

Overview

- Provide a brief history of HEC-SSP.
- Demonstration of HEC-SSP.
 - ▶ Import, inspect, and manipulate data
 - ▶ Create, compute, and visualize results of various analyses
- Detail DSS usage and conventions within HEC-SSP.



History, Status, Future...

- HEC-FFA, STATS, and REGFRQ developed by HEC in response to Corps statistical needs in 1970's
- Evolved with addition of new capabilities and platform support
- In late 1980's, HEC-FFA, STATS, and REGFRQ reconfigured for PC and UNIX



History, Status, Future...

- HEC-SSP started development in FY2005
 - ▶ Gary Brunner, Beth Faber, Jeff Harris, and Matt Fleming
- Version 1.0 Beta (Released June 2006)
 - ▶ Only computation is Bulletin 17B analysis
- Version 1.0 (Released August 2008)
 - ▶ Included General Frequency and Volume Frequency analyses
- Version 1.1 (Released April 2009)
- Version 2.0 (Released October 2010)
 - ▶ Included Duration, Coincident Frequency, and Curve Combination analyses
- Version 2.1 (Released August 2016)
 - ▶ Included B17C/EMA methodology and Balanced Hydrograph analysis
- Version 2.1.1 (Released January 2017)
 - ▶ Updated USGS Plugin and recompiled EMA Fortran code
- Version 2.2 (Released June 2019)
 - ▶ Updated EMA code, Mixed Population, and Distribution Fitting analyses



History, Status, Future...

TEAM MEMBERS

H&S Division Lead	Matt Fleming
Lead Developer / Project Lead	Mike Bartles
Development and Application	Beth Faber
Development and Application	Greg Karlovits
Development and Application	Will Lehman
Development and Application	Haden Smith
Development and Application	John England
Development	Mark Ackerman
Development	Paul Ely
Development	Caleb DeChant
Development	Stephen Ackerman



History, Status, Future...

- New analytical tools to meet Corps needs
 - ▶ Updated Distribution Fitting Analysis
 - ▶ Updated Bulletin 17 Analysis
 - ▶ New Correlation Analysis
 - ▶ New Record Extension Analysis
- Improved user experience
 - ▶ Easier data input



HEC-SSP Software

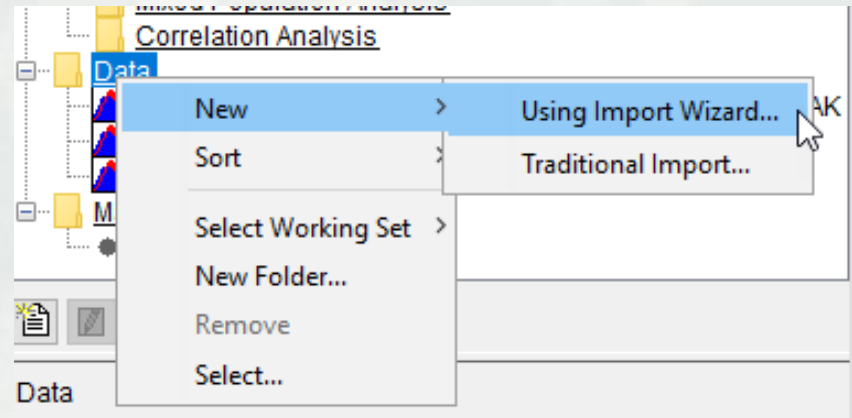
The screenshot displays the HEC-SSP 2.2 software interface. The main window is titled "HEC-SSP 2.2 - B17B_and_B17C_Workshop". The interface is divided into several panes:

- Study Explorer:** A tree view on the left showing the project structure. It includes folders for "Analysis" (with sub-folders like "Bulletin 17 Analysis" and "General Frequency Analysis") and "Data". Three data points are listed: "BIG SANDY RIVER-BRUCETON, TN-FLOW-ANNUAL PEAK", "BEAVER RIVER-BEAVER, UT-FLOW-ANNUAL PEAK", and "WEBER RIVER-OAKLEY, UT-FLOW-ANNUAL PEAK".
- Base Map:** A map window showing a grid overlay on a map of the United States. Three red dots mark the locations of the data points, with labels: "WEBER RIVER-OAKLEY, UT-FLOW-ANNUAL PEAK", "BEAVER RIVER-BEAVER, UT-FLOW-ANNUAL PEAK", and "BIG SANDY RIVER-BRUCETON, TN-FLOW-ANNUAL PEAK".
- Summary:** A pane at the bottom left showing details for the selected study "WeberRiver_B17C". It lists the method as "17C EMA Java", skew option as "Station Skew", and other parameters like "Low Q", "Plottin", "Confid", "Mean", "St Dev: 0.168", and "Adopted Skew: -0.524". It also shows the last compute and modified times.
- Message Window:** A pane at the bottom right displaying a log of actions: "Loading Data WEBER RIVER-OAKLEY, UT-FLOW-ANNUAL PEAK", "Opened Study B17B_and_B17C_Workshop from directory C:\PROJECTS\Classes\2021_Statistical_Methods\Workshops\W5_B17B_and_B17C\B17B_and_B17C_Workshop", "Display Unit System set to English(Watershed)", "Base Map added to Map Window", "Base Map added to Base Map", and "Loading Bulletin 17 Analysis WeberRiver_B17C".

Navigation tabs at the bottom left include "Study", "Maps", and "Files". The status bar at the bottom shows "Coordinates: -67 east, 25 north".

Data Importer

- New Import Wizard or Traditional Import
- Import Time Series and Paired Data
- DSS, USGS website, manual entry, Excel, and text files



Data Importer

USGS Website

New Data Import Wizard

Import From USGS Data

Data Type

Annual Peak Data

Daily

Instantaneous (15-min, hourly)

Retrieve Data For

Flow

Stage

Station ID's

Do Not Get USGS Station ID's by State

Get USGS Station ID's by State

Get ID's for State

States Retrieved:

< Back Next > Cancel



Data Importer

Multiple State Searches

New Data Import Wizard

Import From USGS Data

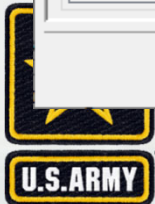
States Retrieved: CT, MA, NH, VT
 Data Type: Annual Peak Data
 Retrieving: Flow

Select All Deselect All Clear Table

USGS Website

Import Data	USGS Station ID's	Basin Name (A Part)	Location (B Part)	Other Qualifier (F Part)
		connecticut		
<input checked="" type="checkbox"/>	01184000	CONNECTICUT RIVER	THOMPSONVILLE, CT	USGS
<input checked="" type="checkbox"/>	01190070	CONNECTICUT RIVER	HARTFORD, CT	USGS
<input checked="" type="checkbox"/>	01193000	CONNECTICUT RIVER	MIDDLETOWN, CT	USGS
<input type="checkbox"/>	01193050	CONNECTICUT RIVER	MIDDLE HADDAM, CT	USGS
<input type="checkbox"/>	01194750	CONNECTICUT RIVER	ESSEX, CT	USGS
<input type="checkbox"/>	01194796	CONNECTICUT RIVER	OLD LYME, CT	USGS
<input type="checkbox"/>	01194825	CONNECTICUT RIVER	OLD SAYBROOK, CT	USGS
<input checked="" type="checkbox"/>	01167000	CONNECTICUT RIVER	TURNERS FALLS, MA	USGS
<input checked="" type="checkbox"/>	01170500	CONNECTICUT RIVER	MONTAGUE CITY, MA	USGS
<input type="checkbox"/>	01172000	CONNECTICUT RIVER	HOLYOKE, MA	USGS
<input type="checkbox"/>	01172003	CONNECTICUT RIVER BELOW PO...	HOLYOKE, MA	USGS
<input type="checkbox"/>	01172010	CONNECTICUT R	I-391 BRIDGE AT HOLYOKE, MA	USGS
<input type="checkbox"/>	01128500	CONNECTICUT R	FIRST CONN LK NR PITTSBUR...	USGS
<input checked="" type="checkbox"/>	01129200	CONNECTICUT R BELOW INDIAN ...	PITTSBURG, NH	USGS
<input checked="" type="checkbox"/>	01129500	CONNECTICUT RIVER	NORTH STRATFORD, NH	USGS
<input type="checkbox"/>	01129850	CONNECTICUT RIVER TRIBUTARY	STRATFORD, NH	USGS

< Back **Next >** Cancel



Background Maps

- Background Maps are Optional
- Types of Map Layers:
 - ▶ Internet Maps (Google, Bing, OSM),
Shapefiles, rasters, Google Earth .kml, etc
- Gage Locations displayed on top
- Map is interactive for Editing Data and Viewing Results



Example Background Map

The screenshot displays the HEC-SSP 2.3 software interface. The main window shows a map of the Great Lakes basin, including Lake Superior, Lake Michigan, Lake Huron, Lake Erie, and Lake Ontario. A red dot on the map is labeled "Spring Creek-Milesburg, PA-FLOW-ANNUAL PEAK". The software's menu bar includes File, Edit, View, Maps, Data, Analysis, Results, Tools, Window, and Help. The left sidebar shows a project tree with folders for Analysis, Data, and Map. The bottom status bar displays the coordinates: -72 east, 42 north.

HEC-SSP 2.3 - SSP_demo

File Edit View Maps Data Analysis Results Tools Window Help

SSP_demo

- Analysis
 - Bulletin 17 Analysis
 - General Frequency Analysis
 - Volume Frequency Analysis
 - Duration Analysis
 - Coincident Frequency Analysis
 - Curve Combination Analysis
 - Balanced Hydrograph Analysis
 - Distribution Fitting Analysis
 - Mixed Population Analysis
 - Correlation Analysis
- Data
 - Spring Creek-Milesburg, PA-FLOW-ANNUAL PEAK
 - Bald Eagle Creek bl Spring Creek-Milesburg, PA-FLOW-ANNUAL PEAK
 - Bald Eagle Creek bl Spring Creek-Milesburg, PA-CODE-PEAK FLOW
- Map
 - Base Map

Base Map

Spring Creek-Milesburg, PA-FLOW-ANNUAL PEAK

Study SSP_demo saved.
Created C:\PROJECTS\Classes\2021_Statistical_Methods\Lectures\SSP_demo Spring Creek-Milesburg, PA-FLOW-ANNUAL PEAK in directory Data
Created C:\PROJECTS\Classes\2021_Statistical_Methods\Lectures\SSP_demo Bald Eagle Creek bl Spring Creek-Milesburg, PA-FLOW-ANNUAL PEAK in directory Data
Created C:\PROJECTS\Classes\2021_Statistical_Methods\Lectures\SSP_demo Bald Eagle Creek bl Spring Creek-Milesburg, PA-CODE-PEAK FLOW in directory Data
Study SSP_demo saved.
Map streetmaps.osm loaded.
Study SSP_demo saved.

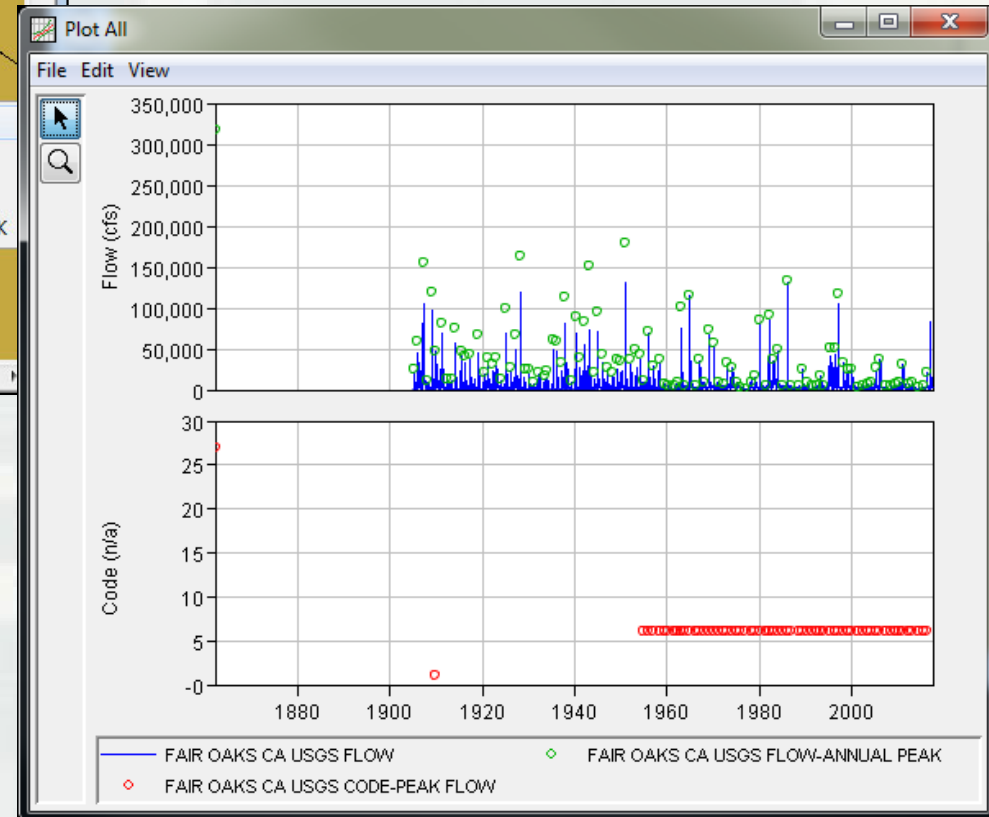
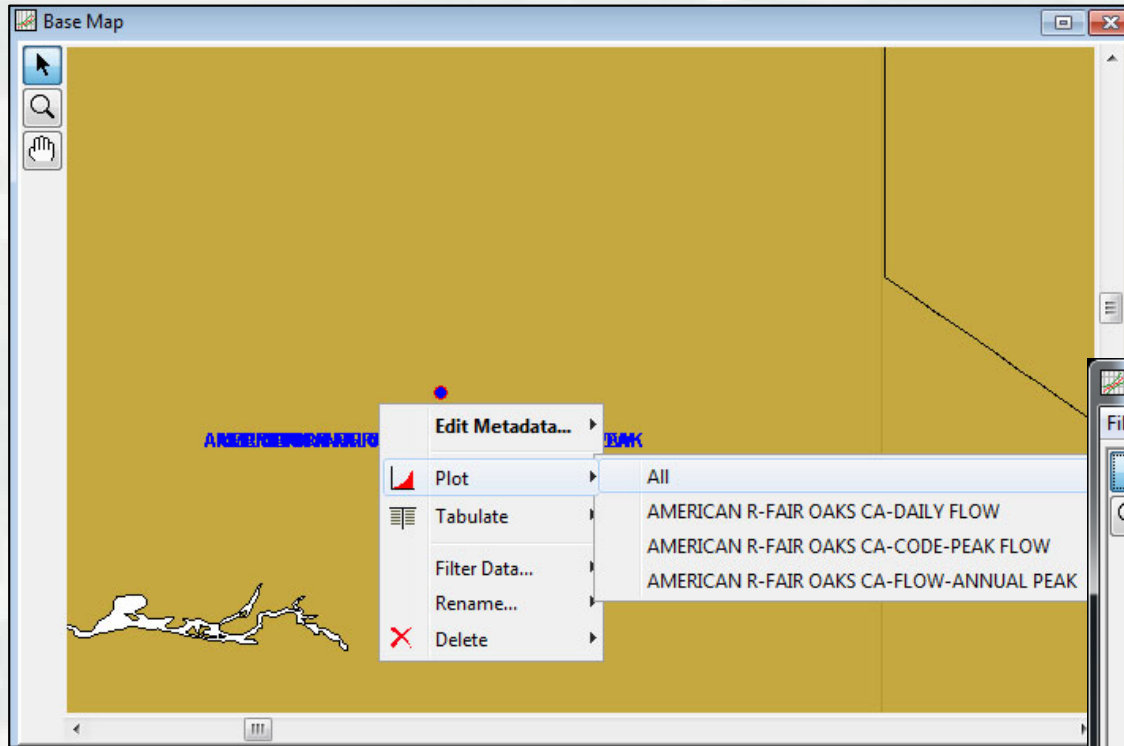
Messages

Study Maps Files

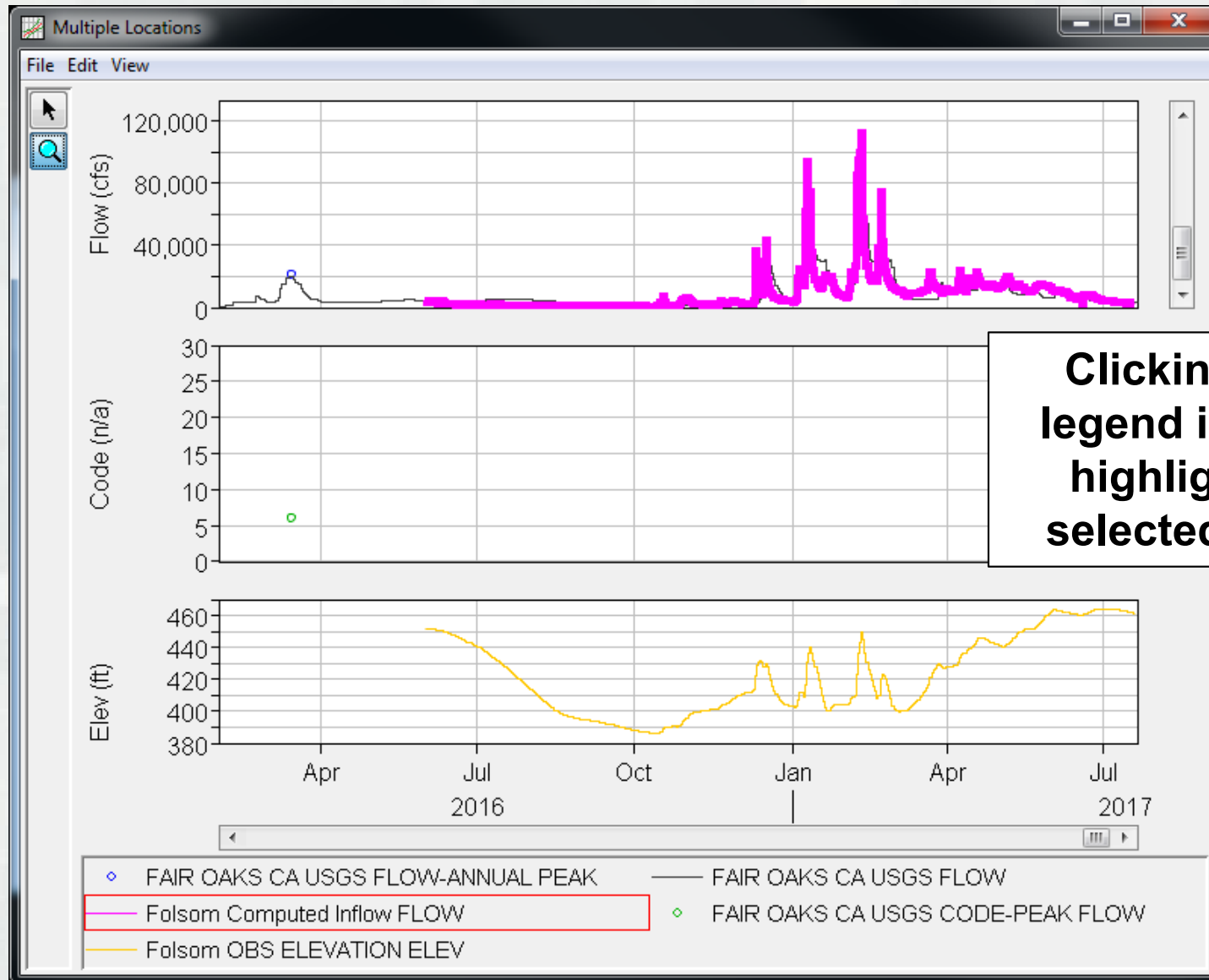
Coordinates: -72 east, 42 north



Data Visualization



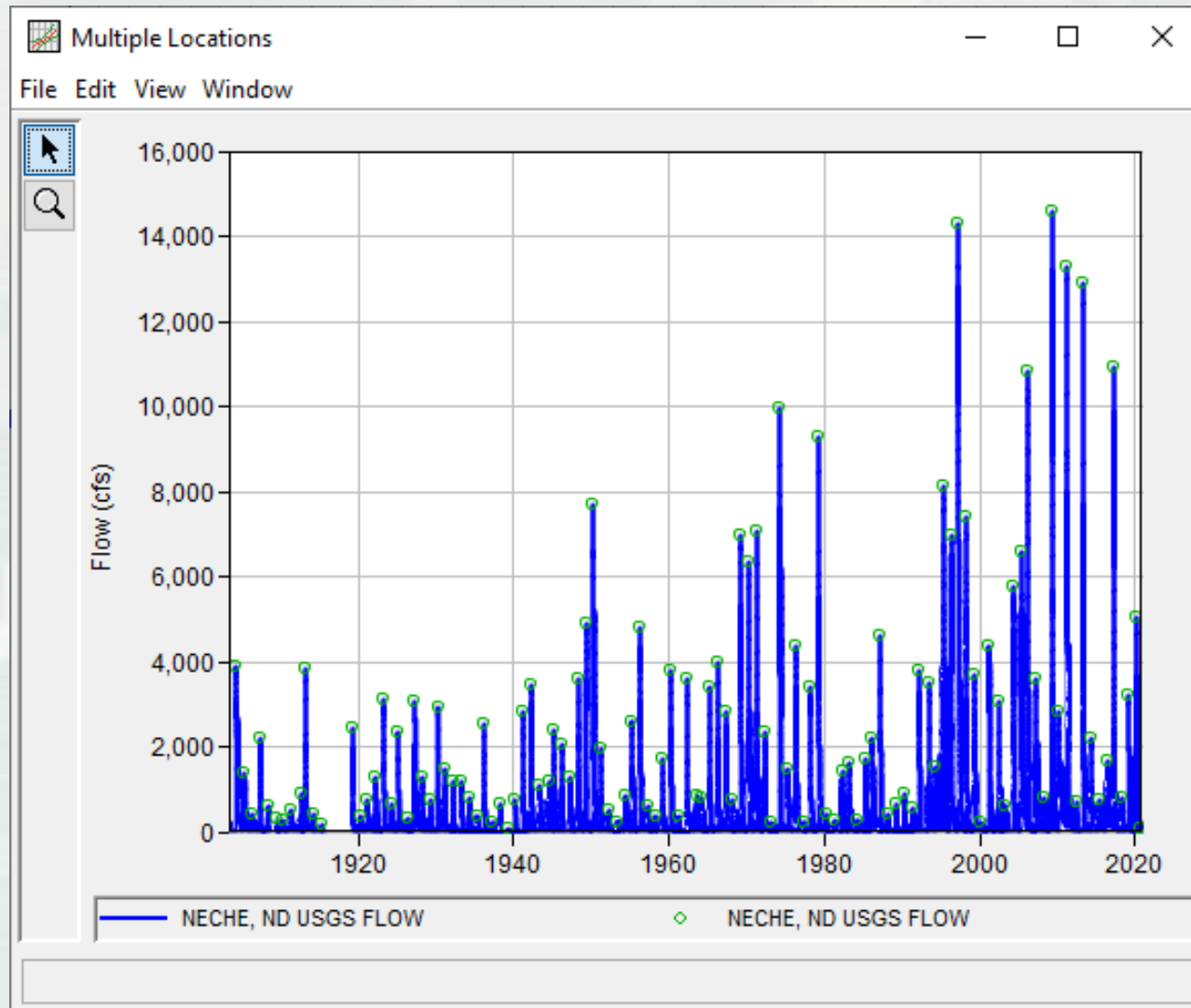
Data Visualization



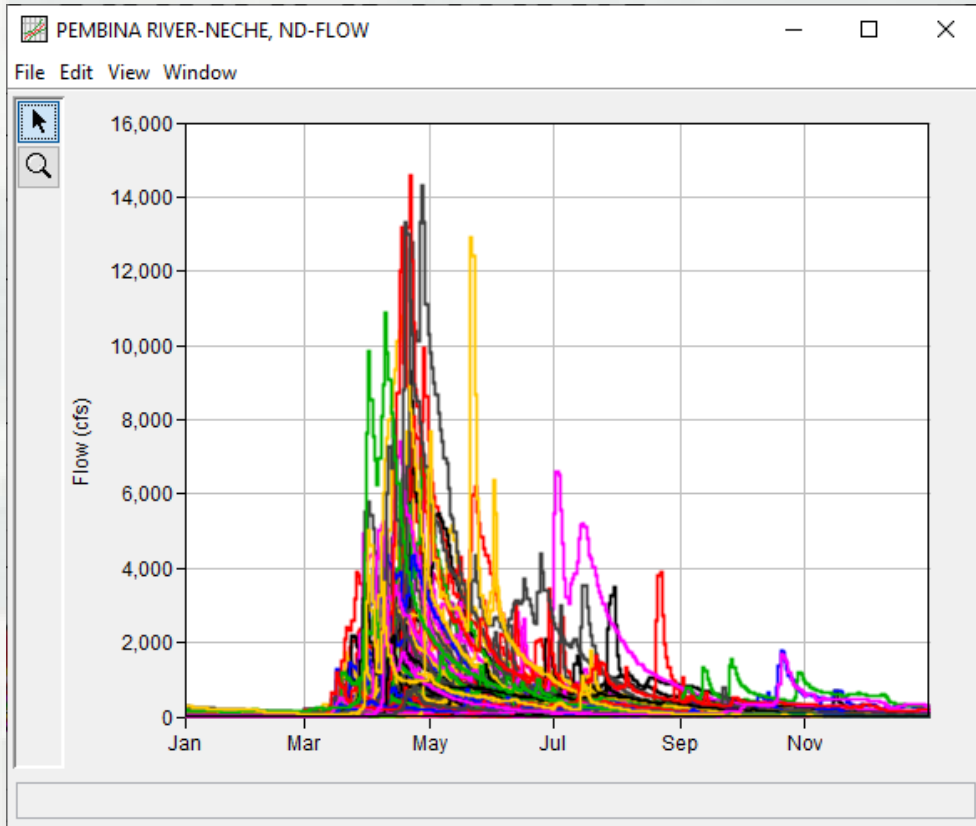
Clicking on a legend item will highlight the selected curve



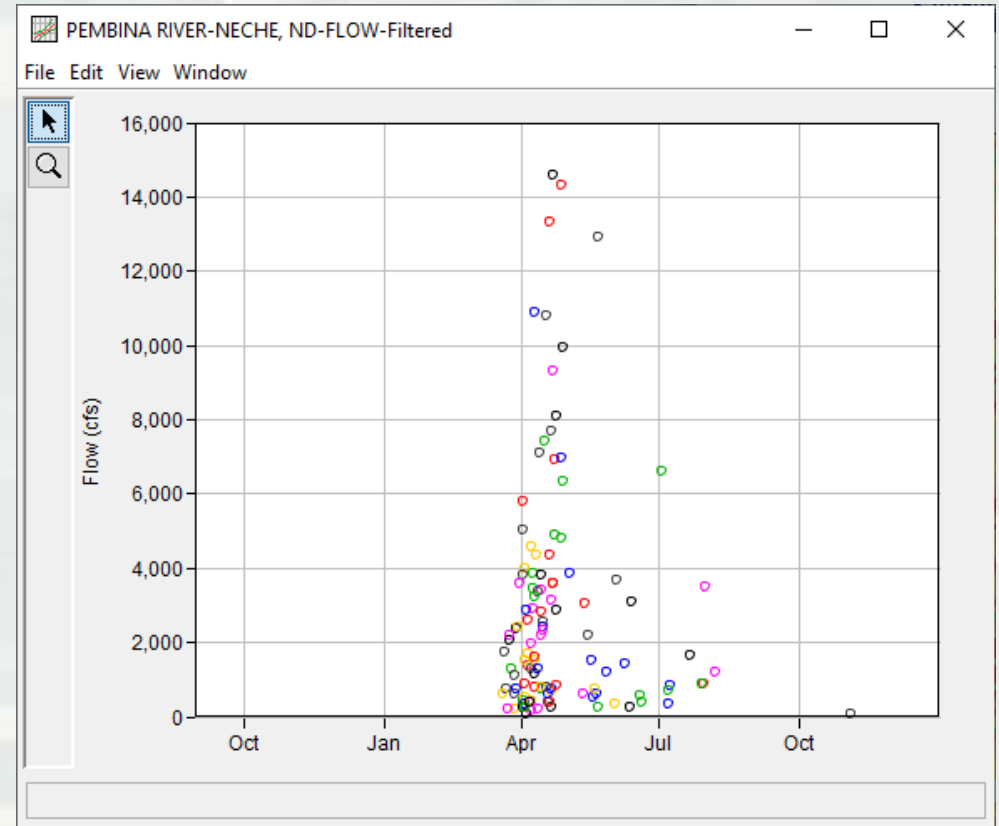
Data Visualization



Data Visualization



Daily Average Flow

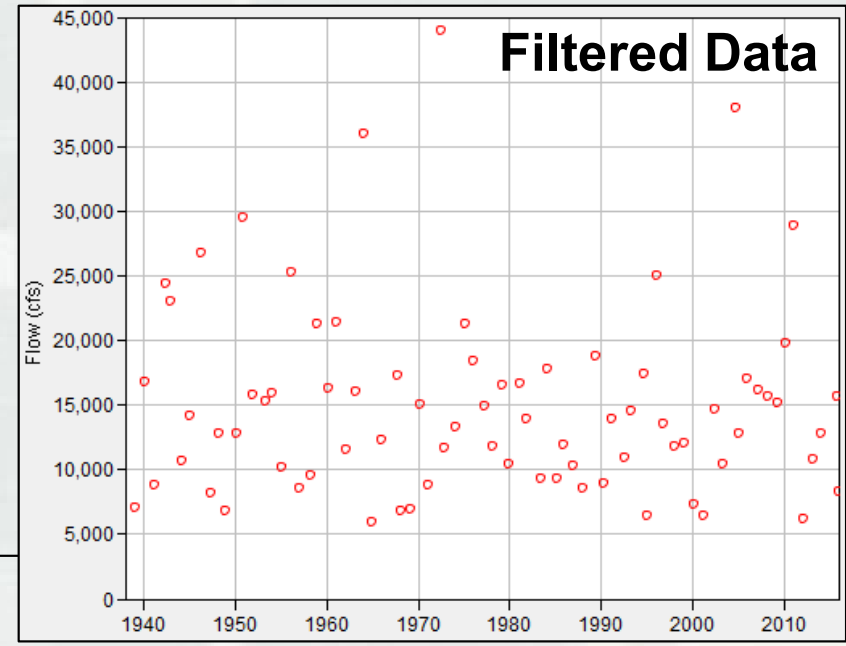
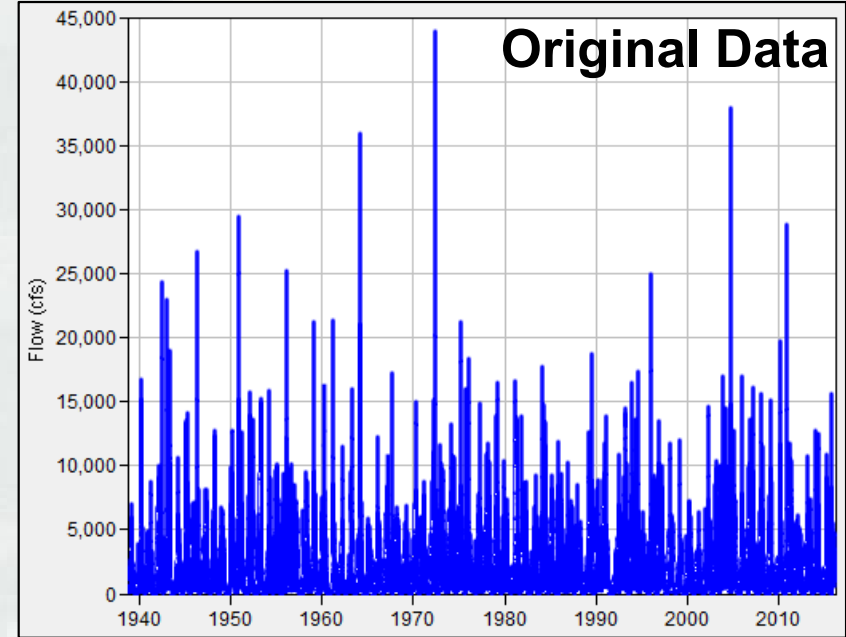


Annual Maximum Daily Average Flow



Data Filtering

- Filter data using:
 - Time Window
 - Season
 - Min/Max Threshold
 - Duration
 - Annual Maxima
 - Peaks Over Threshold
 - Starting Pool Stage/Elev



Data Storage System (DSS)

- Data is stored within the file in “*blocks*”, for example:
 - ▶ Time Series (hourly data stored in months)
 - ▶ Paired Data (flow vs stage curve w/ single stage axis and multiple flow axes)
 - ▶ Gridded (single radar scan)
- Multiple blocks may make up a single “*data set*”, e.g., 50 years of hourly data is one data set
- Each block is called a “*record*”
- A HEC-DSS file can have many records
- Name of a record is called a “*pathname*”
- Each pathname within a file must be unique



DSS

Time Series Data | Pathnames

- Pathname self-documents the data
- Consists of 6 parts, separated by forward slashes “/”
- Parts are labeled A – F: “/A/B/C/D/E/F/”
- Each part can be 0 to 64 characters long
- A single pathname can be up to 391 characters long
- Example:
 - ▶ /SACRAMENTO/RED BLUFF/FLOW/01MAR1972/1HOUR/OBS/



DSS

Time Series Data | Pathnames

/A/B/C/D/E/F/

<u>Part</u>	<u>Description</u>
-------------	--------------------

- | | |
|---|--|
| A | Group, basin, river, region or study name |
| B | Location or gage name |
| C | Data parameter |
| D | Starting date for block (not 1 st data) |
| E | Time interval (standard) |
| F | Version or additional information |

/SACRAMENTO/RED BLUFF/FLOW/01MAR1972/1HOUR/OBS/



DSS

Conventions

- Use optional part names
- Be descriptive, but not “overly” descriptive

- Please **do not** do this:

“///FLOW/01JUN1972/1HOUR//” (i.e. no A-, B-, or F-parts)

- Instead, **do** this:

“/BALD EAGLE CREEK/SAYERS/FLOW/01JUN1972/1HOUR/COMPUTED/”



DSS

Time Series Data | Interval

- Each record contains a “*header*”
 - ▶ Data Units (e.g., FEET, CFS)
 - ▶ Data Type:
 - PER-AVER Period Average (daily average flows)
 - INST-VAL Instantaneous (15-min flows)
 - PER-CUM Period Cumulative (daily precip accumulation)
 - INST-CUM Instantaneous Cumulative (incremental precip)
 - ▶ Time offset (e.g., daily data read at 8:00 am)
- Missing data flags (-901.) are used as a place holder



DSS

Time Series Data | Regular

- Blocks are “standard size” (there are always 365 or 366 values for one year of daily data)

Interval

Block Length

1MIN, 2MIN, 3MIN, 4MIN,
5MIN, 6MIN, 10MIN, 12MIN

One day

15MIN, 20MIN, 30MIN, 1HOUR,
2HOUR, 3HOUR, 4HOUR,
6HOUR, 8HOUR, 12HOUR

One month

1DAY

One year

1WEEK, TRI-MONTH,
SEMI-MONTH, 1MON

One decade

1YEAR

One century



DSS

Time Series Data | Irregular

- Same as regular-interval, except:
- Date and time store with each data value (which makes data sets much larger)
- Blocks (E parts) are:
 - ▶ IR-DAY
 - ▶ IR-MONTH
 - ▶ IR-YEAR
 - ▶ IR-DECADE
 - ▶ **IR-CENTURY**
- Block sizes are (user) variable length. Try to limit sizes between 100 and 1000 values per block



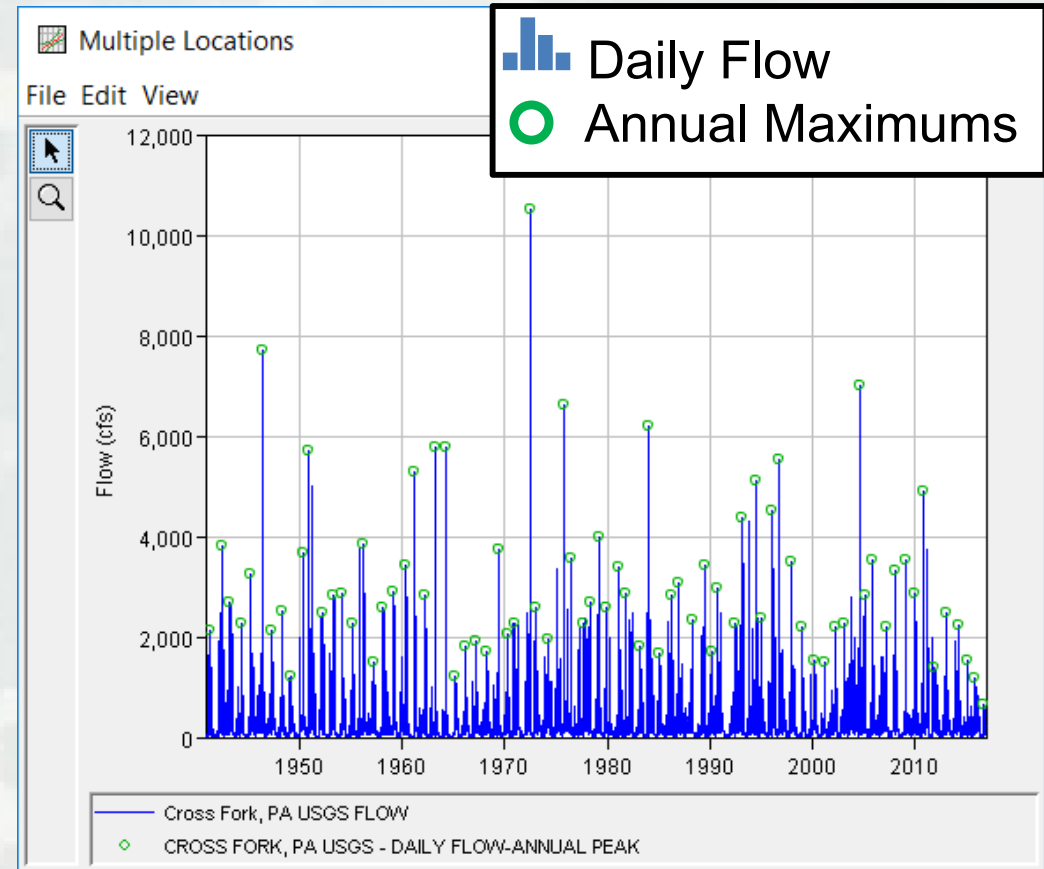
DSS Data within SSP

- **Bulletin 17** (and General Frequency) analyses require the use of **irregular** data sets
 - ▶ **Please use IR-CENTURY**
- Regular data sets will not be selectable
 - ▶ If you don't see the data set you just entered, it's because it's not irregular
- **Volume Frequency** analyses require the use of **regular** data sets
 - ▶ Use 1DAY
- Irregular data sets will not be selectable



Extracting Annual Maximum or Partial Duration Series

- Download data
- Right-click | Filter Data...
- Select Filter Options
 - ▶ Absolute Time Window
 - ▶ Seasonal Time Window
 - ▶ Min/Max Threshold
 - ▶ Filter to Annual Maximums
 - ▶ Filter to Partial Duration Series

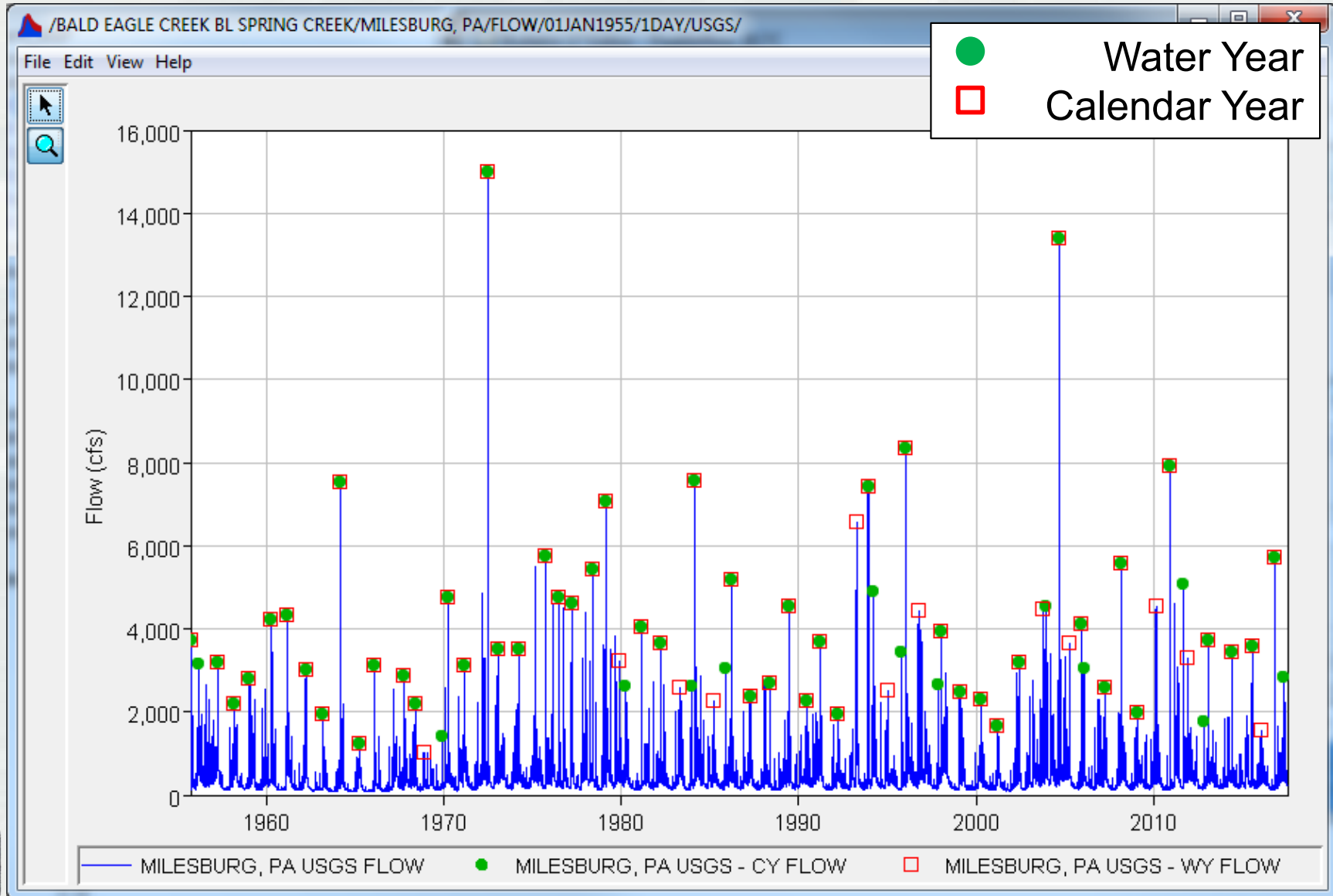


Calendar Year vs. Water Year

- Within SSP, Bulletin 17 analyses using EMA/B17C require that only one peak be present in any given water year
 - ▶ i.e. If the linked DSS data set contains two values in water year 1969 (01Oct1968 – 30Sep1969), **your analysis will not compute**
- If your watershed has more than one peak in a water year that must be included (i.e. partial duration) or calendar year is more appropriate to use, contact HEC for help

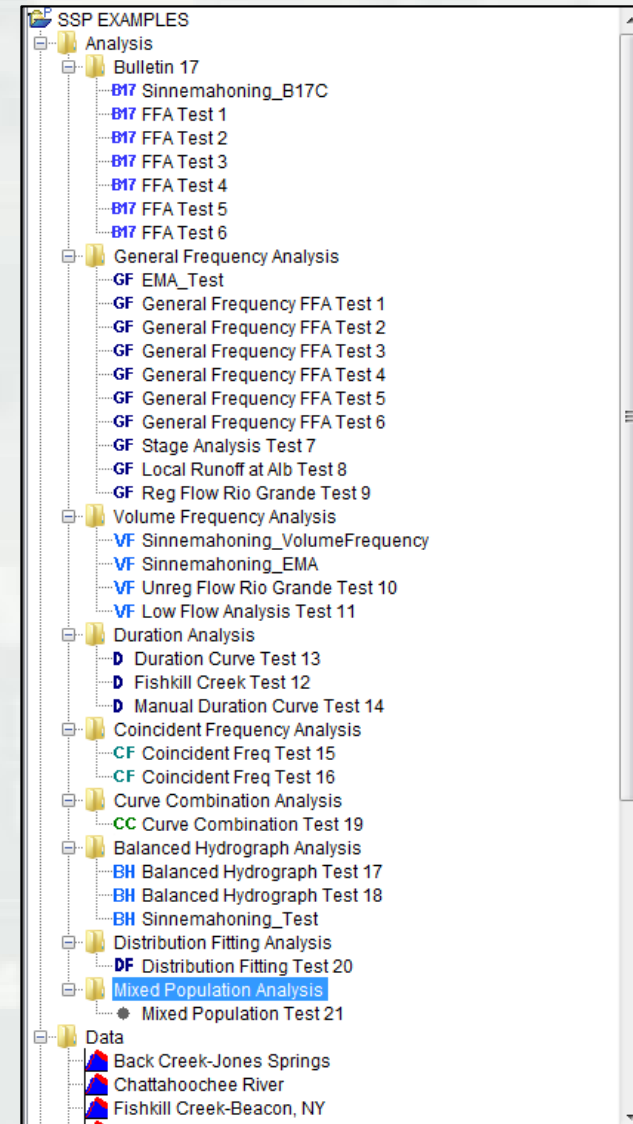


Calendar Year vs. Water Year



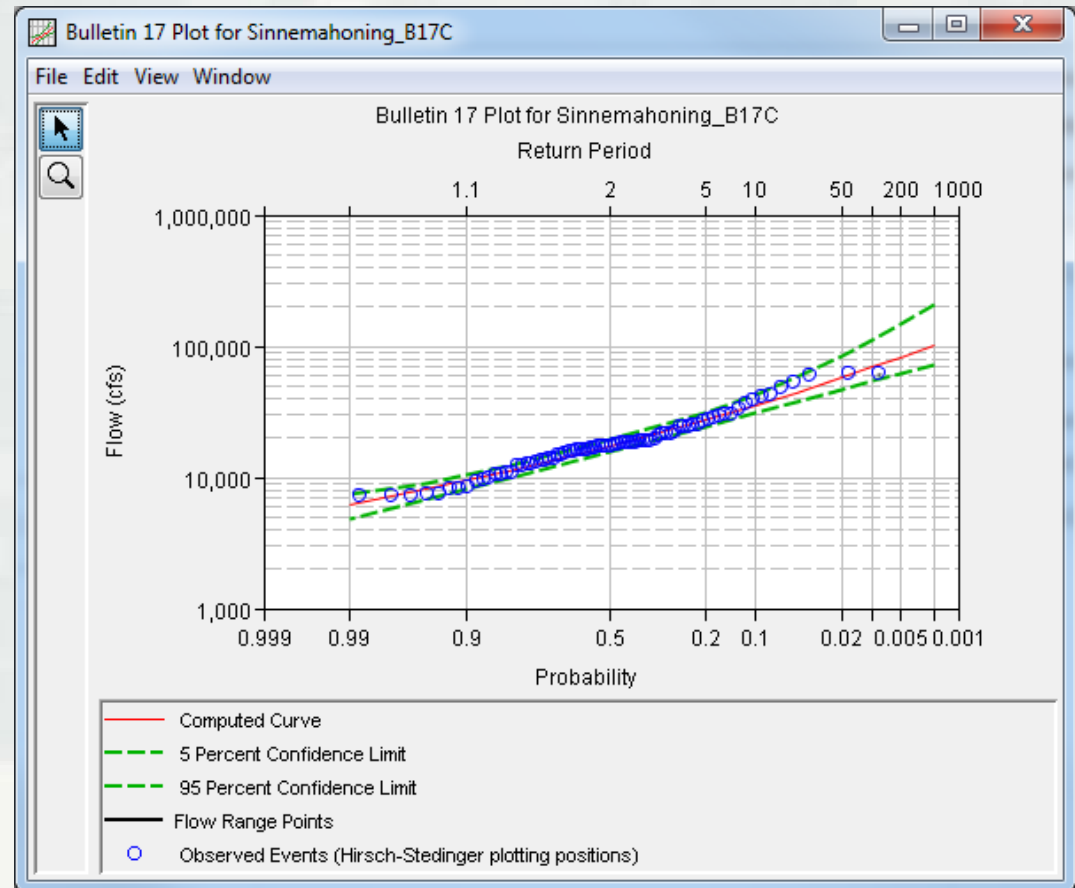
HEC-SSP Analysis Types

- Eleven Analysis Types
 - ▶ Bulletin 17
 - ▶ General Frequency
 - ▶ Volume-Frequency
 - ▶ Duration Analysis
 - ▶ Coincident Frequency
 - ▶ Curve Combination
 - ▶ Balanced Hydrograph
 - ▶ Distribution Fitting
 - ▶ Mixed Population
 - ▶ Correlation
 - ▶ Record Extension

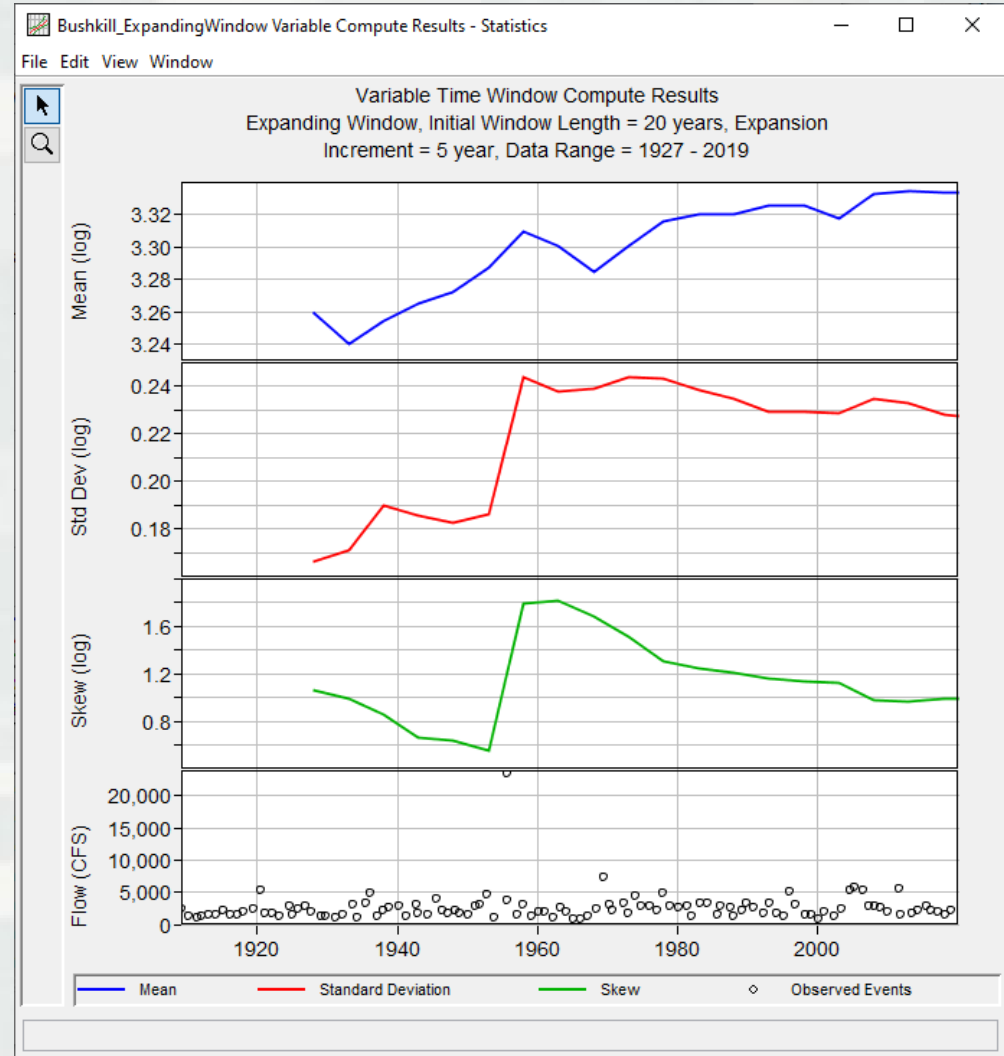
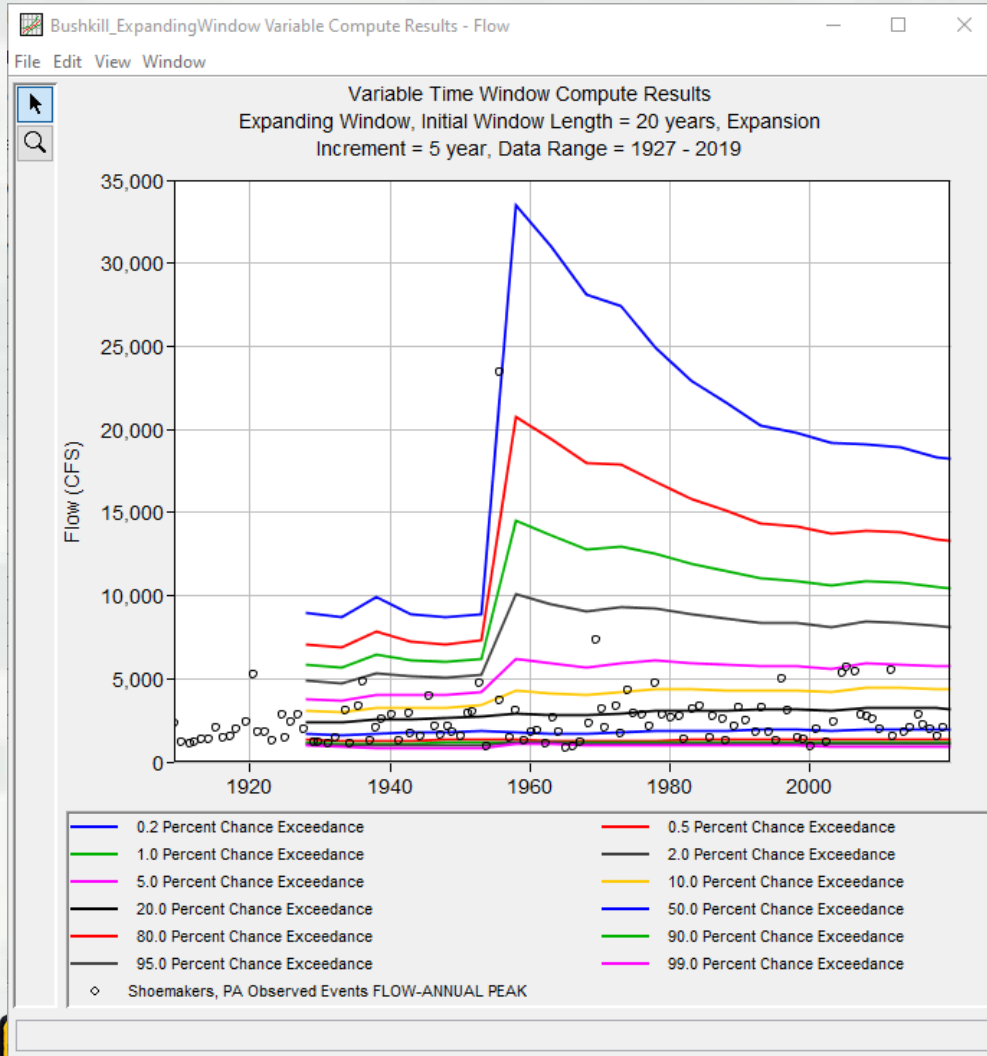


Bulletin 17 Analysis

- “**Strict**” flow-frequency analysis using either **Bulletin 17B** or **Bulletin 17C** procedures
- Can evaluate moving or expanding time windows
- **IRREGULAR** data required
 - ▶ i.e. IR-CENTURY



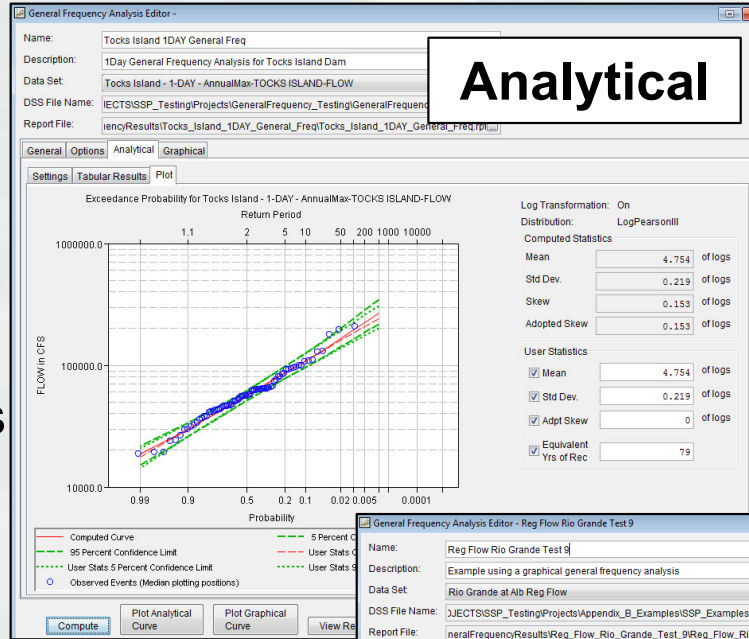
Bulletin 17 Analysis



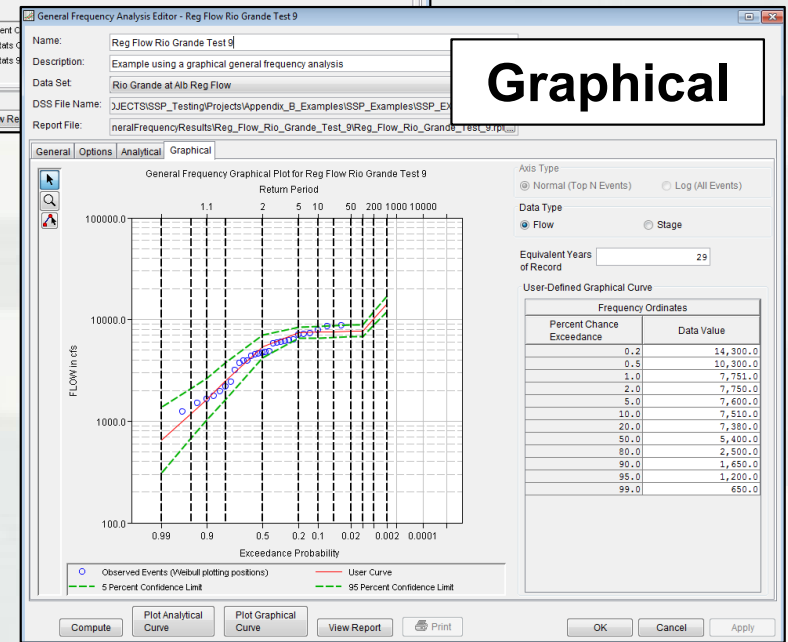
General Frequency Analysis

- “Less strict” flow-, stage-, precipitation-, etc frequency analysis
 - ▶ Mix and match procedures
- **Numerous** analytical distributions
 - ▶ Product Moments-LPIII
 - ▶ EMA-LPIII
 - ▶ Linear Moments-GEV
 - ▶ etc
- Manually define distribution parameters
- Graphical/Empirical distribution
- Annual or Partial Duration series
- **IRREGULAR** data required

i.e. IR-CENTURY



Analytical



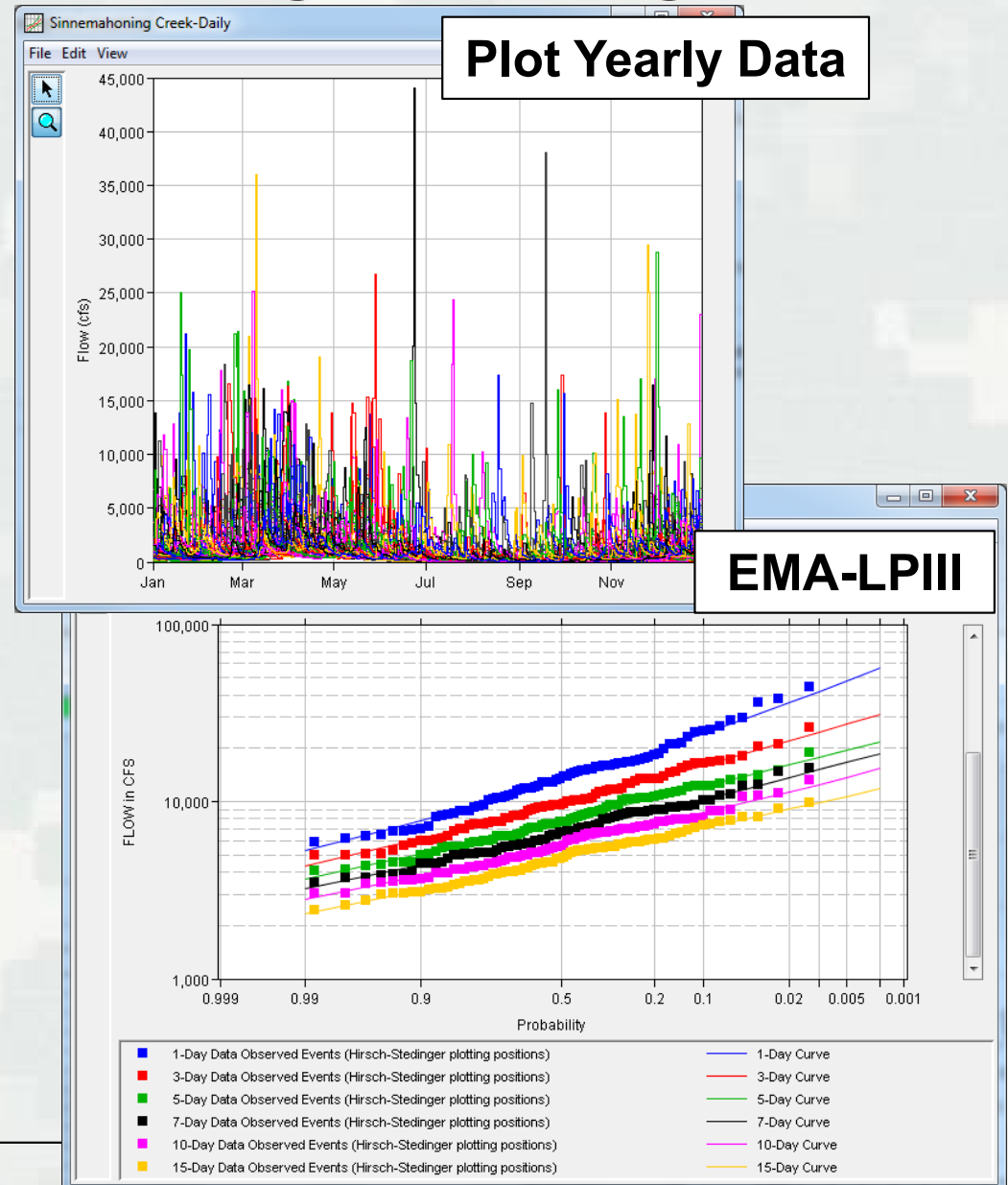
Graphical



Volume Frequency Analysis

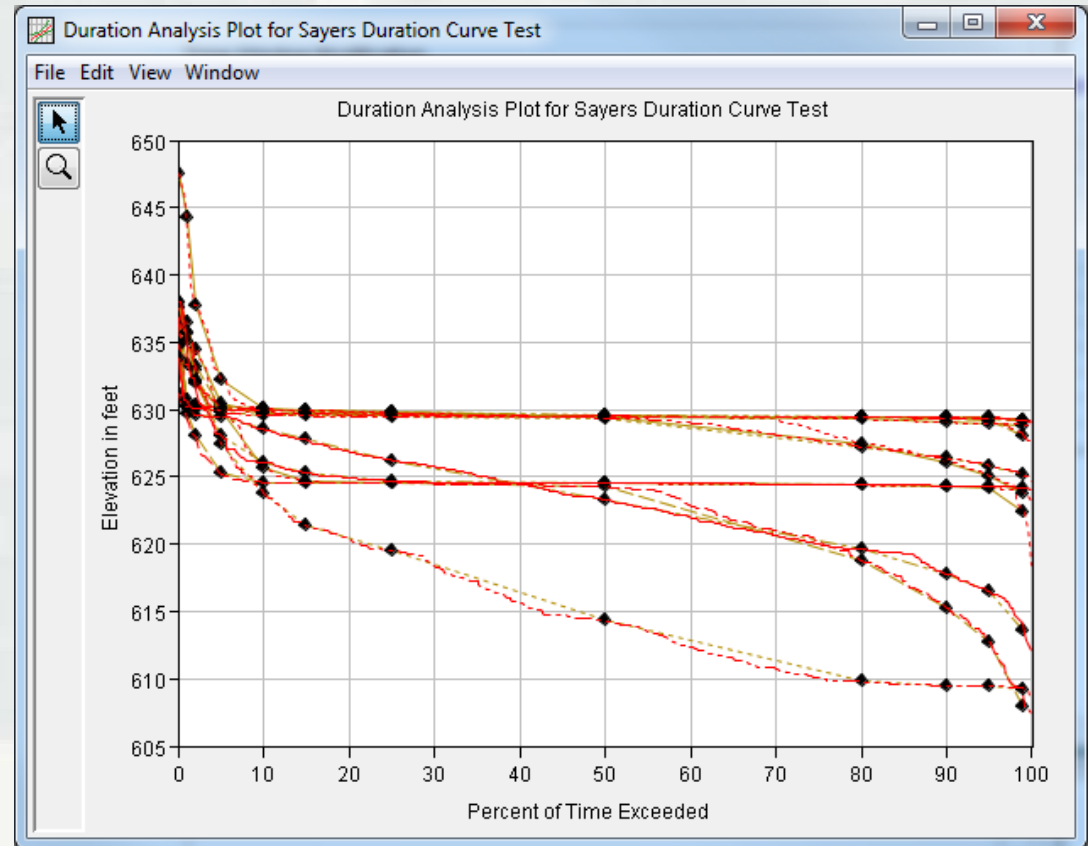
- Iterative/duplicative frequency analysis
 - ▶ Mix and match procedures
- Extract annual maximum series from input data and fit distribution
- Numerous analytical distributions
 - ▶ Product Moments-Normal
 - ▶ Product Moments-LPIII
 - ▶ EMA-LPIII
 - ▶ etc
- Manually define distribution parameters (i.e. smooth statistics)
- Graphical/Empirical distribution
- **REGULAR** data required

i.e. 1DAY



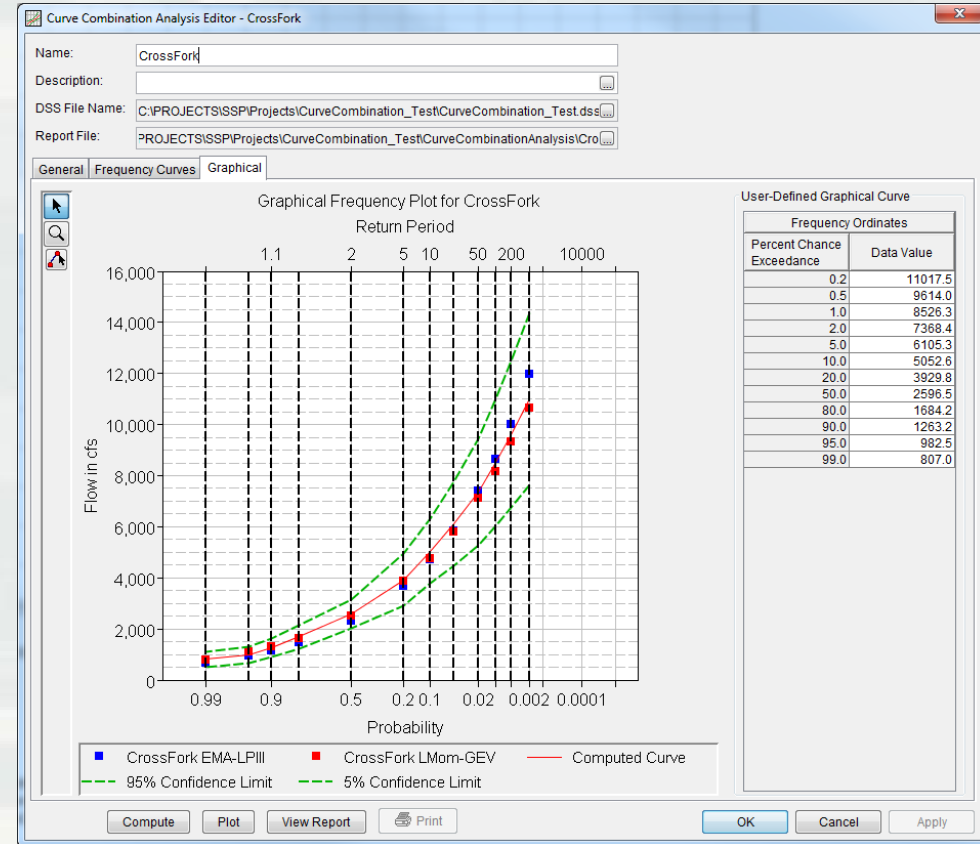
Duration Analysis

- Computes Stage- or Flow-Duration
 - ▶ i.e. percent of time stage/flow was in excess of a certain value
- Rank/Sort and STATS (i.e. bin) methods
- Annual, Quarterly, Monthly, or User-Defined Periods
- **REGULAR** data required
 - ▶ i.e. 1DAY



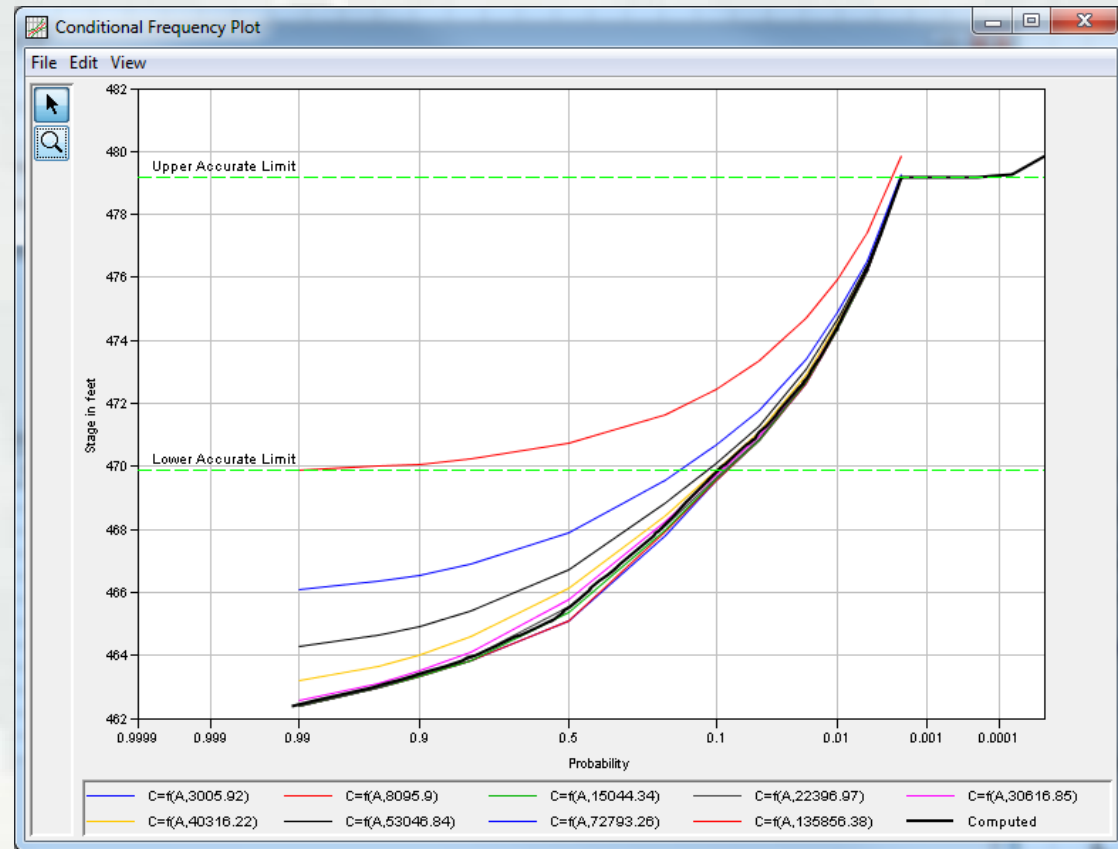
Curve Combination Analysis

- **Graphically-define an empirical distribution for two or more input frequency curves**
 - ▶ i.e. best-fit pool stage-frequency curve
- **Results from other analyses can be imported**
 - ▶ Bulletin 17, General Frequency

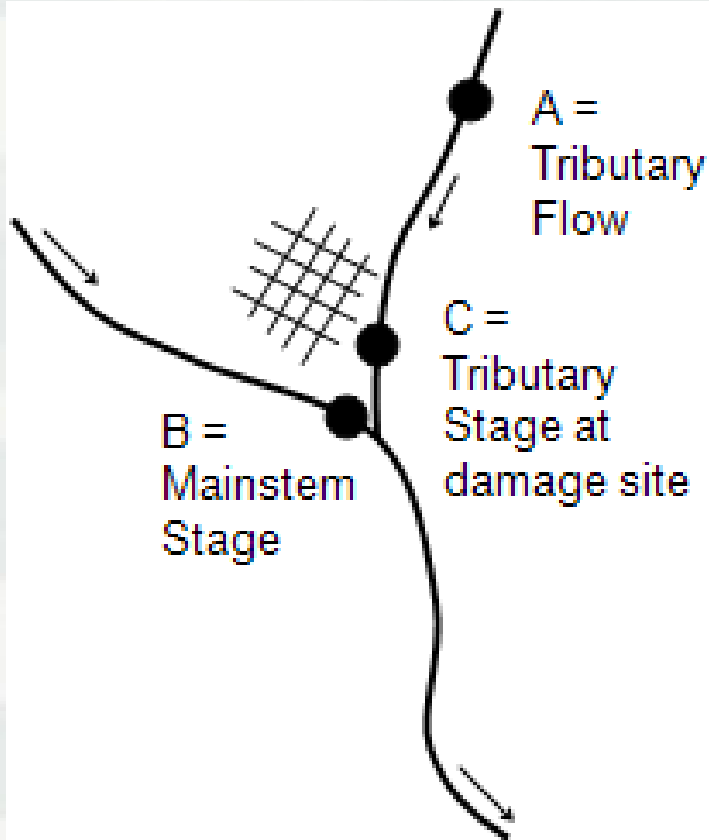


Coincident Frequency Analysis

- Uses **Total Probability Theorem** to compute a frequency curve that is a **function of two variables** (A and B)
 - ▶ Variable A and B are independent
 - ▶ Variable A and B are not independent
- Variable A
 - ▶ Flow- or Stage-Frequency Curve
- Variable B
 - ▶ Index Points from Flow- or Stage-Duration Curve
- Response Curves
 - ▶ Variable A results for each Variable B
 - ▶ Can have different Variable A for each Response Curve



Coincident Frequency Analysis

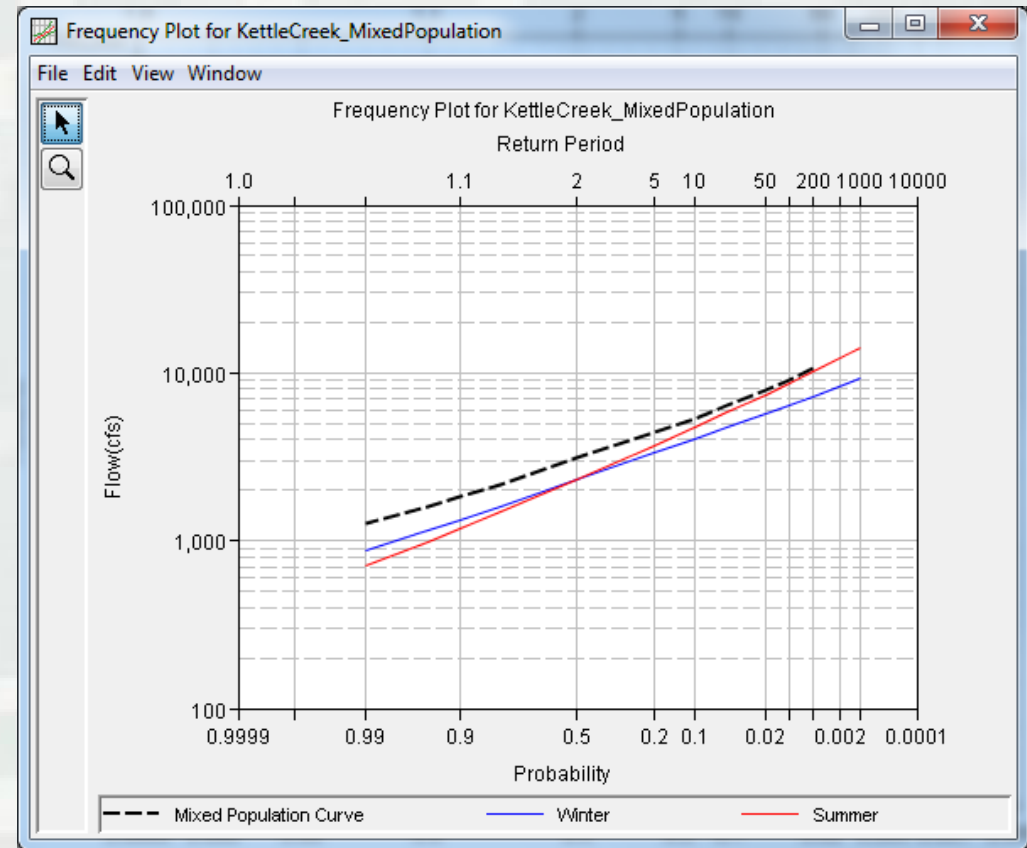


- A = Tributary Flow — probability distribution “known”
- B = Mainstem Stage — probability distribution “known”
- C = Tributary Stage — probability distribution not known, value computed $f(A,B)$



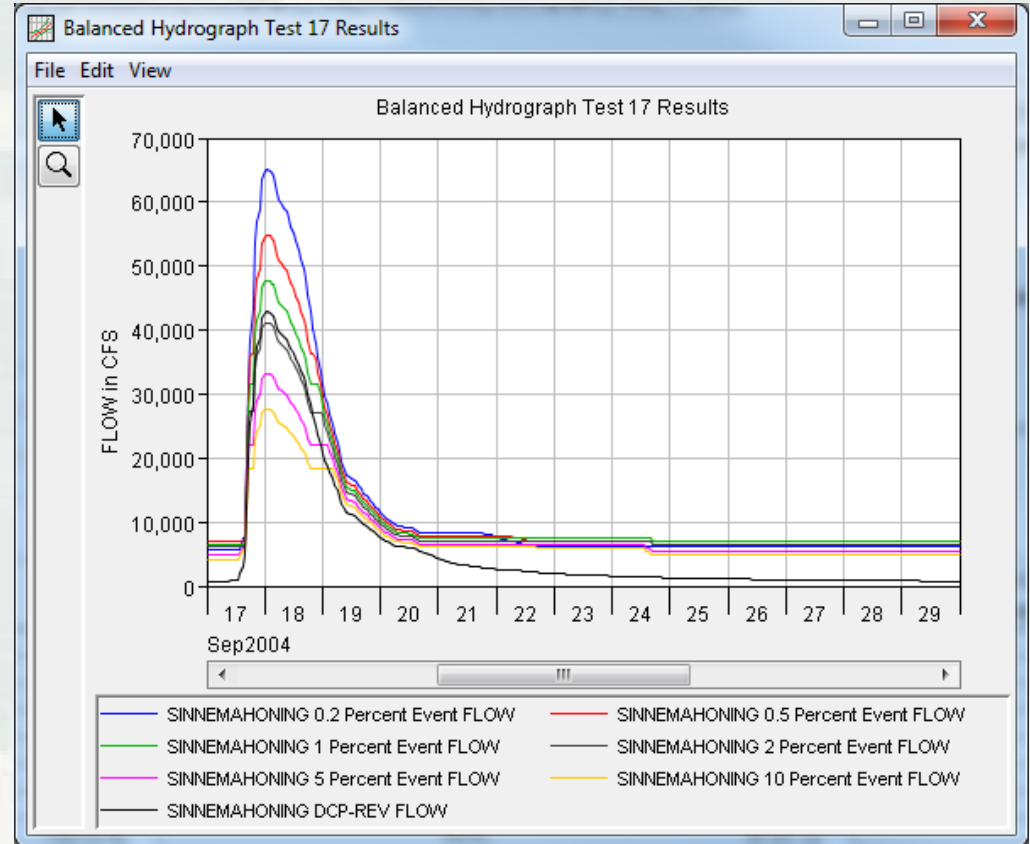
Mixed Population Analysis

- Uses **Total Probability Theorem** to compute a **frequency curve** from **two or more different runoff/causative mechanisms**
 - ▶ i.e. rainfall-only vs rain-on-snow vs snowmelt-only vs tropical storms
 - ▶ annual maximum series cannot be fit using the same analytical distribution
 - ▶ resultant empirical distribution takes into account the relative probability of a flood occurring in any year due to any of the input runoff mechanisms
- **Results** from other analyses **can be imported**
 - ▶ Bulletin 17, General Frequency



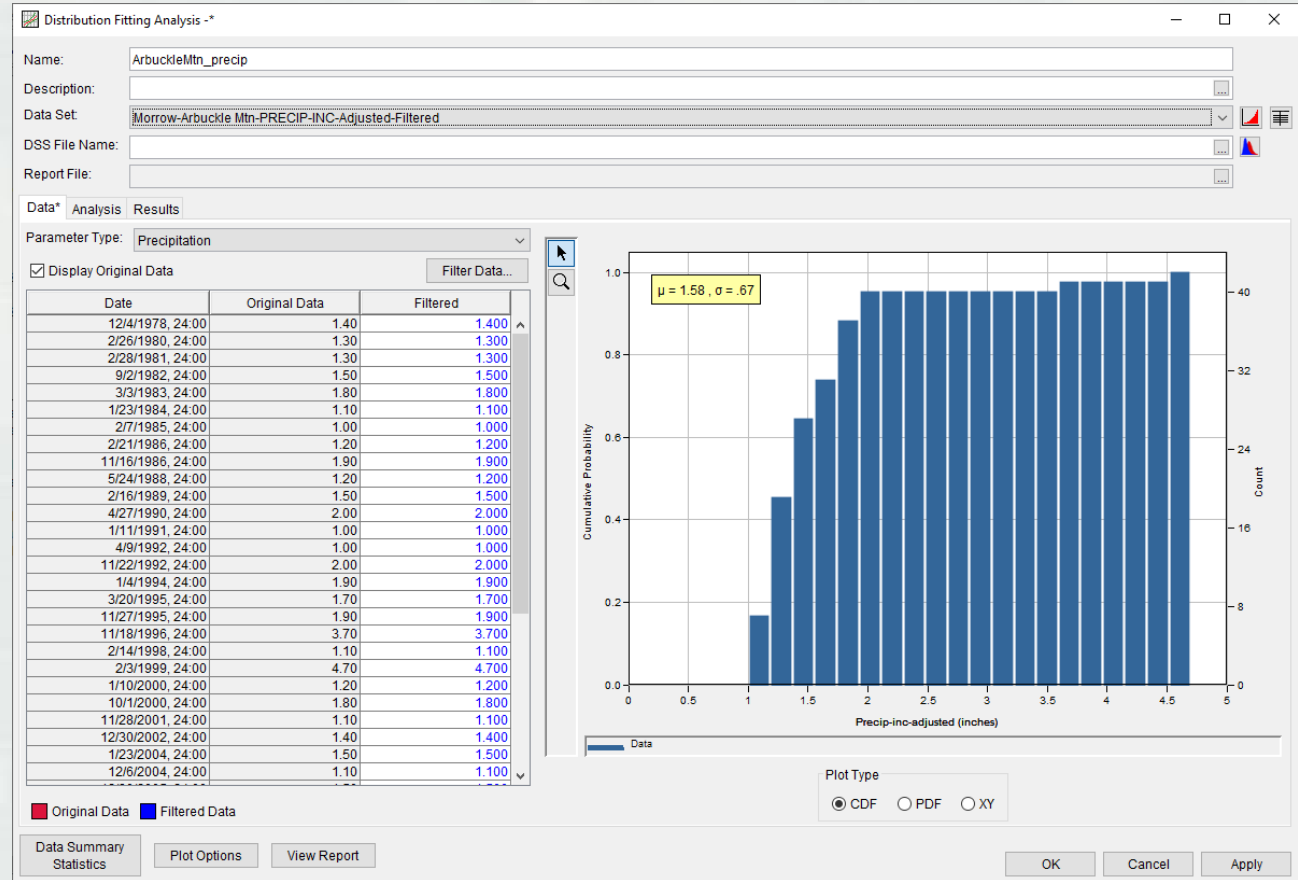
Balanced Hydrograph Analysis

- Computes **hydrograph shapes** that have been **modified to contain specific exceedance flow rates/volumes** across one or more **durations**
- **Results** from other analyses can be imported
 - ▶ Bulletin 17, General Frequency, Volume Frequency
- **REGULAR** data required
 - ▶ i.e. 1DAY



Distribution Fitting Analysis

- **Have you ever wondered what 19 analytical distributions look like when fit to the same data set?**
- **How much uncertainty is due to the choice of analytical distribution?**
- **IRREGULAR, REGULAR, and PAIRED DATA** accepted
- Can be used for flow, stage, precipitation, wind speed, wind direction, flood/event seasonality, etc



Distribution Fitting Analysis

Analysis Tab

Distribution Fitting Test 22*

Name: Distribution Fitting Test 22

Description: Sinnemahoning Creek Daily Flow using Time Window, Seasonal, and Peaks Over Threshold Filtering Example

Data Set: Sinnemahoning Creek-Daily

DSS File Name: C:\PROJECTS\SSP\Projects\Test\SSP_Examples\SSP_EXAMPLES.dss

Report File: C:\PROJECTS\SSP\Projects\Test\SSP_Examples\DistributionFitting\Distribution_Fitting_Test_22\Distribution_Fitting_Test_22.rpt

Data Analysis* Results

Distribution Filter: Filter Using Parameter Display All Distributions

Distribution Fitting Methods: Product Moments (PM) L-Moments (LM) Maximum Likelihood Estimation (MLE)

Goodness of Fit Test: Kolmogorov-Smirnov (Test Statistic)

Goodness of Fit Summary Statistics

Distribution	Median Curve	Confidence Limits	Expected Probability Curve	Kolmogorov-Smirnov (Test Statistic)	Accept Distribution
Generalized Pareto (LM)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0.043	<input type="checkbox"/>
Pearson III (PM)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0.043	<input type="checkbox"/>
Shifted Gamma (PM)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0.043	<input type="checkbox"/>
Generalized Pareto (PM)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0.055	<input type="checkbox"/>
Shifted Exponential (LM)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0.057	<input type="checkbox"/>
Generalized Pareto (MLE)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0.059	<input type="checkbox"/>
Log-Pearson III (LM)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0.062	<input type="checkbox"/>
Log-Pearson III (PM)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0.072	<input type="checkbox"/>
Shifted Exponential (PM)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0.073	<input type="checkbox"/>
Generalized Extreme Value (LM)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0.077	<input type="checkbox"/>
Generalized Extreme Value (MLE)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0.077	<input type="checkbox"/>
Generalized Logistic (LM)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0.086	<input type="checkbox"/>
Pearson III (MLE)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0.107	<input type="checkbox"/>
Shifted Gamma (MLE)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0.107	<input type="checkbox"/>
Gumbel (MLE)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0.109	<input type="checkbox"/>
Generalized Logistic (MLE)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0.116	<input type="checkbox"/>
Ln-Normal (MLE)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0.117	<input type="checkbox"/>
Ln-Normal (PM)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0.117	<input type="checkbox"/>
Log10-Normal (MLE)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0.117	<input type="checkbox"/>
Log10-Normal (PM)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0.117	<input type="checkbox"/>
Generalized Extreme Value (PM)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0.119	<input type="checkbox"/>

Display All Median Curves

Plot Type: CDF PDF PP Plot QQ Plot CDF - Plotting Position

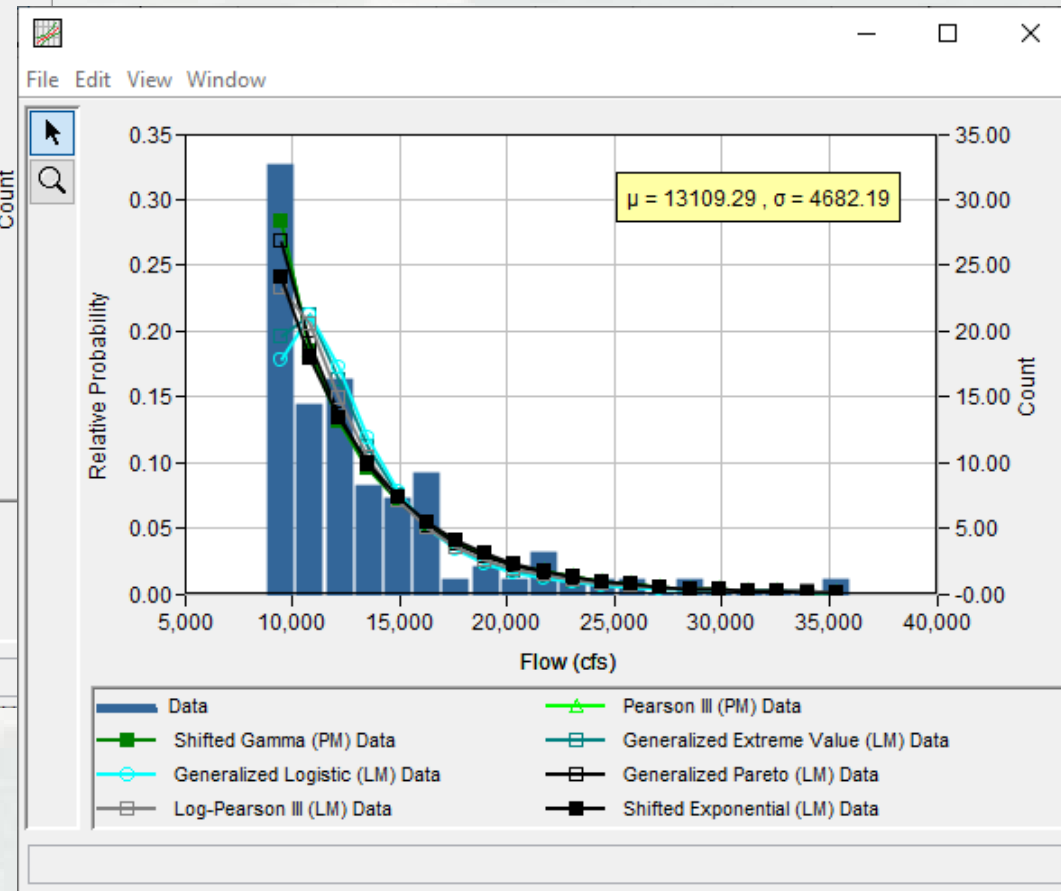
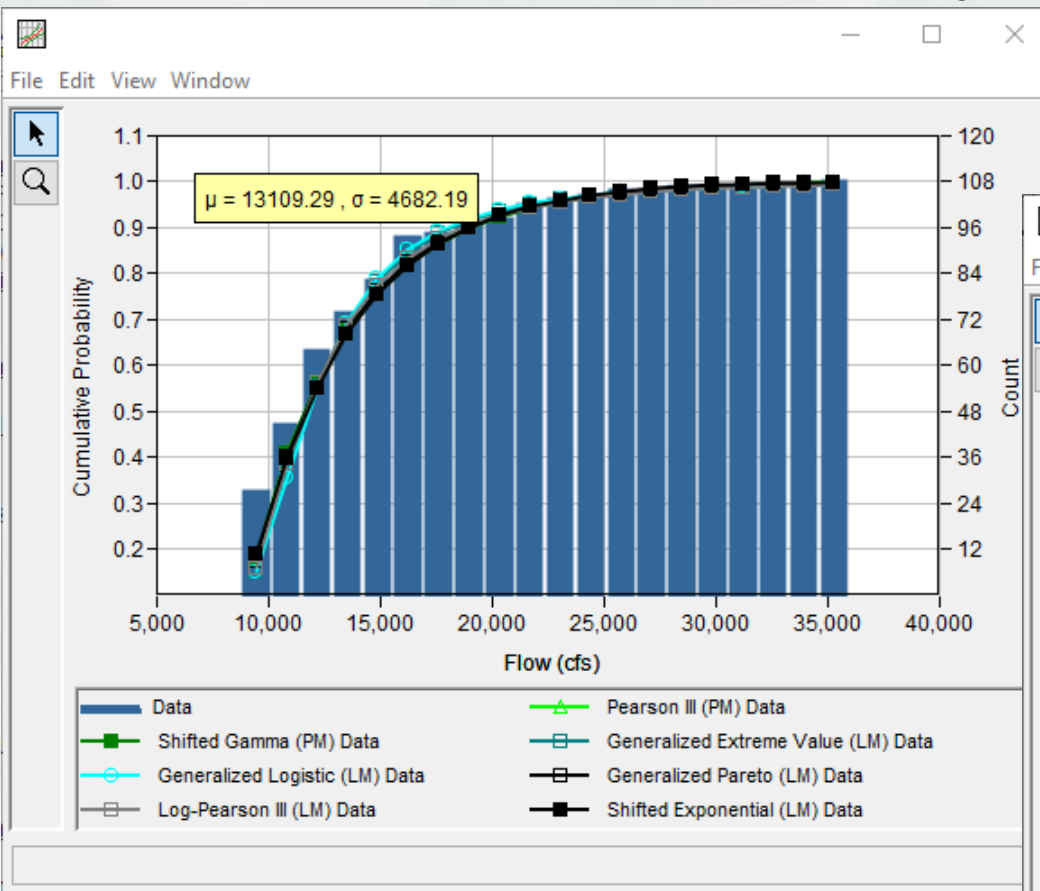
Data Summary Statistics Plot Options Distribution Summary Statistics Confidence Limits and Expected Probability Options View Report

OK Cancel Apply



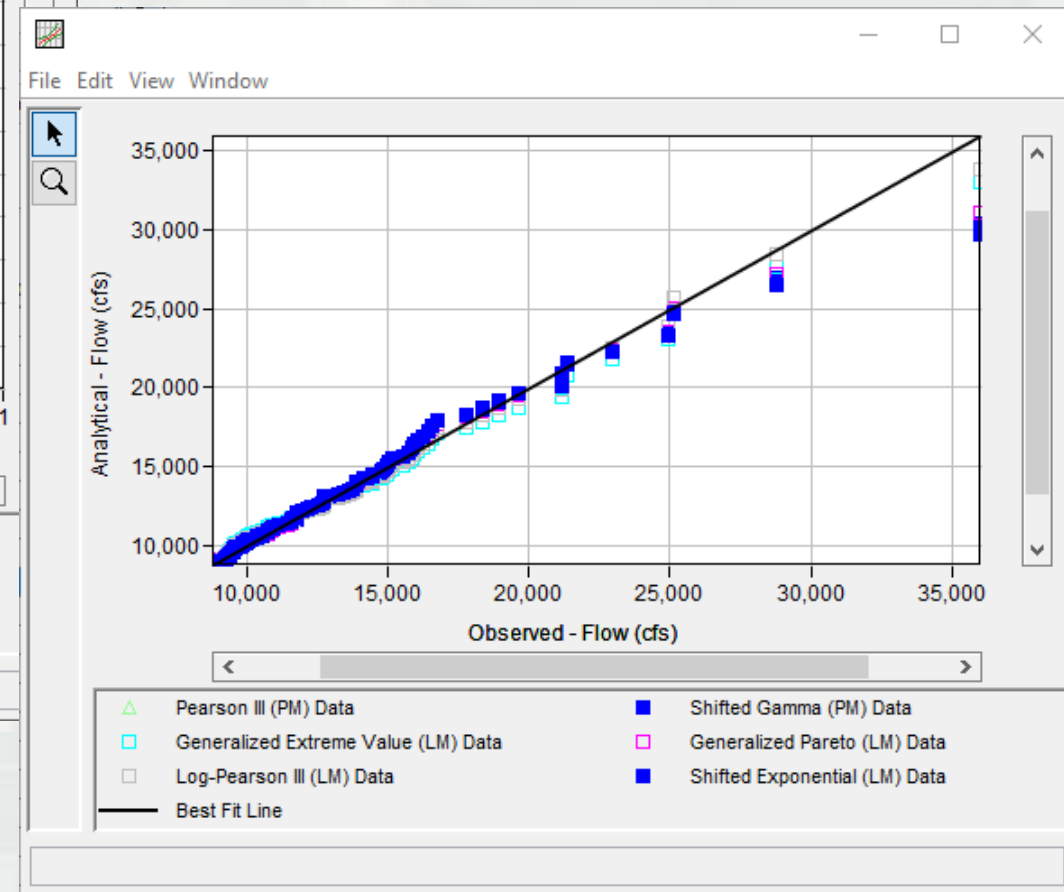
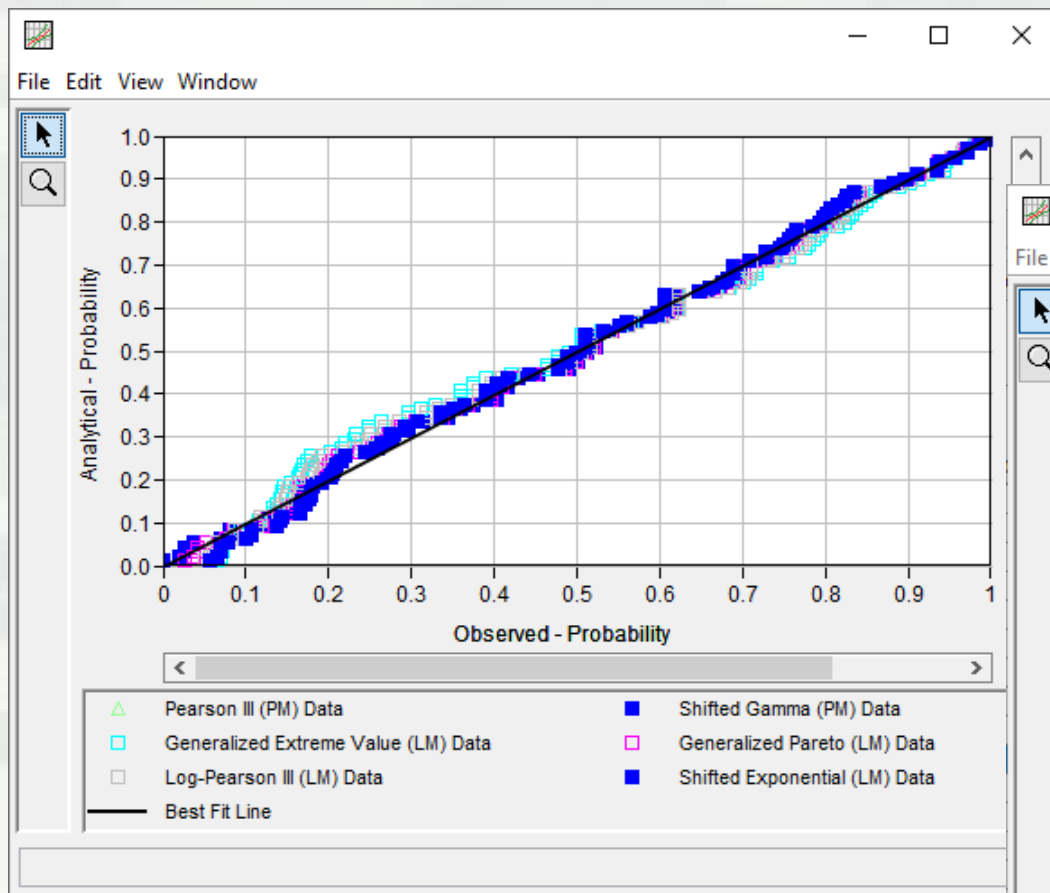
Distribution Fitting Analysis

Analysis Tab



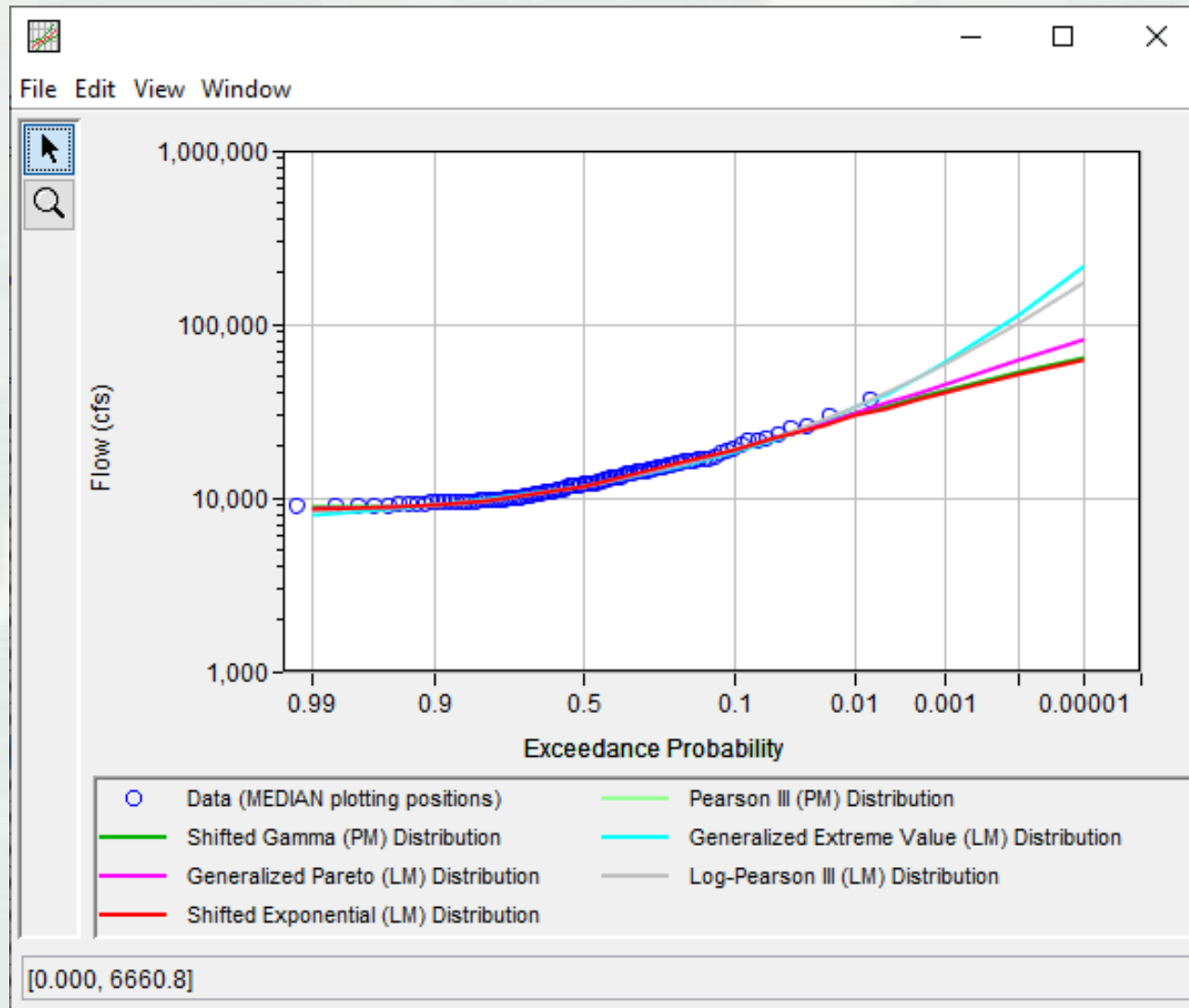
Distribution Fitting Analysis

Analysis Tab



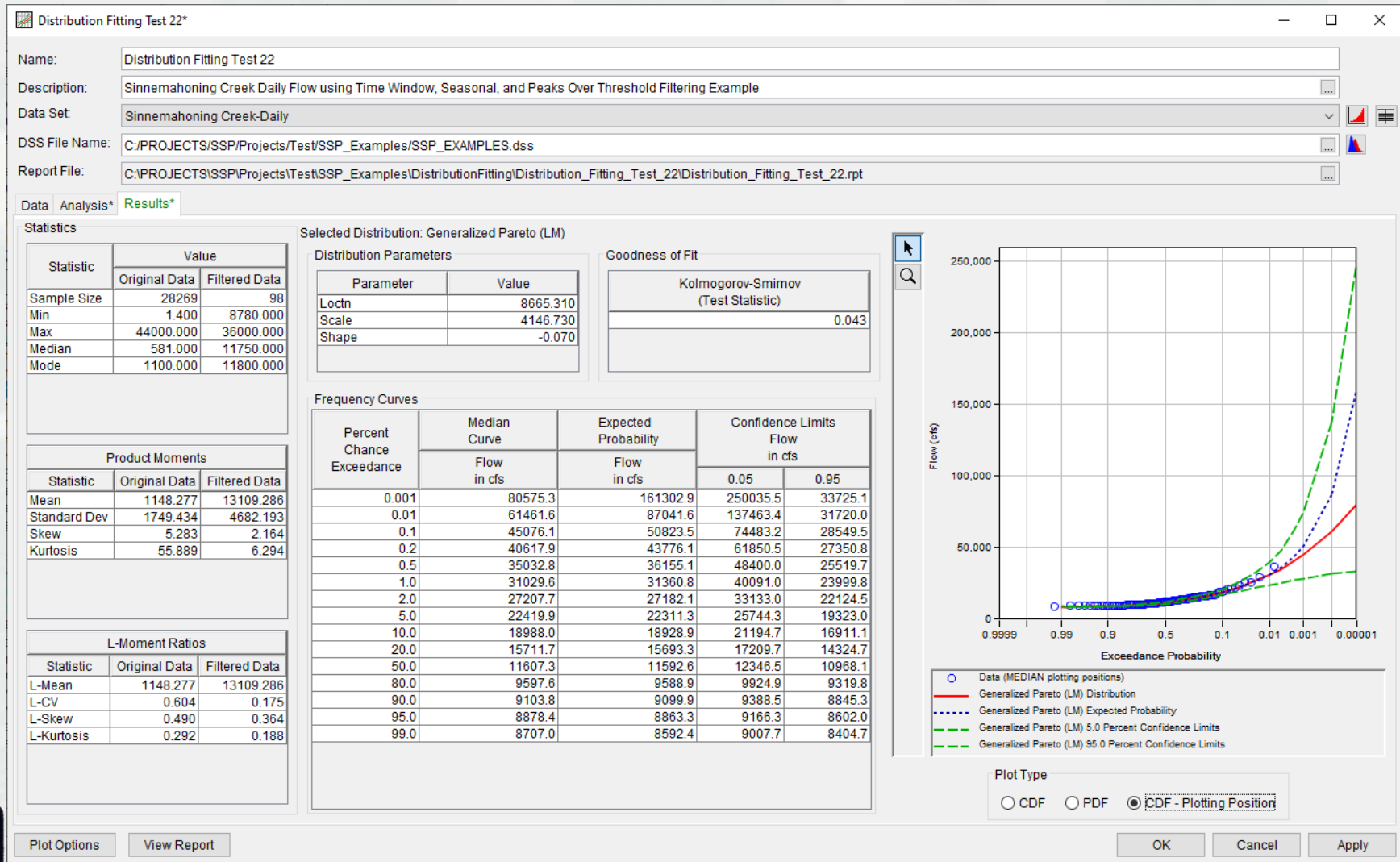
Distribution Fitting Analysis

Analysis Tab



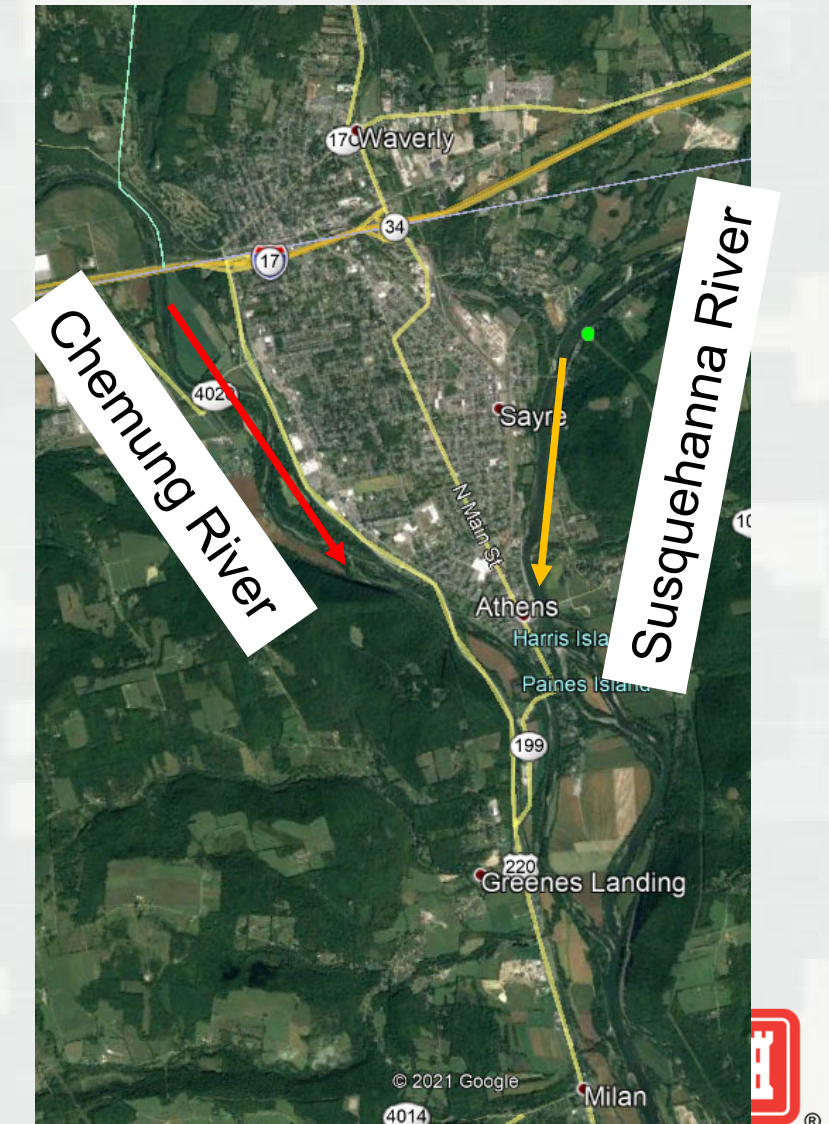
Distribution Fitting Analysis

Results Tab

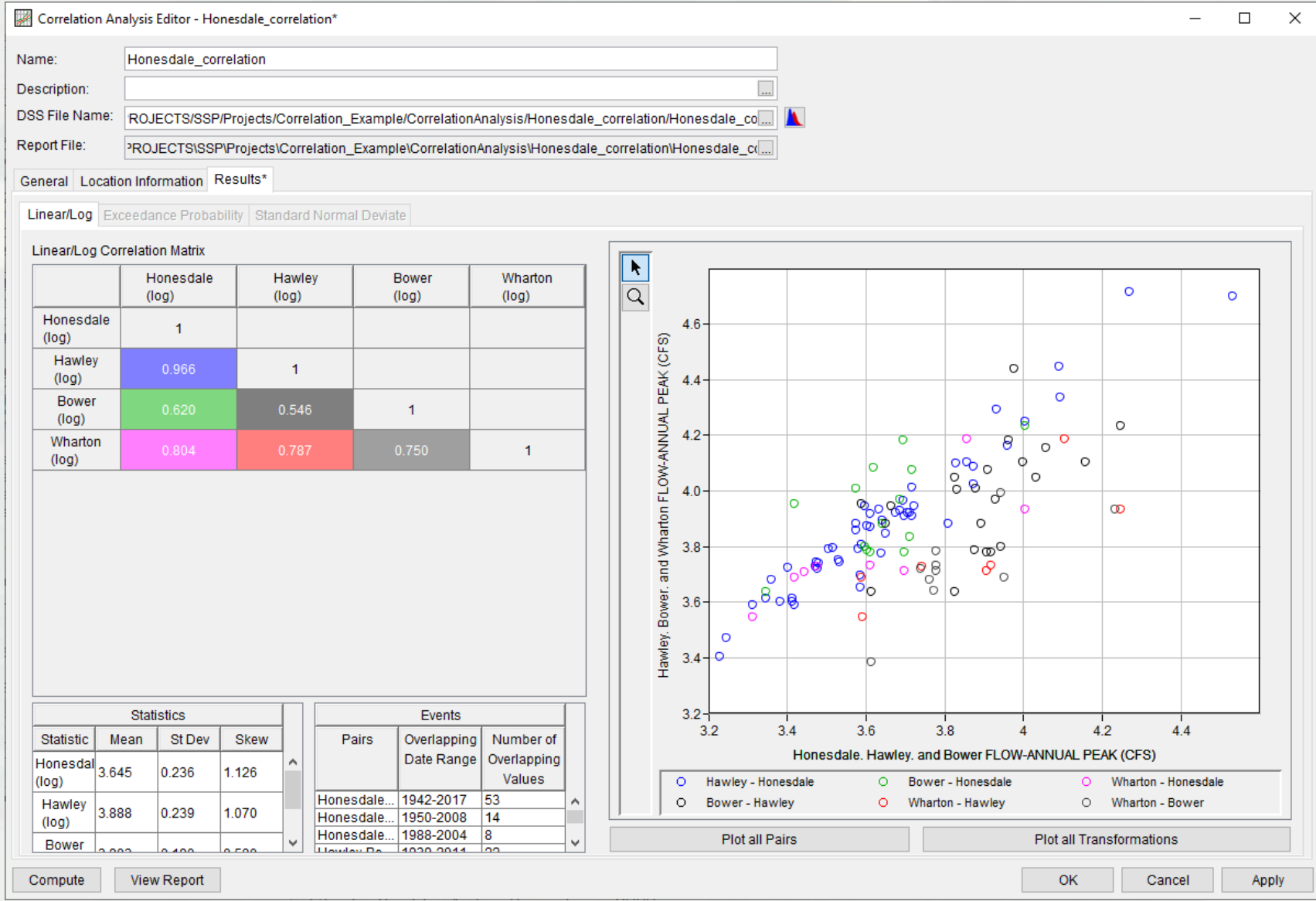


Correlation Analysis

- Compute the amount of correlation between various data sets
 - ▶ Tributary peak flow vs. mainstem stage
 - ▶ 3-day precipitation accumulation vs. 3-day average temperature
 - ▶ Annual maximum SWE vs. annual maximum 24-hour precipitation accumulation
- **Results** from B17 analyses can be imported
- **IRREGULAR** and **REGULAR** data accepted

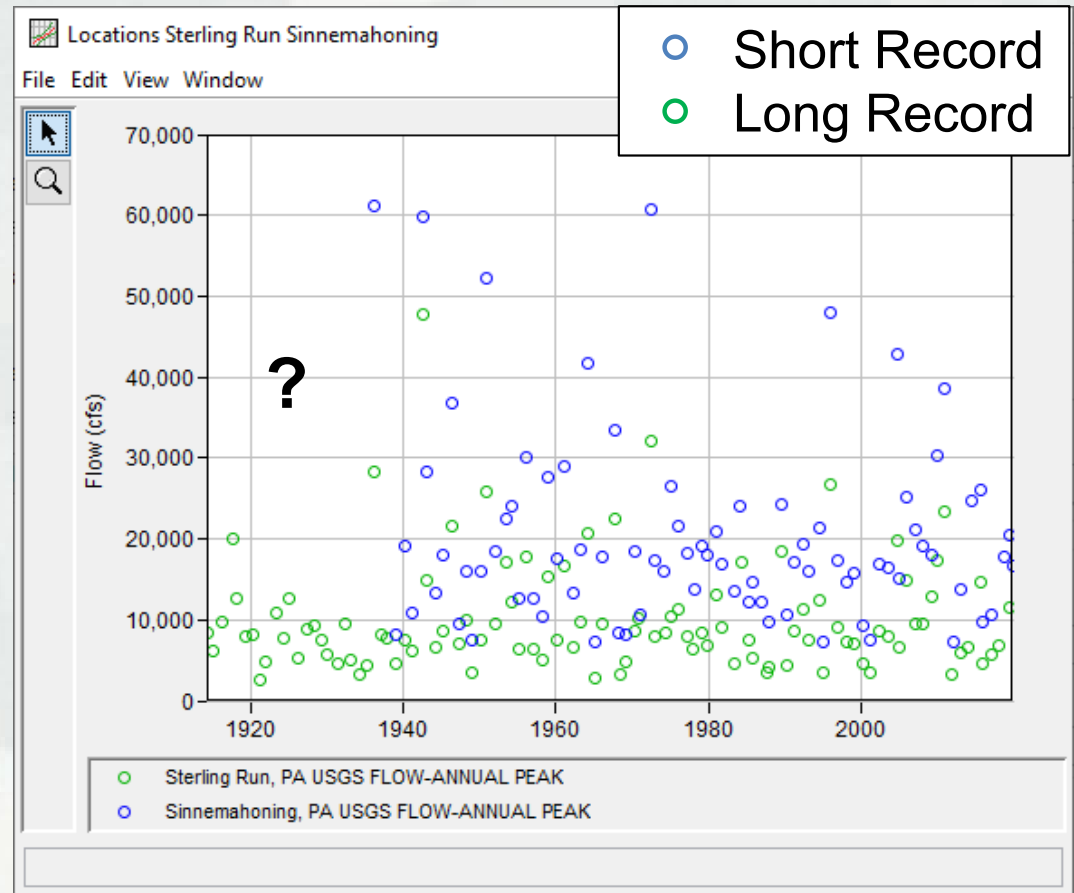


Correlation Analysis

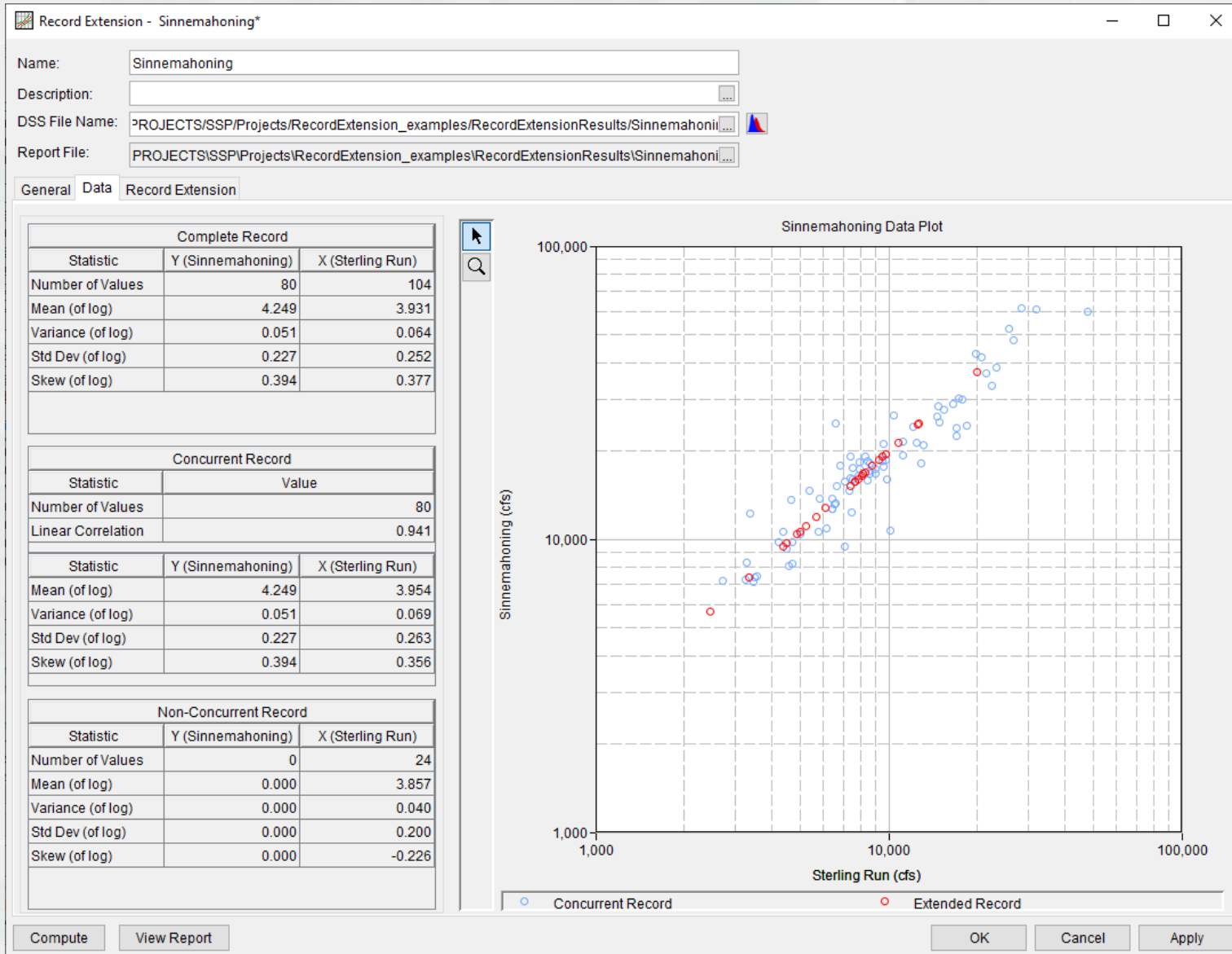


Record Extension Analysis

- Extend a short record using a longer record
- Multiple computational methods
 - ▶ Ordinary Least Squares
 - ▶ MOVE.1
 - ▶ MOVE.2
 - ▶ MOVE.3
 - ▶ MOVE.4
- **Results** can be used within B17 analyses to infer flow-frequency for the extended record
- **IRREGULAR** and **REGULAR** data accepted



Record Extension Analysis



Record Extension Analysis

Record Extension - Sinnemahoning*

Name: Sinnemahoning

Description:

DSS File Name: PROJECTS\SSP\Projects\RecordExtension_examples\RecordExtensionResults\Sinnemahoni...

Report File: PROJECTS\SSP\Projects\RecordExtension_examples\RecordExtensionResults\Sinnemahoni...

General Data Record Extension

Year	Sterling Run (...)	Sinnemahoni...	Extend?
1914	8340.0	16922.1	<input type="checkbox"/>
1915	6090.0	12738.4	<input type="checkbox"/>
1916	9800.0	19576.6	<input type="checkbox"/>
1917	20000.0	37288.2	<input type="checkbox"/>
1918	12600.0	24565.3	<input type="checkbox"/>
1919	7880.0	16076.7	<input type="checkbox"/>
1920	8110.0	16500.0	<input type="checkbox"/>
1921	2470.0	5637.7	<input type="checkbox"/>
1922	4880.0	10428.5	<input type="checkbox"/>
1923	10800.0	21372.3	<input type="checkbox"/>
1924	7650.0	15652.3	<input type="checkbox"/>
1925	12700.0	24741.4	<input type="checkbox"/>
1926	5240.0	11121.0	<input type="checkbox"/>
1927	8820.0	17799.4	<input type="checkbox"/>
1928	9300.0	18672.1	<input type="checkbox"/>
1929	7420.0	15226.6	<input type="checkbox"/>
1930	5660.0	11923.1	<input type="checkbox"/>
1931	4500.0	9692.2	<input type="checkbox"/>
1932	9550.0	19124.9	<input type="checkbox"/>
1933	4990.0	10640.6	<input type="checkbox"/>
1934	3330.0	7384.2	<input type="checkbox"/>
1935	4380.0	9458.4	<input type="checkbox"/>
1936	28400.0	61200.0	<input type="checkbox"/>
1937	8210.0	16683.6	<input type="checkbox"/>
1938	7660.0	15670.7	<input type="checkbox"/>

Original Data Extended Data

Matalas-Jacobs Estimators

Statistic	Value
Concurrent V...	80

MJ-Mean

Statistic	Value
Mean (of log)	4.231
$n_e + \text{overlap}$	100.475
n_e (years)	20.475
Variance of M...	0.001

MJ-Variance

Statistic	Value
Variance (of l...	0.048
Std Dev (of log)	0.219
$n_e + \text{overlap}$	97.468
n_e (years)	17.468
Variance of V...	0.000

Estimators for Augmentation

Estimator	Value
Intercept (of l...	4.170
Slope (of log)	0.903

Sinnemahoning - Extended R...

Statistic	Value
Number of Va...	24
Mean (of log)	4.170
Variance (of l...	0.033
Std Dev (of log)	0.181
Skew (of log)	-0.226

Record Extension Plot for Sinnemahoning

Sterling Run Sinnemahoning
 Sinnemahoning-Extended



History, Status, Future...

- New analytical tools to meet Corps needs
 - ▶ Updated Distribution Fitting analysis
 - ▶ New Bulletin 17 moving/expanding time window
 - ▶ New Correlation Analysis
 - ▶ New Record Extension Analysis
- Improved user experience
 - ▶ Improved data entry
 - ▶ Separate DSS files for each analysis
 - ▶ Button to view/open DSS file
 - ▶ Button to plot/tabulate selected data set



Summary

- Currently contains nine different statistical analyses
 - ▶ Future versions will include two additional analyses
- Developed primarily to meet USACE needs
- If you have ideas for future enhancements or questions about existing features, let us know

