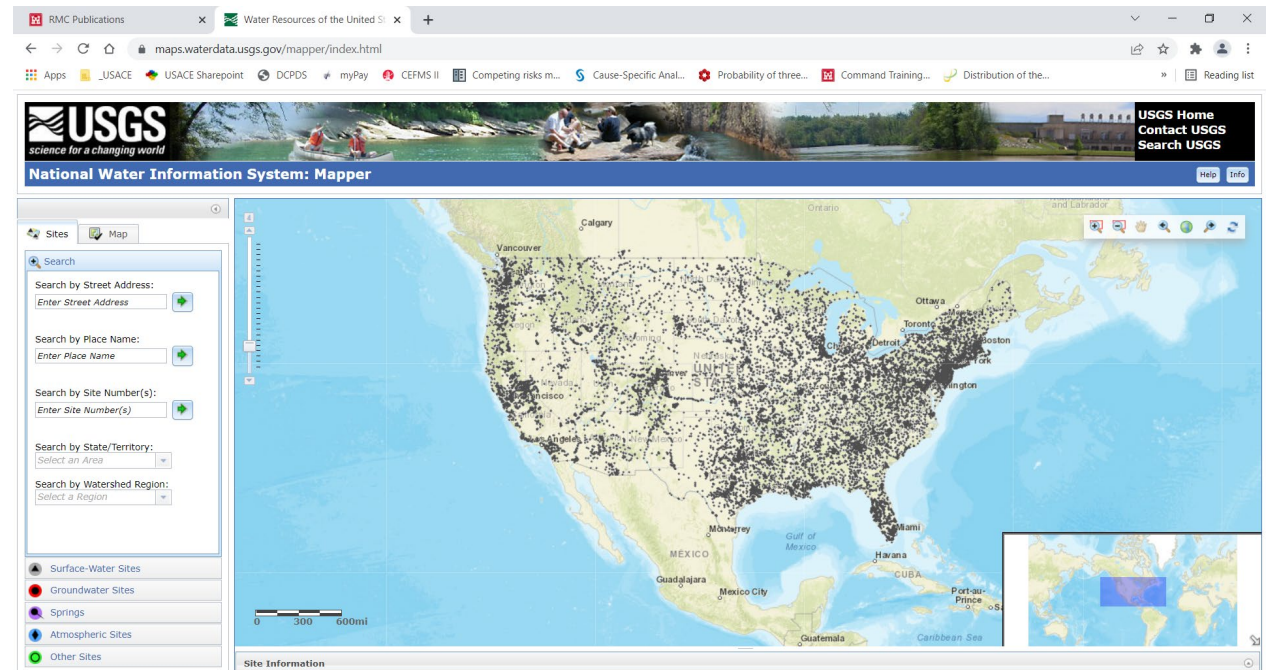
RMC-BestFit Input Data



- Simple Example
 - Time Series Data
 - Example Time Series
 - Input Data ←
 - Example Input
 - Distribution Fitting Analysis
 - Example Distribution Fitting
 - Univariate Distribution Analysis
 - Example Bayesian Analysis
 - Bivariate Distribution Analysis
 - Rating Curve Analysis

Data Sources - Systematic

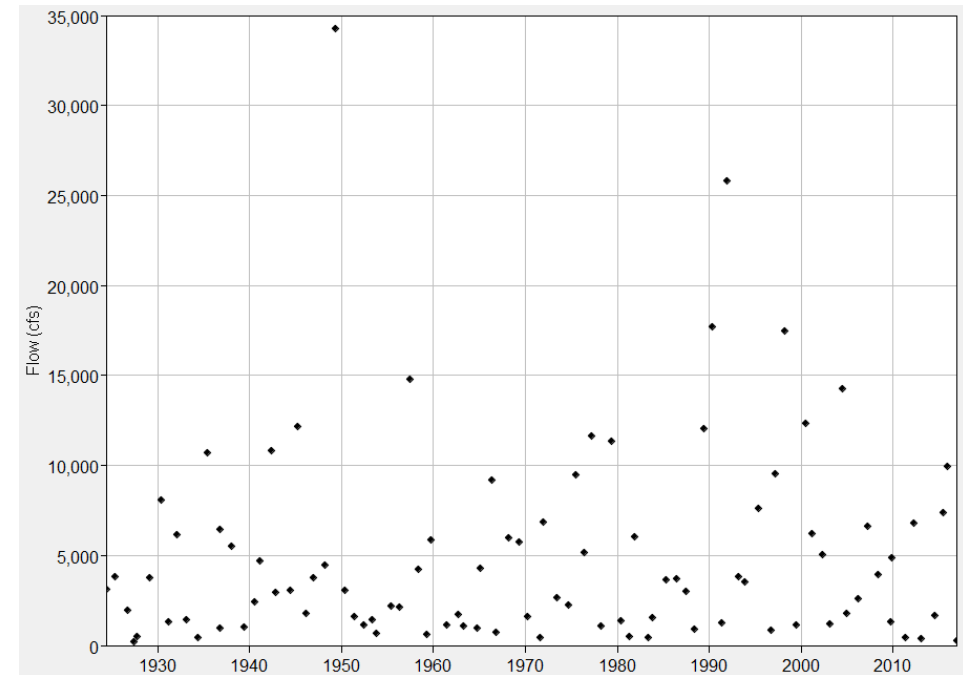
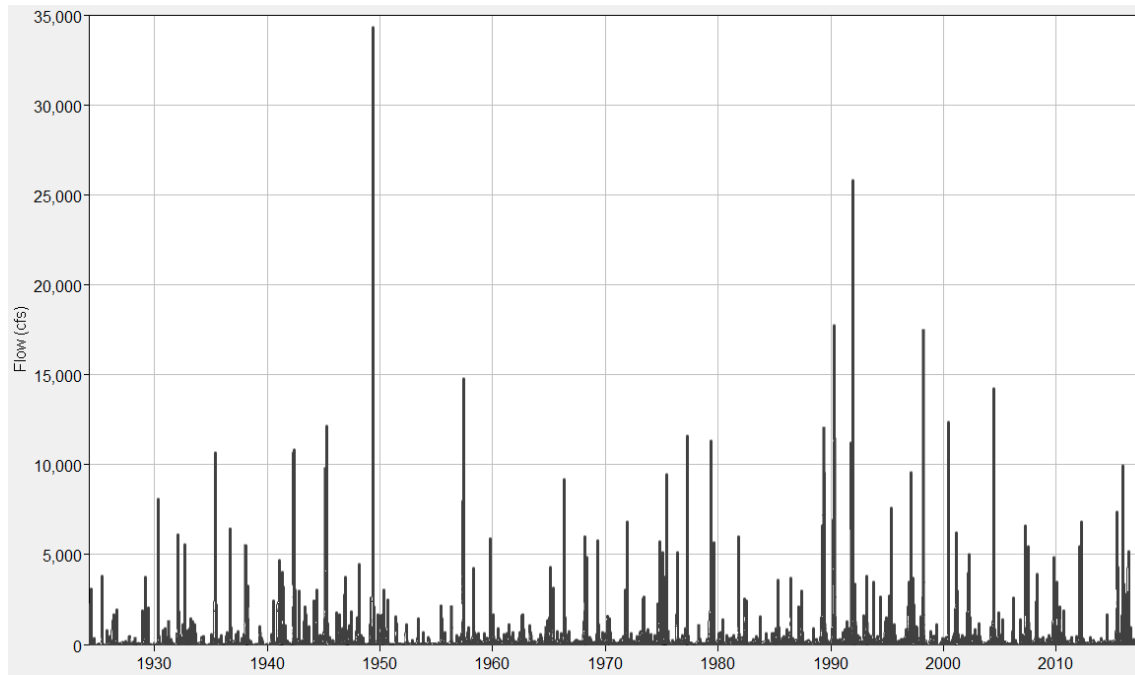
- USGS
 - <https://waterdata.usgs.gov/nwis>
- Design documents
- Dam owner records
- Operation manual



RMC-BestFit 2.0: New Features

- Time series data
- Automated calculation of block maxima
 - Annual
 - Monthly
 - Seasonal
 - Peak-Over-Threshold
- Hypothesis test for independent and identically distributed (IID)

Systematic Data



Annual Maximum Series (AMS) Data

- Use same duration as Critical Inflow Duration
- Bestfit 2.0
 - Bestfit 2.0 can calculate AMS from time series data
 - Manual Entry
 - USGS import
 - Peaks-Over-Threshold (advanced)

▲ EXACT DATA OPTIONS

Data Entry Method	Block Series
Time Series	Manual Entry
Block Function	Block Series
Time Block	Peaks-Over-Threshold Series
Start Month	USGS Peak Discharge
	USGS Peak Stage
Smoothing	Moving Average
Period	4

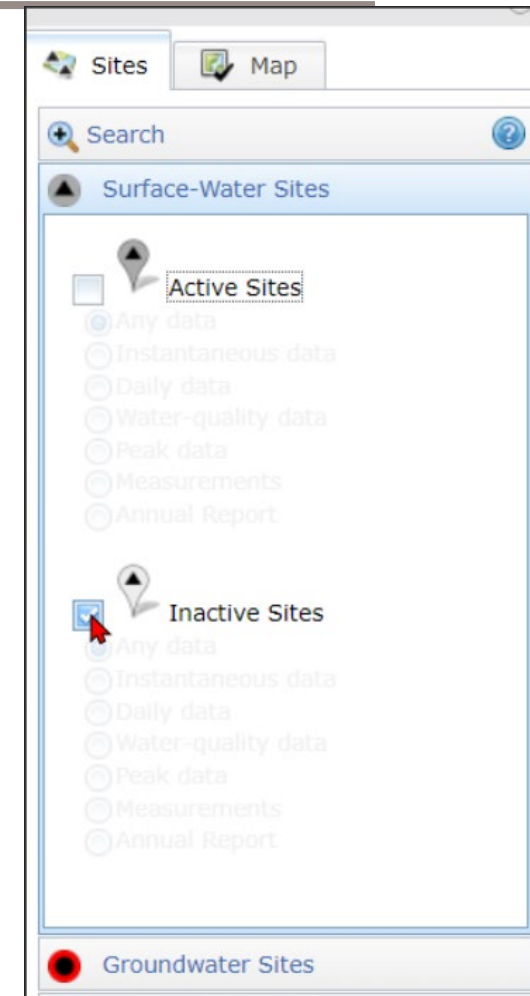
↓ Process

Inflow Data Considerations

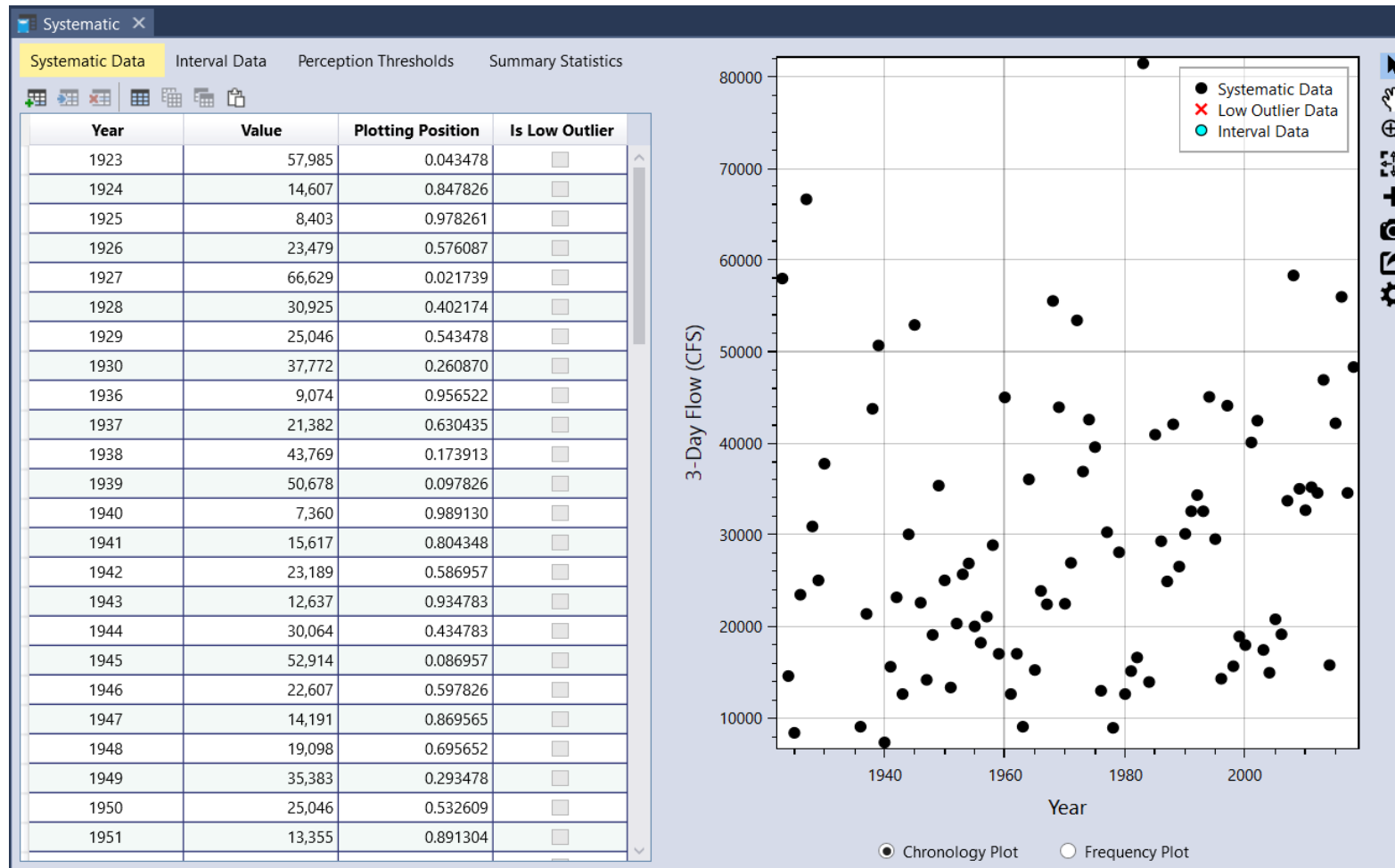
- Upstream Regulation
- Storm Mechanisms
- Seasonality
- Low-Flows or Zero Flows (Semi-Arid West)
- Major Changes in Land-Use

Inflow Record Extension Methods

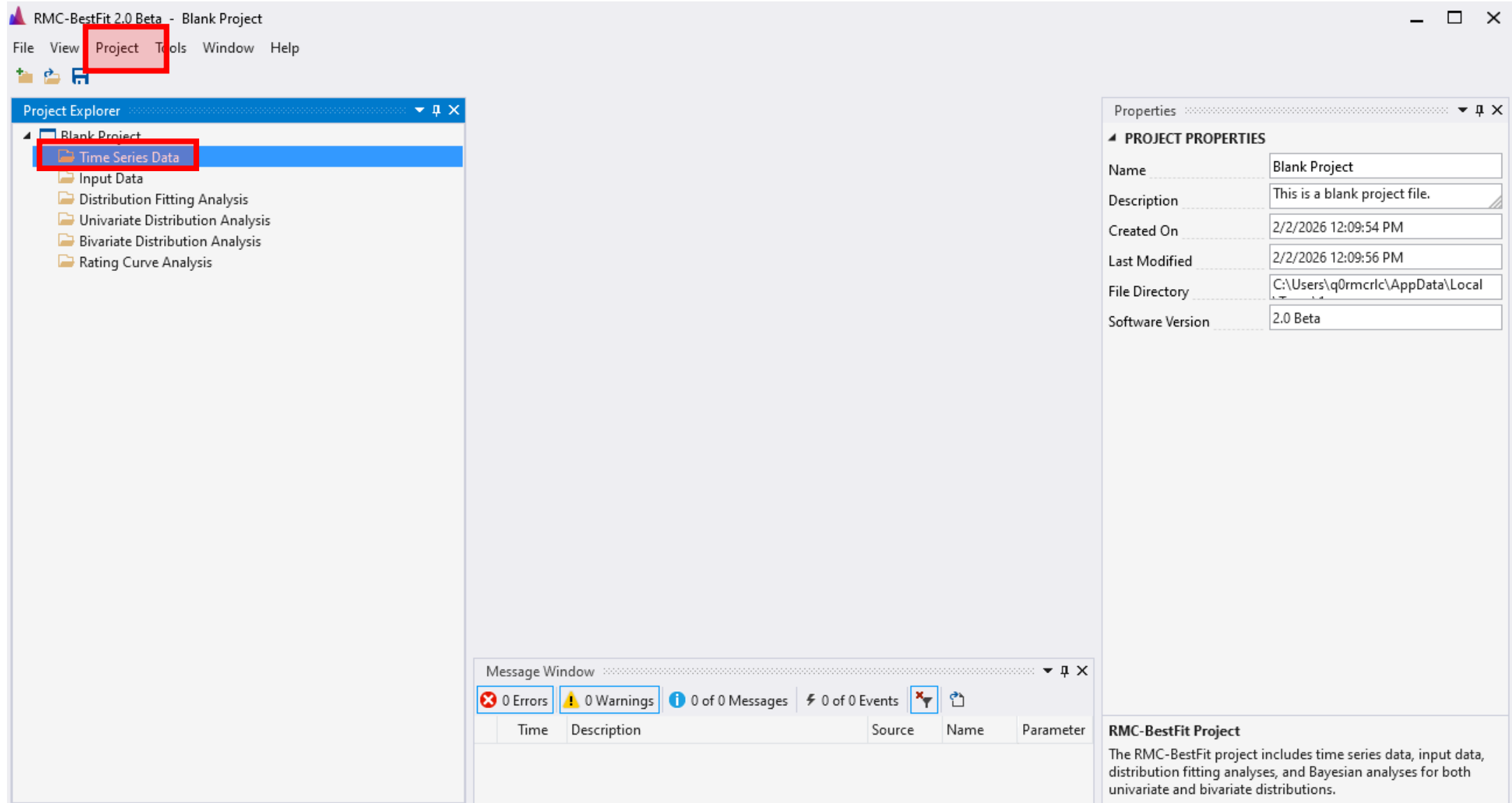
- Nearby discontinued USGS gages
 - <https://maps.waterdata.usgs.gov/mapper/index.html>
- Drainage Area Regression Equation
 - $Q_2 = Q_1 \left(\frac{A_2}{A_1} \right)^\phi$
- Bulletin 17C MOVE
 - <https://pubs.usgs.gov/tm/04/b05/tm4b5.pdf>



RMC-BestFit: Systematic Data



Creating Time Series Data



Entering Time Series Data

RMC-BestFit 2.0 Beta - Blank Project

File View Project Tools Window Help

Project Explorer

- Blank Project
 - Time Series Data
 - 03294500 Ohio Rv at Louisville KY*
 - Input Data
 - Distribution Fitting Analysis
 - Univariate Distribution Analysis
 - Bivariate Distribution Analysis
 - Rating Curve Analysis

Time Series Data Summary Statistics

Date Time	Value
1/1/1928 12:00 AM	73000
1/2/1928 12:00 AM	116000
1/3/1928 12:00 AM	124000
1/4/1928 12:00 AM	134000
1/5/1928 12:00 AM	155000
1/6/1928 12:00 AM	174000
1/7/1928 12:00 AM	170000
1/8/1928 12:00 AM	155000
1/9/1928 12:00 AM	143000
1/10/1928 12:00 AM	132000
1/11/1928 12:00 AM	117000
1/12/1928 12:00 AM	106000
1/13/1928 12:00 AM	116000
1/14/1928 12:00 AM	118000
1/15/1928 12:00 AM	112000
1/16/1928 12:00 AM	114000
1/17/1928 12:00 AM	103000
1/18/1928 12:00 AM	102000
1/19/1928 12:00 AM	100000
1/20/1928 12:00 AM	132000

Daily Discharge (cfs)

Time Series Plot Seasonality Plot

Properties

TIME SERIES PROPERTIES

Name: 03294500 Ohio Rv at Louisville KY

Description:

Created On: 2/2/2026 12:14:45 PM

Last Modified: 2/2/2026 12:14:45 PM

Unit Label: Value

TIME SERIES OPTIONS

Data Entry Method: USGS

Data Type: Daily Discharge

Site Number: 03294500

Import

Message Window

0 Errors 1 Warnings 0 of 1 Messages 0 of 1 Events

Time	Description	Source	Name	Parameter
12:14:45	Missing data detected; analysis may be affected.	Time Series Data	03294500 Ohio Rv at L	TimeSeries

USGS Site Number

The USGS surface water site number. The site number must be 8 digits, starting with the 2-digit part number followed by the 6-digit downstream-order number.

Creating Input Data (1 of 2)

The screenshot displays the RMC-BestFit 2.0 Beta software interface. The main window shows a project titled "DLS114_2026_BestFit2_Lec15". The Project Explorer on the left lists the project structure, with "Input Data" highlighted. The Properties window on the right shows project details. The Message Window at the bottom indicates a warning about missing data.

Project Explorer

- DLS114_2026_BestFit2_Lec15
 - Time Series Data
 - 03294500 Ohio Rv at Louisville KY
 - Input Data**
 - Distribution Fitting Analysis
 - Univariate Distribution Analysis
 - Bivariate Distribution Analysis
 - Rating Curve Analysis

Properties

PROJECT PROPERTIES

Name	DLS114_2026_BestFit2_Lec15
Description	This is a blank project file.
Created On	2/2/2026 12:09:54 PM
Last Modified	2/2/2026 12:23:16 PM
File Directory	C:\Users\q0rmcrlc\Documents\RMC
Software Version	2.0 Beta

Message Window

0 Errors 1 Warnings 0 of 1 Messages 0 of 2 Events

Time	Description	Source	Name	Parameter
12:14:45	Missing data detected; analysis may be affected.	Time Series Data	03294500 Ohio Rv at L	TimeSeries

RMC-BestFit Project

The RMC-BestFit project includes time series data, input data, distribution fitting analyses, and Bayesian analyses for both univariate and bivariate distributions.

Creating Input Data (2 of 2)

RMC-BestFit 2.0 Beta - C:\Users\q0rmcrlc\Documents\RMC\DLSCourses\DL5_114_BestFit_RFA\FY26\BestFit\DL5114_2026_BestFit2_Lec15.bestfit

File View Project Tools Window Help

Project Explorer

- DL5114_2026_BestFit2_Lec15*
 - Time Series Data
 - 03294500 Ohio Rv at Louisville KY
 - Input Data
 - 4-Day_Duration***
 - Distribution Fitting Analysis
 - Univariate Distribution Analysis
 - Bivariate Distribution Analysis
 - Rating Curve Analysis

4-Day_Duration*

Data Frame

Interval Data

Exact Data

Threshold Data

Uncertain Data

Summary Statistics

Hypothesis Tests

Seasonality Plot

Density Plot

Histogram Plot

Normal Q-Q Plot

ACF Plot

PACF Plot

Date Time	Value	Plotting Position	Low Outlier
7/4/1928 12:00	391,750	0.810000	<input type="checkbox"/>
3/7/1929 12:00	504,250	0.460000	<input type="checkbox"/>
1/18/1930 12:00	370,000	0.860000	<input type="checkbox"/>
4/8/1931 12:00	368,000	0.870000	<input type="checkbox"/>
2/8/1932 12:00	517,750	0.390000	<input type="checkbox"/>
3/24/1933 12:00	691,750	0.080000	<input type="checkbox"/>
3/12/1934 12:00	405,000	0.760000	<input type="checkbox"/>
3/19/1935 12:00	537,500	0.320000	<input type="checkbox"/>
3/30/1936 12:00	616,500	0.150000	<input type="checkbox"/>
1/28/1937 12:00	1,085,000	0.010000	<input type="checkbox"/>
3/23/1938 12:00	340,250	0.930000	<input type="checkbox"/>
2/10/1939 12:00	607,000	0.190000	<input type="checkbox"/>
4/27/1940 12:00	585,000	0.230000	<input type="checkbox"/>
6/12/1941 12:00	241,750	0.970000	<input type="checkbox"/>
3/20/1942 12:00	400,500	0.780000	<input type="checkbox"/>
3/25/1943 12:00	607,500	0.180000	<input type="checkbox"/>
4/18/1944 12:00	434,500	0.670000	<input type="checkbox"/>
3/10/1945 12:00	792,750	0.020000	<input type="checkbox"/>
1/14/1946 12:00	433,250	0.680000	<input type="checkbox"/>

Value

Year

Exact Data

Chronology Plot

Frequency Plot

Properties

INPUT DATA PROPERTIES

Name: 4-Day_Duration

Description:

Created On: 2/2/2026 12:27:44 PM

Last Modified: 2/2/2026 12:27:44 PM

Unit Label: Value

Index Label: Year

EXACT DATA OPTIONS

Data Entry Method: Block Series

Time Series: 03294500 Ohio Rv at Louisville KY

Block Function: Maximum

Time Block: Water Year

Start Month: October

Smoothing: Moving Average

Period: 4

Process

PLOTTING POSITIONS

Parameter: Weibull ($\alpha = 0.0$)

LOW OUTLIER TEST

Multiple Grubbs-Beck Test: ☒

Threshold Value: 0

Run Test

Smoothing Period

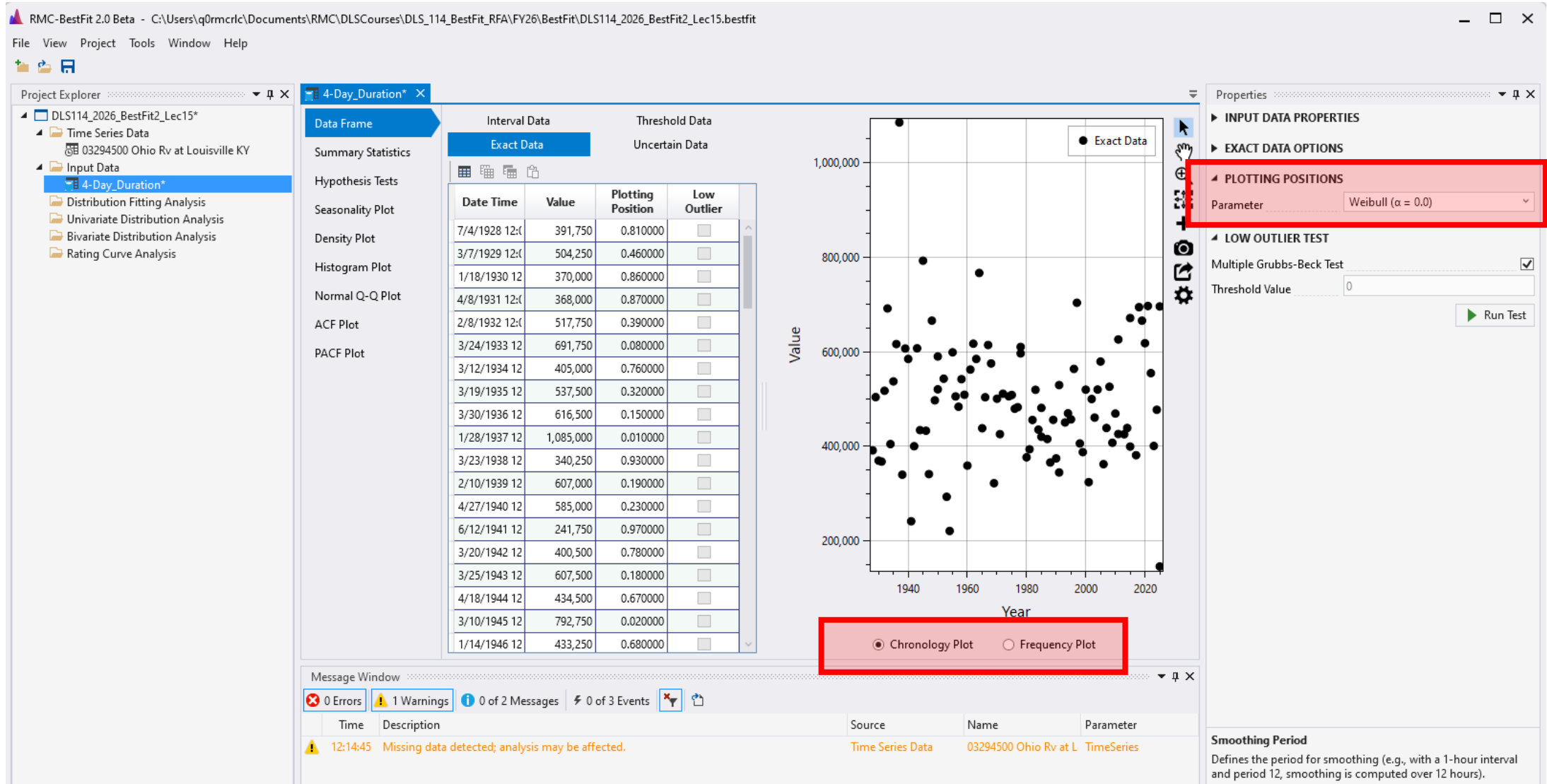
Defines the period for smoothing (e.g., with a 1-hour interval and period 12, smoothing is computed over 12 hours).

Message Window

0 Errors 1 Warnings 0 of 2 Messages 0 of 3 Events

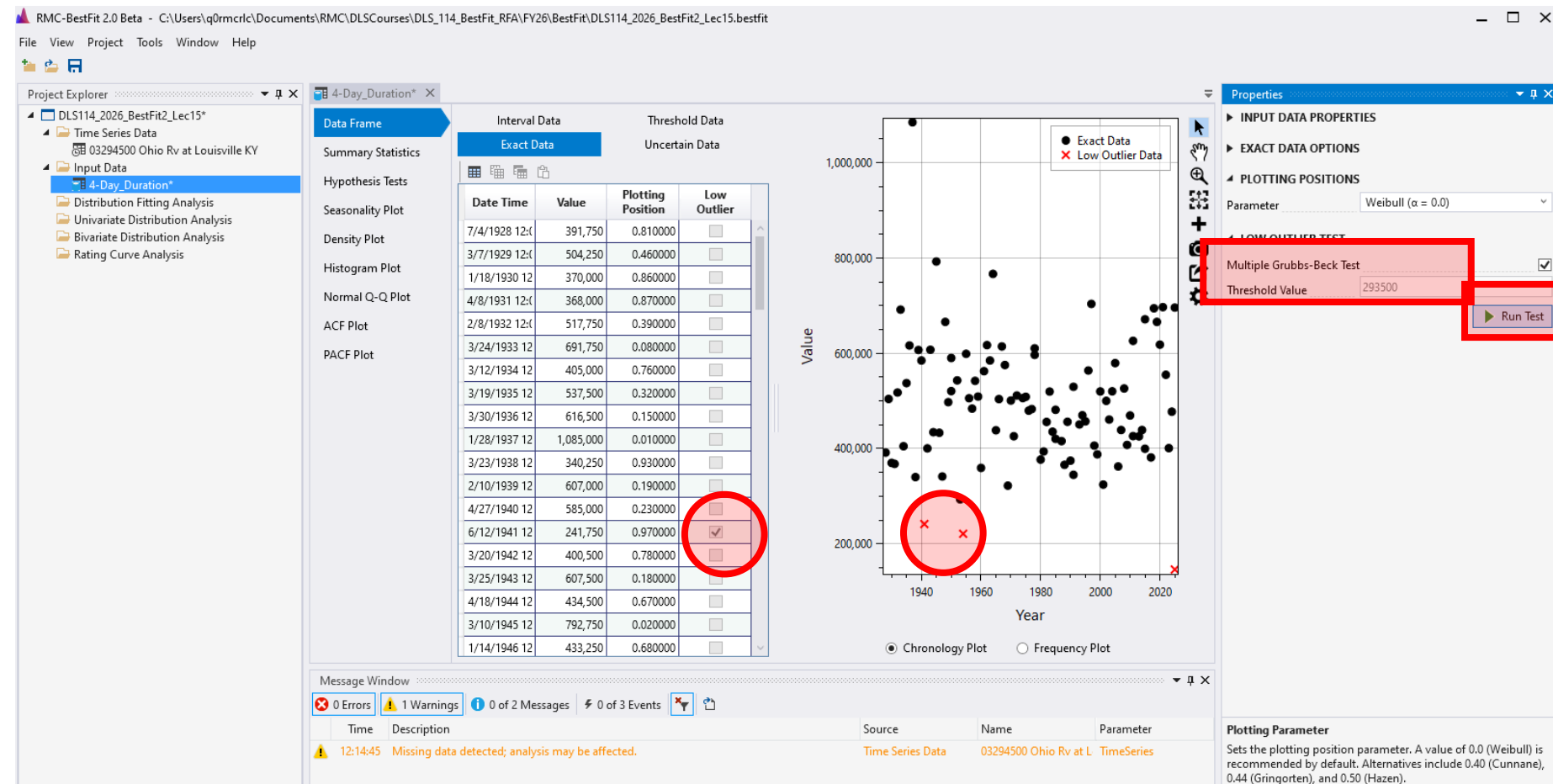
Time	Description	Source	Name	Parameter
12:14:45	Missing data detected; analysis may be affected.	Time Series Data	03294500 Ohio Rv at L	TimeSeries

Plotting Positions

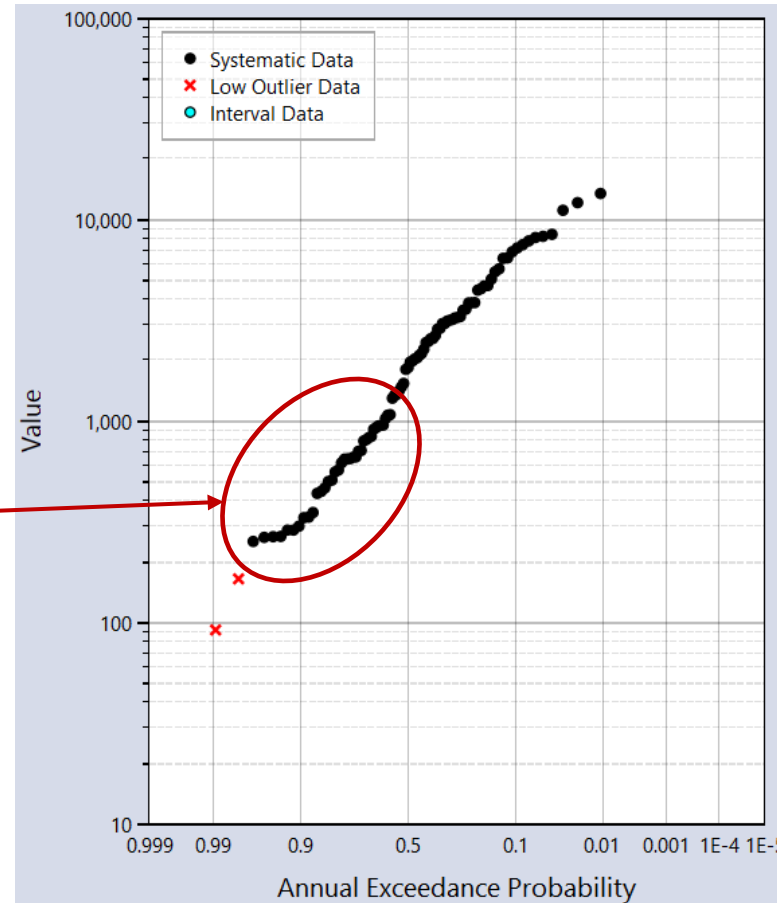
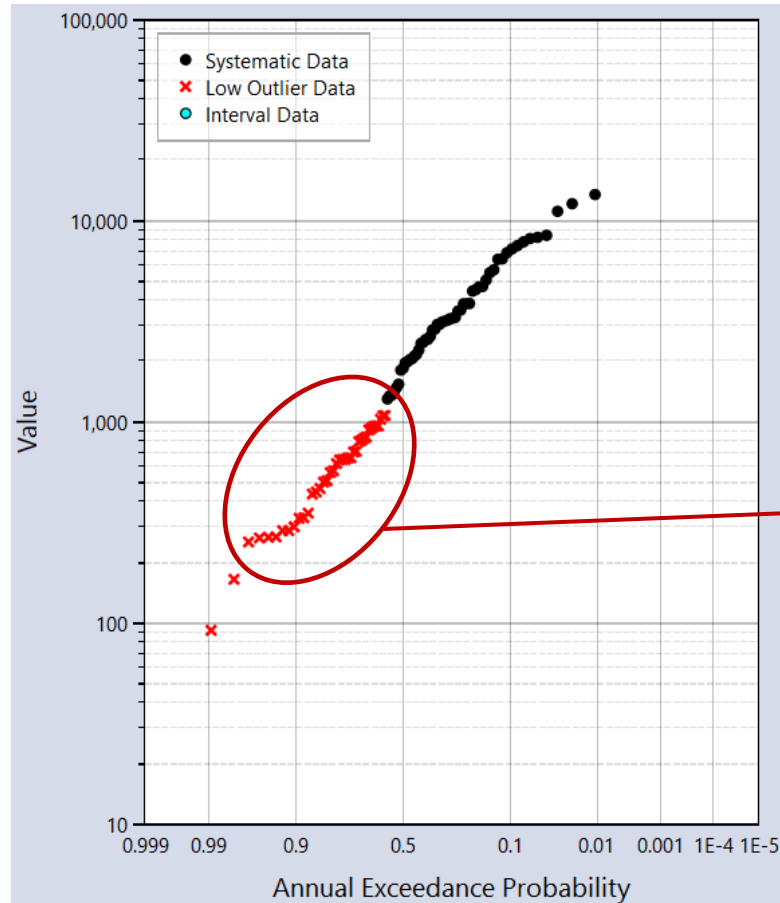


Multiple Grubbs-Beck Test (MGBT)

- Low-outliers or potentially influential low flood (PILF)
- Improve fit

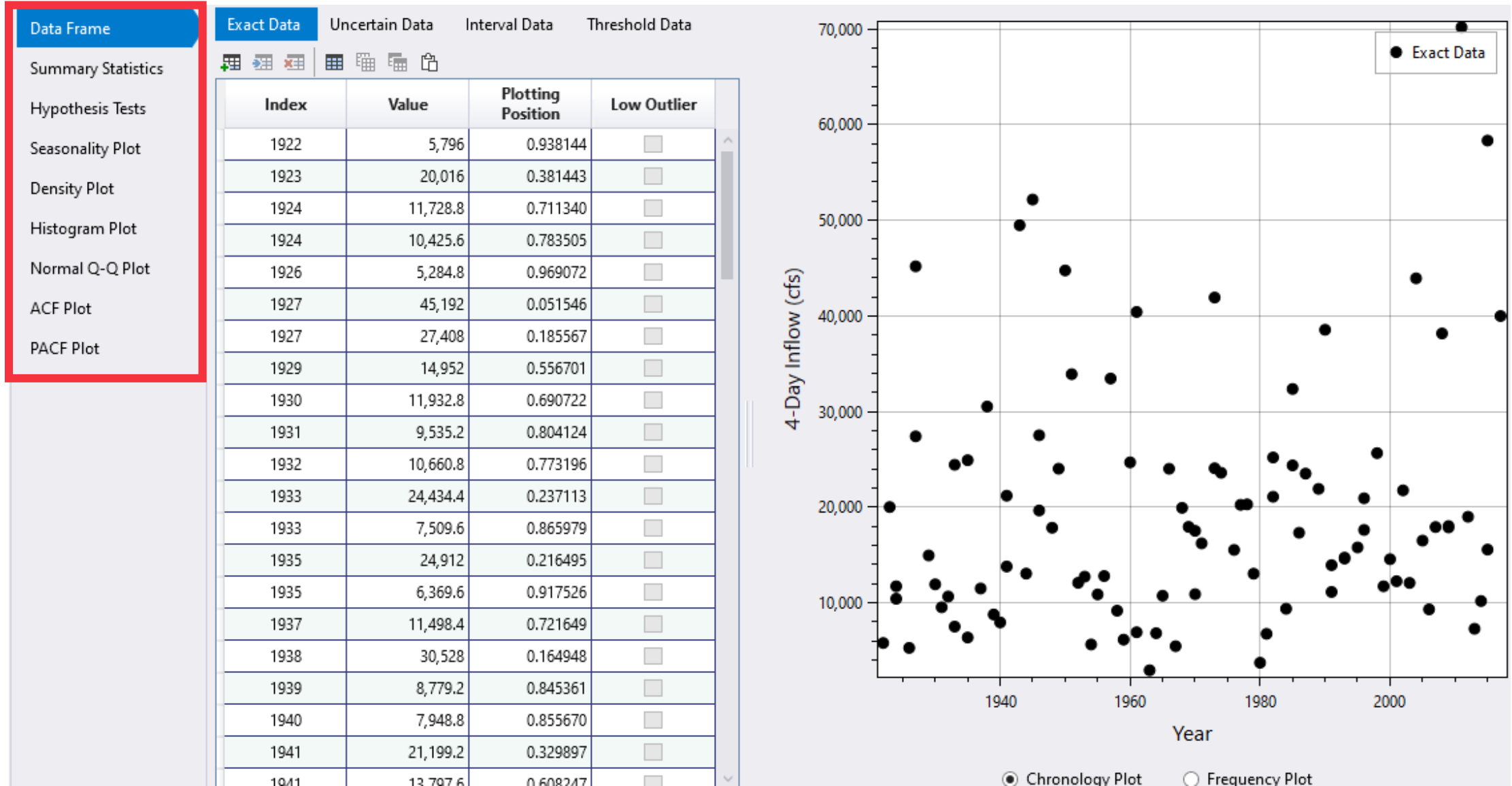


Include or Exclude Low-Outliers



- Inspection
- Flood mechanisms
- Distribution fitting

Additional Information for Input Data



Summary Statistics

Measure	Exact Data Only	Nonparametric
Record Length	99	99
Events Per Index (λ)	1.0102	1.0102
Low Outliers	3	3
Minimum	146,250	146,250
Maximum	1,085,000	1,085,000
Mean	496,651.5152	497,739.8018
Std Dev	131,675.1463	137,738.4171
Skewness	0.8453	0.8916
Kurtosis	6.3655	6.1227
Mean (of log)	5.6805	5.6797
Std Dev (of log)	0.1202	0.1259
Skewness (of log)	-0.8166	-0.8477
Kurtosis (of log)	6.3565	6.1363
1%	219,750	146,250
5%	324,275	322,250
25%	407,000	406,250
50%	497,500	497,500
75%	577,500	579,500
95%	696,100	697,000
99%	798,595	1,085,000

Hypothesis Tests

Data Frame

Summary Statistics

Hypothesis Tests

Seasonality Plot

Density Plot

Histogram Plot

Normal Q-Q Plot

ACF Plot

PACF Plot

Split Index

1977

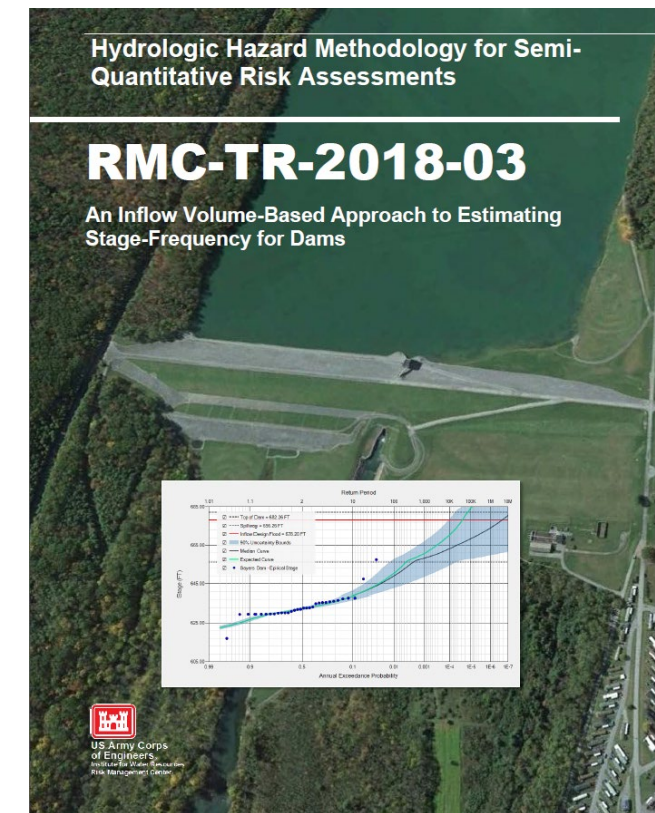
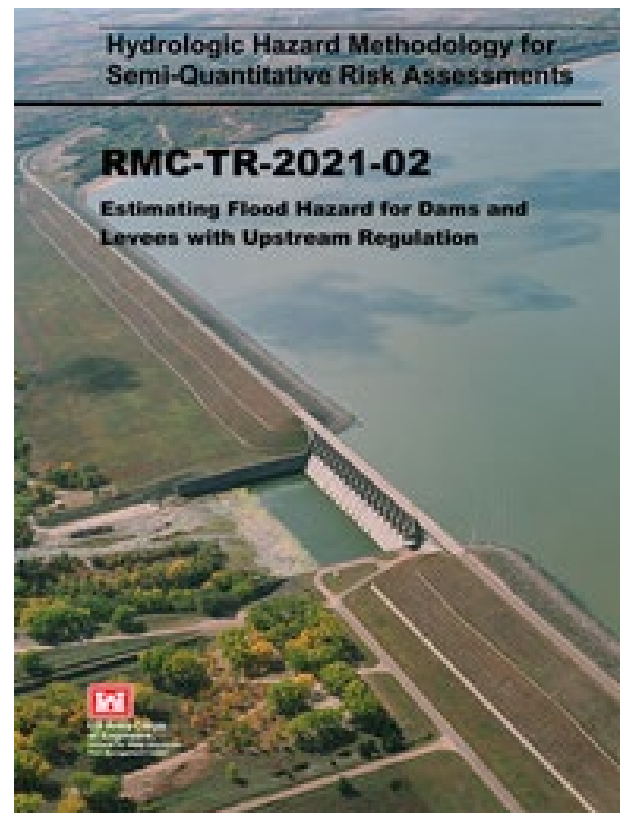
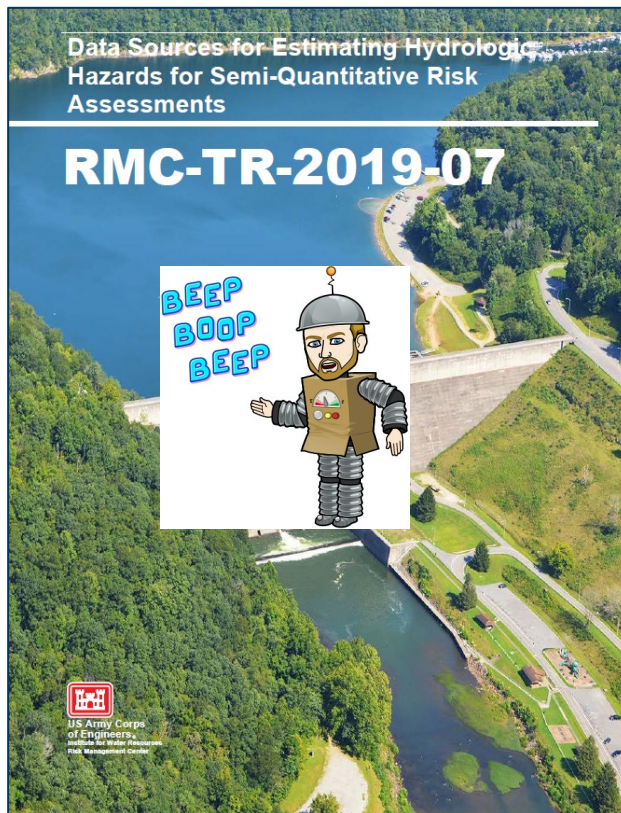
☒ Logarithmic Data

Hypothesis Test	P-Value	Signif.	Inference
Jarque-Bera test for normality	3.31E-013	***	The data is not Normally distributed.
Ljung-Box test for independence	0.7553		The autocorrelation of the data is zero.
Wald-Wolfowitz test for independence and stationarity (trend)	0.9466		The data is stationary.
Mann-Whitney test for homogeneity and stationarity (jump)	0.3152		The data is stationary.
Mann-Kendall test for homogeneity and stationarity (trend)	0.6899		The data is stationary.
Linear trend test for stationarity (trend)	0.6300		The data is stationary.
Equal variance t-test for differences in the means of two samples	0.3949		The two samples (assuming equal variance) have the same mean.
Unequal variance t-test for differences in the means of two samples	0.3954		The two samples (assuming unequal variance) have the same mean.
F-test for differences in the variances of two samples	0.5190		The two samples have the same variance.
Mixture model test for unimodality	0.0033	**	The data is multimodal.

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Resources

- RMC publications:
<https://www.rmc.usace.army.mil/Library/RMC-Publications/>



Questions