**US Army Corps
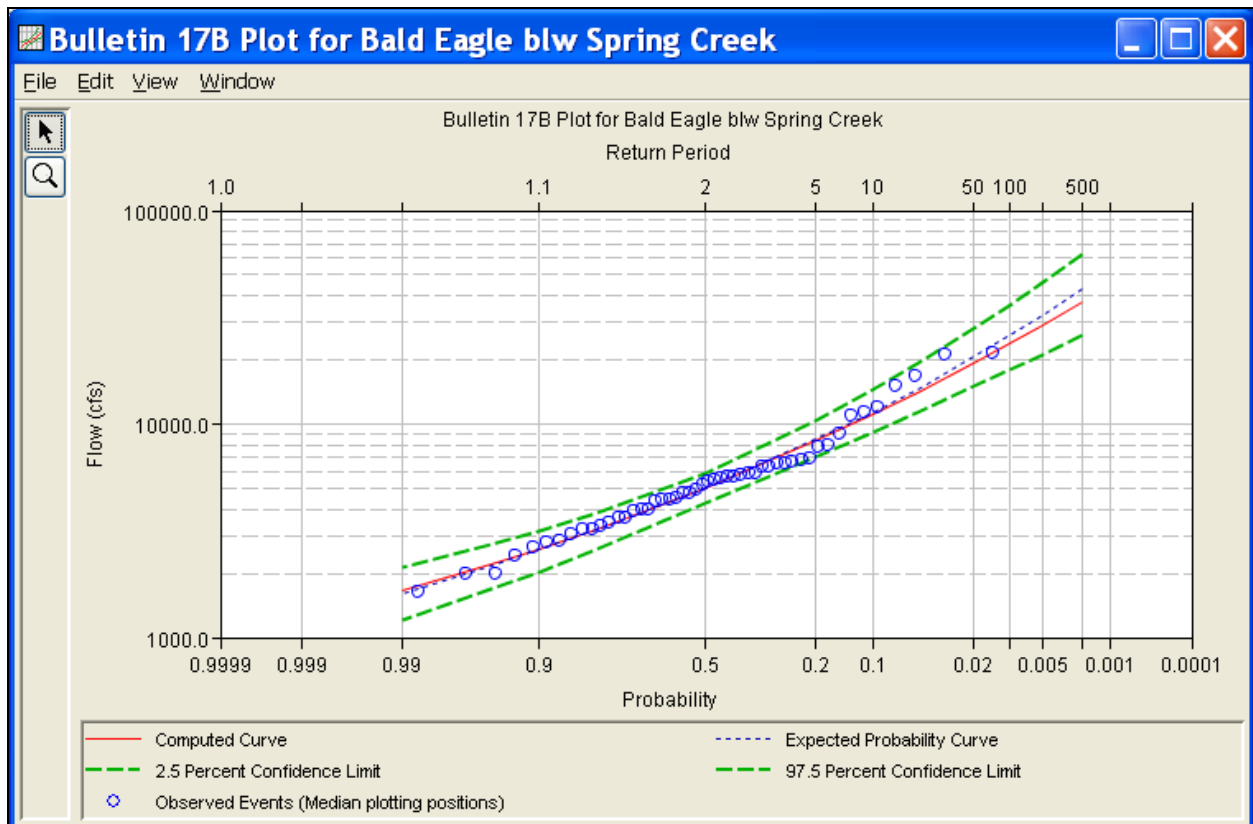of Engineers**
Hydrologic Engineering Center

HEC-SSP
Statistical Software Package

Release Notes

Version 2.0
October 2010

Statistical Software Package, HEC-SSP
Software Distribution and Availability Statement

The HEC-SSP executable code and documentation are public domain and were developed by the Hydrologic Engineering Center for the U.S. Army Corps of Engineers. The software was developed with United States Federal Government resources, and is therefore in the public domain. This software can be downloaded for free from the HEC internet site (www.hec.usace.army.mil). HEC does not provide technical support for this software to non-Corps users. However, we will respond to all documented instances of program errors. Documented errors are bugs in the software due to programming mistakes not model problems due to user-entered data.

Introduction

Version 1.1 of the Statistical Software Package (HEC-SSP) was completed in April 2009 and released for general use shortly thereafter. Three new statistical analyses have been added and improvements to existing features have been completed for version 2.0. The three new analyses include a duration analysis, a coincident frequency analysis, and a curve combination analysis. Enhancements were added to the existing general frequency and volume frequency analyses along with continued improvements for customization of output graphs.

The HEC-SSP development team has also continued careful and systematic testing of the program since the last release. The results of this testing in combination with reports from users have allowed the identification and repair of various bugs. Some of the bugs that were fixed are described in this document.

Installation

The installation program and all documentation are available on the HEC web site at http://www.hec.usace.army.mil/. This new release is installed independently of any previous versions of the program so you will need to remove Version 1.0 or 1.1 if you do not want to use these versions anymore. However, you may keep different versions of the program installed for parallel use or testing if you choose to do so. This new version will automatically open projects developed with any previous version of the program. However, once a project has been opened in Version 2.0, it may not be possible to open it with older versions of the program.

The new installation package is designed to be easy to use. It will take you through the steps of selecting a directory for the program files and making other settings. Use the following steps to install the program on the Microsoft Windows® operating system:

1. Download the installation package from the HEC website to a temporary folder on the computer. If the software was provided to you on a CD-ROM or other media, insert it in the appropriate drive.
2. Run the installation program. In Windows Explorer, double-click the icon for the installation program. You must have administrator privileges to run the installer.
3. Follow the on-screen prompts to install the program.

New Capabilities

The following paragraphs list the new capabilities that were added to HEC-SSP for version 2.0.

Duration Analysis – This component of the software allows the user to perform a duration analysis on any type of data recorded at regular intervals. The duration analysis can be used to show the percent of time that a hydrologic variable is likely to equal or exceed some specific value of interest. Figure 1 shows example output from the flow duration analysis. Two methods are available for the duration analysis: **Rank All Data Values** method or **Bin (STATS)** method. The rank all data values method computes the duration curve by sorting the data from largest to smallest, ranking the values from 1 to n, and using:

$P = 100 * [M/(n+1)]$ where M is the ranked position and n is the number of events. The Bin method uses a similar procedure as in the STATS program for computing the duration

curve. The data is grouped into bins (classes) and the duration curve is computed using the number of data in each bin. Other options available in the duration analysis include setting the y-axis scale, x-axis scale, and selecting the duration period to perform the analysis. The duration period option allows the user to compute multiple duration curves for different time windows within the year. If **Annual** is selected, then the program uses all the data when computing the duration curve. If **Quarterly** is selected, then the program separates the data into calendar quarters and computes a separate duration curve for each quarter. For example, a duration curve for the 1st quarter includes all data measured from Jan 1 – March 31. The program will compute a separate duration curve for each month of the year when the **Monthly** option is selected. The **User-Defined** option lets the user define one or multiple periods within the year.   Then the program will perform the duration analysis using data only measured during the user-defined period(s).
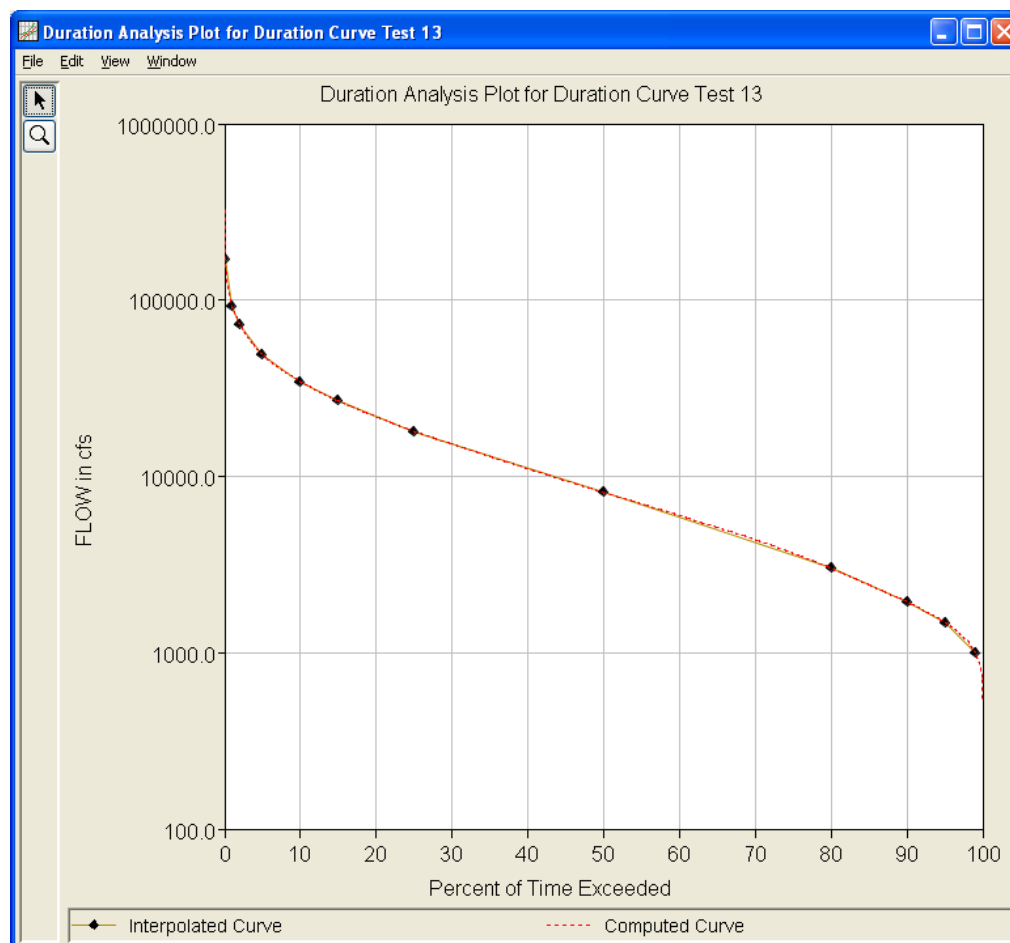

Figure 1. Example Duration Curve.

Coincident Frequency Analysis – The Coincident Frequency Analysis is designed following guidelines in EM 1110-2-1415, titled "Hydrologic Frequency Analysis". This analysis tool can be used to compute the exceedance frequency relationship for a variable that is a function of two other variables. An example is illustrated in Figure 2. In this example, the stage at the damage site on the tributary, variable C, is a function of stream flow from the tributary, variable A, and the stage in the mainstem river, variable B.
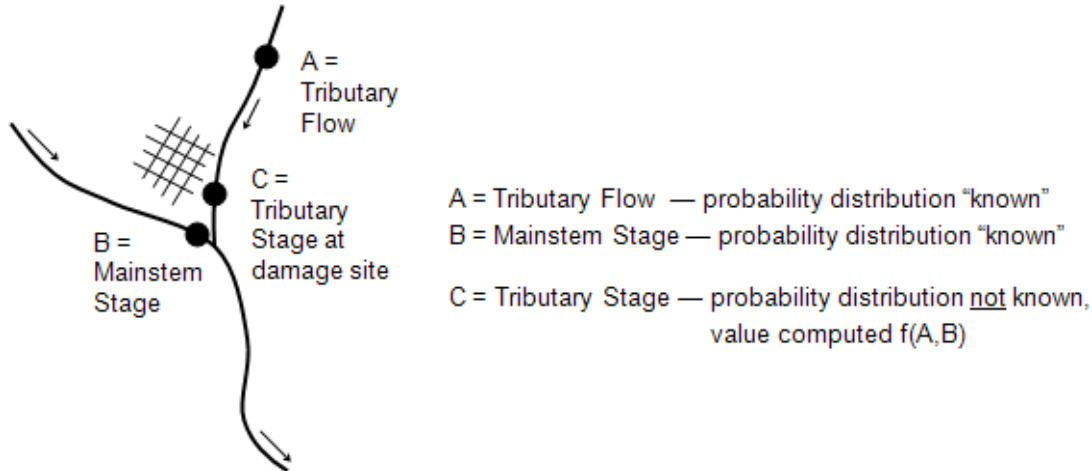
Figure 2. Example Application of the Coincident Frequency Analysis.

A duration curve is used for variable B and a frequency curve is used for variable A. The user can choose to define these curves manually or select an existing analysis within the HEC-SSP study. A major component of the Coincident Frequency Analysis is to develop the response of variable C for combinations of variable A and variable B. This could be done using a hydrology or hydraulics model. For the example shown in Figure 2, a flow value from the variable A frequency curve would be applied to the tributary and the index flow (or stage) from the variable B duration curve would be applied to the mainstem. A hydraulics model could be used to compute the variable C stage at some reference point on the tributary. This model simulation would be computed for many combinations of variable A and variable B. The program uses the output from the hydraulics model and the total probability theorem to compute the variable C frequency curve.

Curve Combination Analysis – The curve combination analysis provides a tool for combining frequency curves from multiple sources into one frequency curve. One example is shown in Figure 3. This example includes observed historic measurements of annual maximum stage, results from a hydrology model, and an estimate of the maximum stage from the probable maximum flood. The curve combination tool can be used to develop one frequency curve that combines all these sources of information. The program contains a number of methods for computing the confidence limits around the combined frequency curve. One option is the order statistics method which is described in ETL 1110-2-537, titled "Uncertainty Estimates for Graphical (non-Analytic) Frequency Curves".
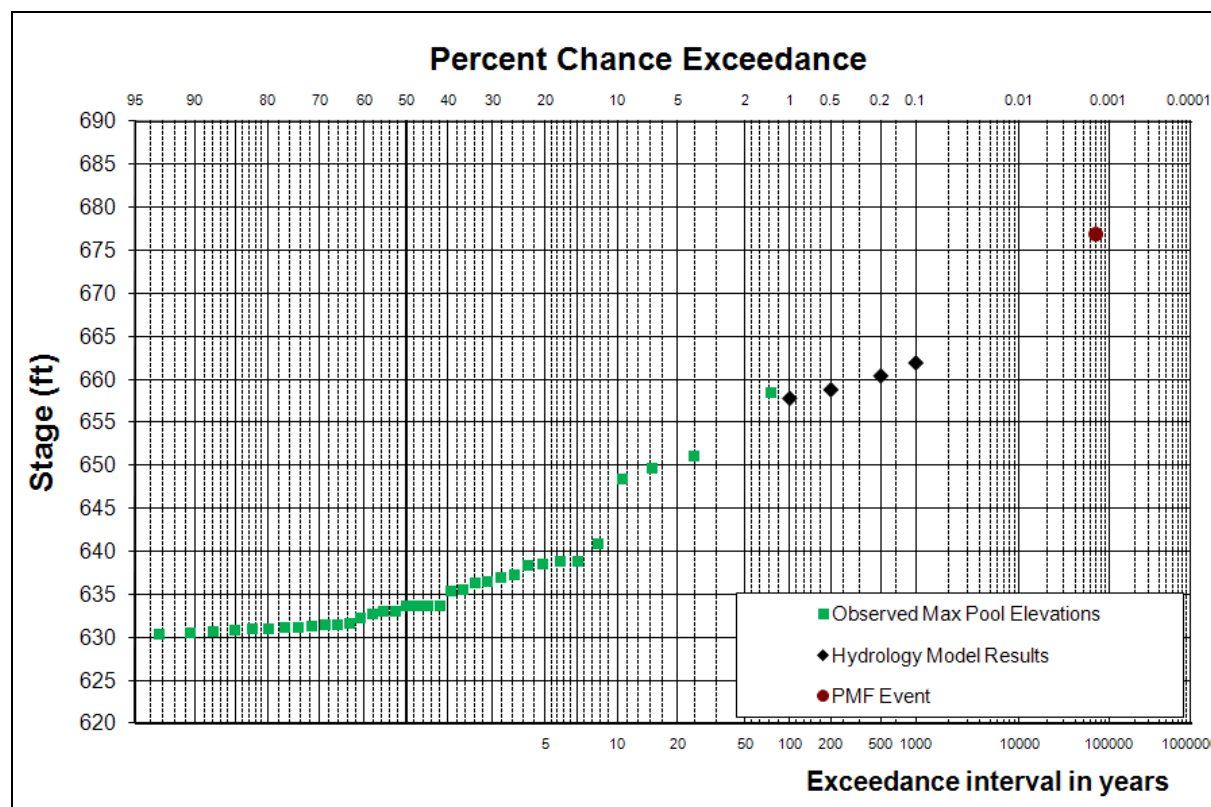
Figure 3. Example Application of the Curve Combination Analysis.

The Plot Probability Lines option was added to let the user add, delete, or edit the probability lines and axis labels that are displayed in all frequency curve plots. To open this tool, select the **Tools→Plot Probability Lines** menu option. Figure 4 shows the Plot Probability Lines editor. The user can add additional probability lines by placing the mouse pointer on a row and clicking the right mouse button. Then choose the **Insert Row(s)…** option in the shortcut menu.

An additional enhancement was added to frequency curve plots. Now the user can turn on minor tic marks and display them along the y-axis, as shown in Figure 5. To display minor tics, place the mouse along the y-axis and click the right mouse button. Then select the **Edit Properties** option in the shortcut menu. Select the **Tics** tab and check the box to "Use minor tick marks". Then select the **Minor Tics** tab and check the box to "Show Tic Labels".

An option was added to the **Duration Table** tab, Volume Frequency Analysis, that lets the user edit the volume-duration data. The **Volume-Duration Data** table becomes editable when the **Allow Editing** box, in the upper left portion of the Duration Table tab, is checked. Then the user can overwrite the extracted volume-duration data. In addition, the program will no longer extract volume-duration data during a compute and the **Extract Volume-Duration Data** button becomes inactive.

The general frequency analysis now uses the order statistics method, described in ETL 1110-2-537 and used by HEC-FDA, when computing the confidence limits for a graphical frequency curve.

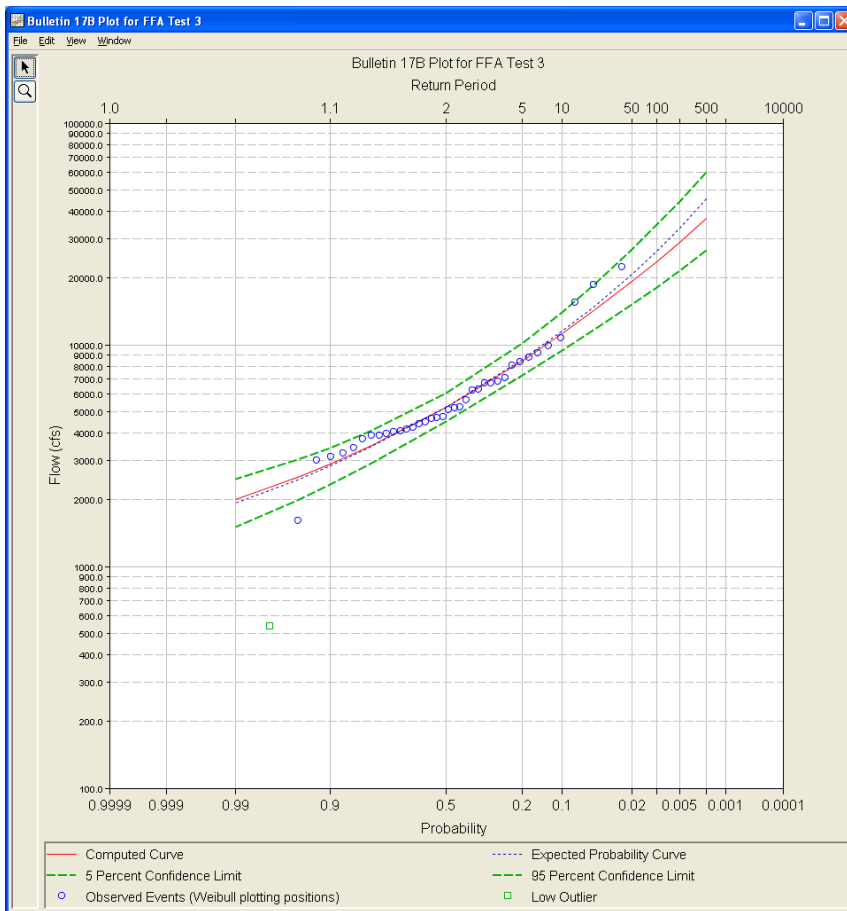**Figure 4. Plot Probability Lines Editor.**

Figure 5. Frequency Curve Plot with Minor Tics Displayed.

An option was added to sort frequency curve data in result tables. For example, click the column header, Percent Chance Exceedance, on the Bulletin 17B **Tabular Results** tab (two mouse clicks are required the first time). The percent chance exceedance ordinates, along with frequency curve and confidence limits values, will sort so that the lowest values are on top or the highest values are on top.

Bug Fixes

The development team continues to test the software even after a new release is made. The team found and repaired a number of bugs since the release of Version 1.1. The following list describes a few of the bug fixes:

1) The number of rows and frequency ordinate values in the graphical frequency curve table (General Frequency Analysis) will now update when the frequency ordinates are changed on the Options tab.
2) The graphical frequency curve plot, for both the General Frequency and Volume Frequency analyses, will graph the observed data when the compute button is pressed without the user entering the graphical frequency curve values.
3) Tabular results for the Bulletin 17B, General Frequency, and Volume Frequency analyses will no longer contain regional or weighted skew if the "Use Station Skew" option is selected.
4) The program would not use the default confidence limits, even though the **Defaults (0.05, 0.95)** radio button was selected, if the user had entered Upper Limit and Lower Limit values.
5) The program no longer rounds the percent chance exceedance ordinates that are displayed in result tables. If the user enters a frequency (in percent) value of 0.01 then 0.01 will be displayed in the result table.
6) The Data Importer would not work correctly and would have to be closed after importing a data set from an HEC-DSS file. Now, the Data Importer correctly resets after importing data from an HEC-DSS file. This allows the user to import multiple data sets at one time without having to close the Data Importer.
7) Horizontal and vertical scroll bars were added to all analysis editors and the Data Importer. This fixes the problem where portions of these windows would not be visible if the screen resolution was not large enough.
8) Results for a volume frequency analysis would become missing after the analysis was renamed. This forced the user to re-compute the analysis in order to view results. Now the program correctly keeps track of results when the analysis is renamed.
9) The compute progress bar has been fixed when computing a Bulletin 17B analysis from the Compute Manager.
10) The Compute Manager could not be used to compute a volume frequency analysis. This has been fixed so that a compute initiated from the Compute Manager will extract the volume-duration data first and then compute the volume frequency curves.
11) The Save As option will now work for data sets. To use this option, place the mouse pointer on top of a data set in the study explorer and click the right mouse button. Then select the Save As option in the shortcut menu. This option will create a copy of the selected data set and store it within the study HEC-DSS file. The new data set will have a F-Part pathname that begins with "Save Data As:".
12) The report file for a volume frequency analysis contained the wrong values for the Regional Skew MSE (the correct values were used in the calculation).

Documentation

The Statistical Software Package HEC-SSP: User's Manual contains extensive information on installing and using the program. Details on the use of each feature and capabilities in the program are included. The manual has been updated with information describing new features added to the program for this Version 2.0 release.

Bug Reports and Suggestions

HEC does not provide technical support for this software to non-Corps users; however, we will respond to all documented instances of program errors. If you encounter a problem, then please take the time to send us a bug report. The report must be written and should be submitted directly to the HEC-SSP team at: hec.ssp@usace.army.mil
The bug report should include the following information:

1. Contact Information: Name, Phone, and E-mail address.
2. What version of the software are you using?
3. What operating system are you using?
4. An explanation of the problem.
5. If the problem is reproducible, please list the steps required to cause it. (example: "1. Create a new file. 2. Insert some text …")
6. If the problem is not reproducible (only happened once, or occasionally for no apparent reason) please describe the circumstances in which it occurred and the symptoms observed (note: it is much harder for us to diagnose and fix non-reproducible bugs).
7. If the problem causes any error messages to appear, please write down the exact text displayed.

Note: Please attach your data files if possible. This will assist in debugging the problem.

If you have any suggestions or ideas for enhancing HEC-SSP, please e-mail your suggestions to hec.ssp@usace.army.mil.