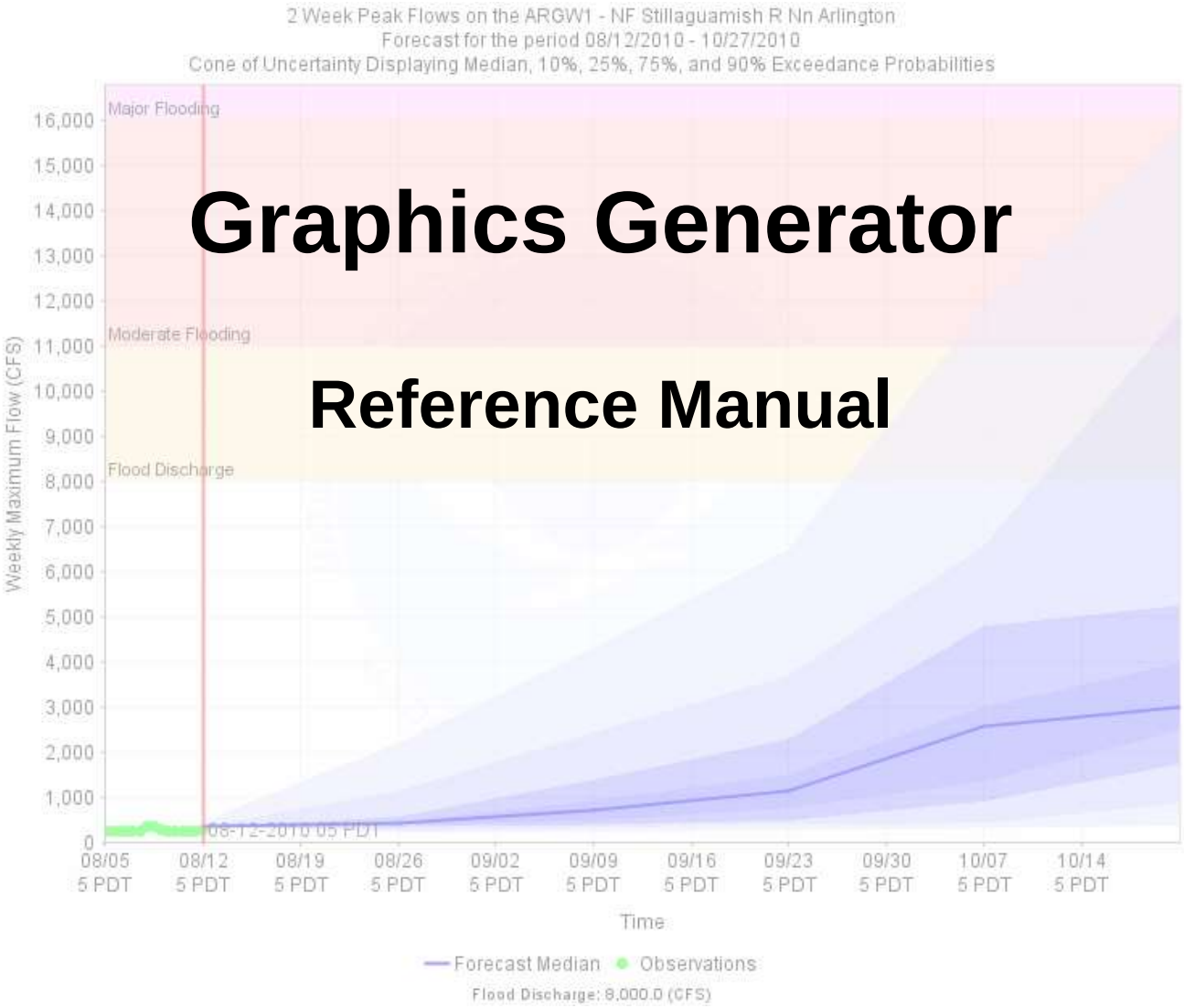

Graphics Generator

Reference Manual

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1 Overview

This manual is intended as a reference manual for five of the six components described in the *Graphics Generator Getting Started Manual*:

- **GraphGen Tree Panel**: A graphics user interface component used to manage the products and settings, including deleting, renaming, importing and exporting.
- **GraphGen Editor Panel**: A graphics user interface component used to build and modify products.
- **GraphGen Thumbnails Panel**: A graphics user interface component used to view a summary of products for an active forecast segment and manage the segment's settings.
- **GraphGen Viewer Panel**: A graphics user interface component used to view one product.
- Graphics Generator Model Adapter: A model adapter that allows for generating product files via a CHPS workflow.

This manual should be referred to as needed when using any of the five components above. The last component, the Graphics Generator Engine, is intended to run behind-the-scenes, so that no direct user interaction is possible.

Be sure to read the *Graphics Generator Getting Started Manual* before using this manual. The contents of this manual require an understanding of the concepts described therein. Of particular importance are the following concepts:

- Products and settings local area and central area
- Templates and Products
- Arguments
- Settings
- Relative dates
- Product plug-ins
- Components of a chart

1.1 *Notation*

The following notation is used:

- Important terms are displayed in *italics* the first time they are used and defined.
- Graphics user interface components are **Capitalized and in Bold**.
- List items, such as available plug-ins or allowed parameter settings, will be in "quotes".
- Parameter names are displayed as normal text.
- Text which is to be entered at a command line or into an ASCII text file (including XML files) is denoted in `courier font`.

1.2 *Manual Organization*

Section 2 presents general components used at various places throughout the interface. The remaining sections are devoted to major components of the software:

- Section 3: The **GraphGen Tree Panel**.
- Section 4: The **GraphGen Thumbnails Panel**.
- Section 5: The **GraphGen Editor Panel**, overview.
- Sections 6 - 13: The component panels of the **GraphGen Editor Panel**. Each section title is prefixed with "Editor:". There are also three panels that are subpanels of the **Chart Series Panel** described in Sections 9 - 11, which are prefixed with "Editor (Chart Series Panel):".
- Section 14: The **GraphGen Viewer Panel**.
- Section 15: The Graphics Generator Model Adapter.

Appendices are provided, as well, describing a few of the finer points of the mathematics behind the Graphics Generator.

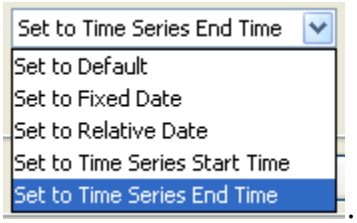
2 General Graphical User Interface Components

Graphical user interface components that are used many times within the components of the Graphics Generator are described below.

2.1 *Date Chooser Panel*

Within many panels of the Graphics Generator, a date must be specified. This is done so via a **Date Chooser Panel**:

The panel consists of a **Date Field** that displays the date text as a fixed date or relative date, and a **Date Choice Box** that is a selectable list of options for setting the date:



The choices within the list depend on the situation, but always include "Set to Fixed Date" and "Set to Relative Date", which open up dialogs described in the next two subsections. The other options always specify a fixed time. For example, given a base time series, "Set to Time Series Start Time" sets the **Date Field** to the start time of the base time series, and "Set to Time Series End Time" sets the **Date Field** to the end time of the base time series. "Set to Default" always sets the **Date Field** to be the relative date, "T0". The **Date Field** can be edited manually, and whenever a change is made that would yield an invalid date, the change is undone.

2.1.1 Choose Fixed Date/Time

When "Set to Fixed Date" is selected from the **Date Choice Box**, a **Choose Date/Time Dialog** will be displayed (see Figure 2-1). This dialog is similar to the **Current System Time Dialog** used to edit the CHPS system time. The time can be set manually, by clicking on the button and modifying the drop-down calendar, or by clicking on the **Now Button** to set the time to the CHPS system time.

A fixed date set with a year for which the first digit is '0' is treated specially. In that case, the date is computed relative to a basis date (described later) such that the rest of the date fields (day, month, etc.) match those specified by the user. A complete description and examples are provided in the *Graphics Generator Getting Started* guide.

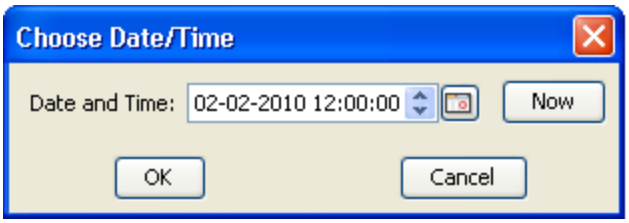


Figure 2-1: Chose Date/TimeDialog, used to edit fixed dates.

2.1.2 Choose Relative Date/Time

When "Set to Relative Date" is selected from the **Date Choice Box**, a **Choose Relative Date/Time Dialog** will be displayed (see Figure 2-2). This dialog allows for defining a relative date (see *Graphics Generator Getting Started* guide). To create a relative date, do the following:

1. Select the `<basis date>` via the first choice box, T0. The available basis dates may vary, but will always include T0.
2. Select whether the date is after or before the basis date via the second choice box , +. This defines the `<+/->` component of a relative date, with '+' being after the basis date.
3. Add the `[<quantity> <unit>]` components of the relative date by selecting a quantity from the spinner, 1, and a unit from the last choice box, hours. Click on the >> button to add the specified component to the relative date. The text field at the bottom displays the current relative date components.

Clicking on the **Reset Button** will reset the relative date to the original relative date displayed when the dialog was opened. Clicking on **OK** will accept the date and clicking on **Cancel** will close the dialog without defining a date.

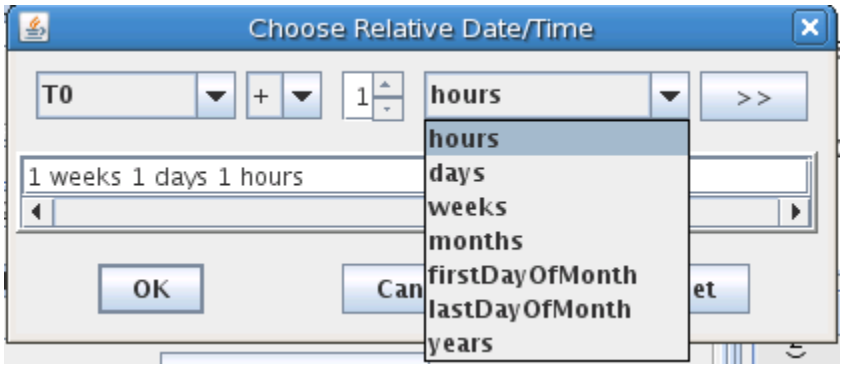


Figure 2-2: Choose Relative Date/Time dialog, used to edit relative dates.

2.2 *Argument Inserting Components*

Argument inserting components come in three varieties:

(1) **Argument Inserting Text Field**,
(2) **Argument Inserting Text Area**, and
(3) **Argument Inserting Choice Box**.

To insert an argument for any component, position the editing cursor where the argument is to be inserted and right click on the component. An **Arguments Pop-up Menu**, shown in Figure 2-3, will display allowing the user to specify an argument or argument function to be inserted. Upon completion, the argument will be inserted into the text where the cursor is located.

All three argument inserting components use the same **Arguments Pop-up Menu**:

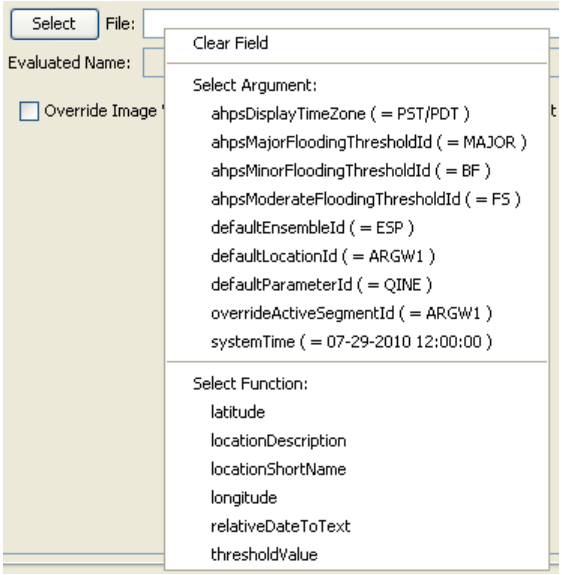
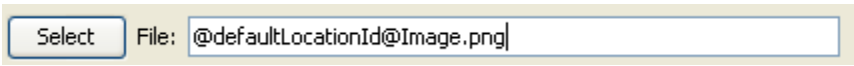


Figure 2-3: Standard **Arguments Pop-up Menu**.

The first option of the pop-up menu clears the component value. The second section lists the names of arguments, alphabetized, with values displayed in parentheses. A value of "-undefined-" means an unspecified argument value. The third section displays argument functions, alphabetized. Upon selecting an argument or function, the component being modified will be updated. For example, this shows an **Argument Inserting Text Field** after "defaultLocationId" is selected from the menu:



When an argument function is selected from the **Arguments Pop-up Menu**, an **Argument Function Parameters Dialog** will be displayed allowing the user to specify parameters for the function. The dialog follows a general layout as described below, with argument function specific features being described afterwards.

2.2.1 General Argument Function Parameters Dialog Layout

Figure 2-4 shows an example of a dialog for specifying parameters of a relativeDateToText argument function. The components of the dialog are as follows:

- **Edit Parameters Panel**: Function specific panel displaying components used to edit parameters.
- **Function Text Field**: The text corresponding by the argument function and its parameters. For example, if editing the plot title, this is the text that will be visible to the user as the title is edited in the interface.
- **Function Value Field**: The evaluated value of the argument function. For example, if editing the plot title, this is the text that will be visible in the constructed chart.

In the sections that follow, the content of the **Edit Parameters Panel** for each argument function will be described.

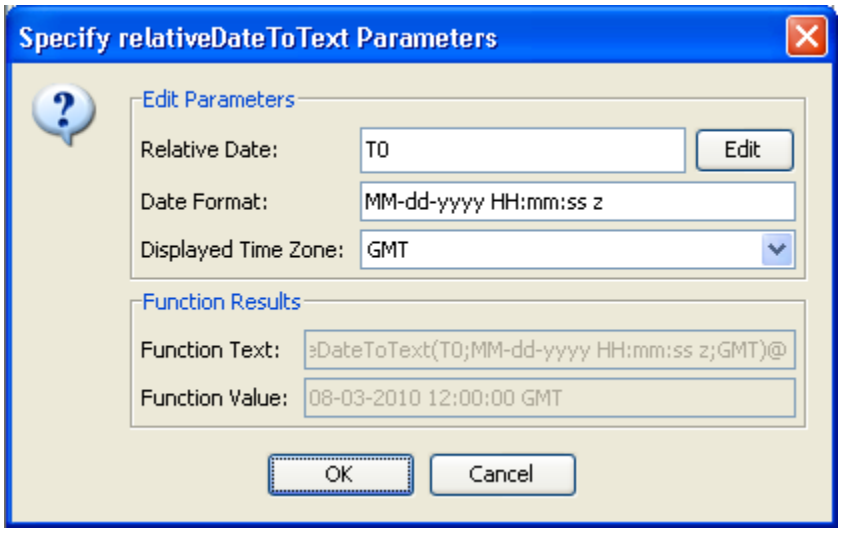
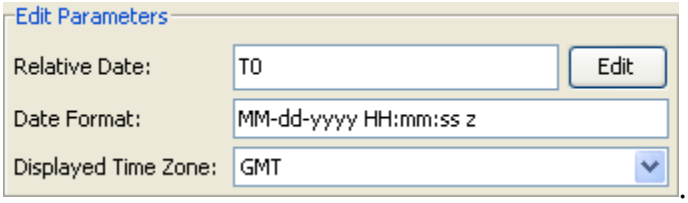


Figure 2-4: Argument Function Parameters Dialog for relativeDateToText function.

2.2.1.1 Edit Parameters Panel for relativeDateToText

The **Edit Parameters Panel** for the relativeDateToText function parameters is as shown:



The **Relative Date Text Field** specifies the relative date for which to produce a text string. It can be edited manually, or by clicking on the **Edit Button** to open up a **Choose Relative Date/Time Dialog** (Section 2.1.2, pg. 9). The **Date Format Field** specifies the format of the date text to return from the argument function. The values that can be used in the date format string are as follows:

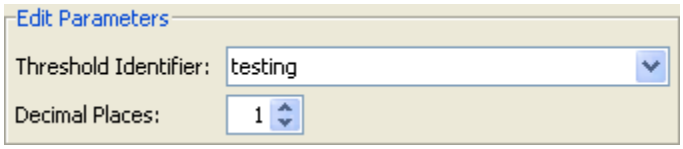
Table 2-1: Value characters to use within a date format.

Letter	Date or Time Component	Presentation	Examples
G	Era designator	Text	AD
y	Year	Year	1996; 96
M	Month in year	Month	July; Jul; 07
w	Week in year	Number	27
W	Week in month	Number	2
D	Day in year	Number	189
d	Day in month	Number	10
F	Day of week in month	Number	2
E	Day in week	Text	Tuesday; Tue
a	AM/PM marker	Text	PM
H	Hour in day (0-23)	Number	0
k	Hour in day (1-24)	Number	24
K	Hour in AM/PM (0-11)	Number	0
h	Hour in AM/PM (1-12)	Number	12
m	Minute in hour	Number	30
s	Second in minute	Number	55
S	Millisecond	Number	978
z	Time zone	General time zone	Pacific Standard Time; PST; GMT-08:00
Z	Time zone	RFC 822 time zone	-800

The **Displayed Time Zone Choice Box** can be used to specify the time zone of the output date.

2.2.1.2 Edit Parameters Panel for thresholdValues

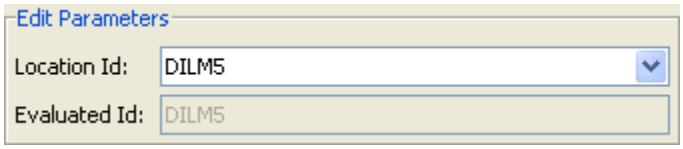
The **Edit Parameters Panel** used to specify the thresholdValue identifier and precision parameters is as shown:



The **Threshold Identifier Choice Box** is an **Argument Inserting Choice Box** that allows for specifying the identifier of the threshold whose value is to be displayed as text. See Section 12.2.8 (pg. 81) for information on thresholds. The value can be edited directly or selected from a list of identifiers. The **Decimal Places Spinner** specifies the number of decimal places that will be displayed in the returned text. The number of decimal places must be a non-negative integer.

2.2.2 Edit Parameters Panel for Location Information Functions

The **Edit Parameters Panel** used to specify the location identifier required for the locationShortName, locationDescription, latitude, and longitude argument functions is as shown:



The **Location Id Choice Box** is an **Argument Inserting Choice Box** that allows for specifying the location id required for the argument function. The **Evaluated Id Text Field** displays the location id after arguments are replaced using their current values, if arguments are used.

2.3 *Choose Color Dialog*

A **Choose Color Dialog**, shown in Figure 2-5, is used within the **Series Drawing Parameters Table** of the **Calculator Panel** and some editing panels for appearance modifier plug-ins to select a color.

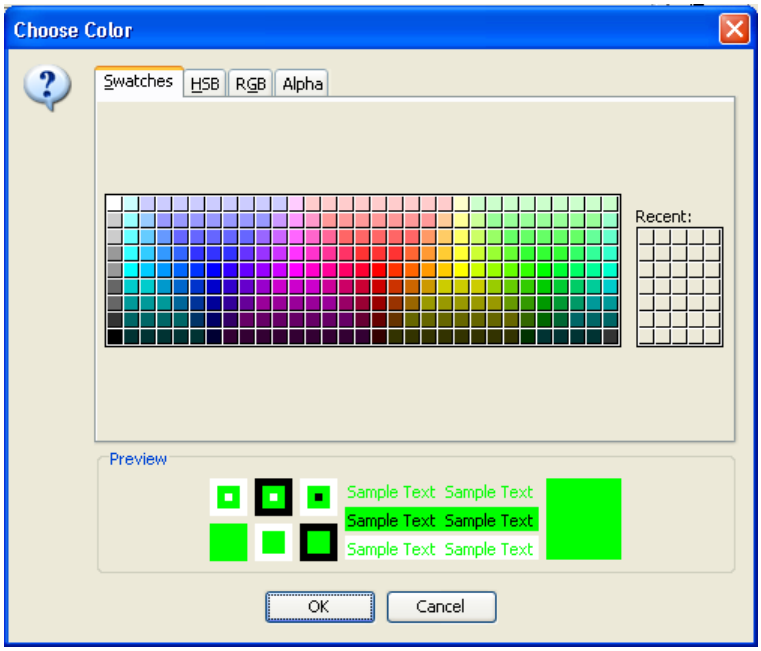


Figure 2-5: The **Choose Color Dialog**.

The dialog provides four different tabbed panels. The **Swatches Tabbed Panel**, **HSB Tabbed Panel**, and **RGB Tabbed Panel** can be used to select the color in standard ways. The **Transparency Tabbed Panel** specifies the transparency level for a color: 0 is completely transparent and 255 is opaque. The panels are shown in Figure 2-6.

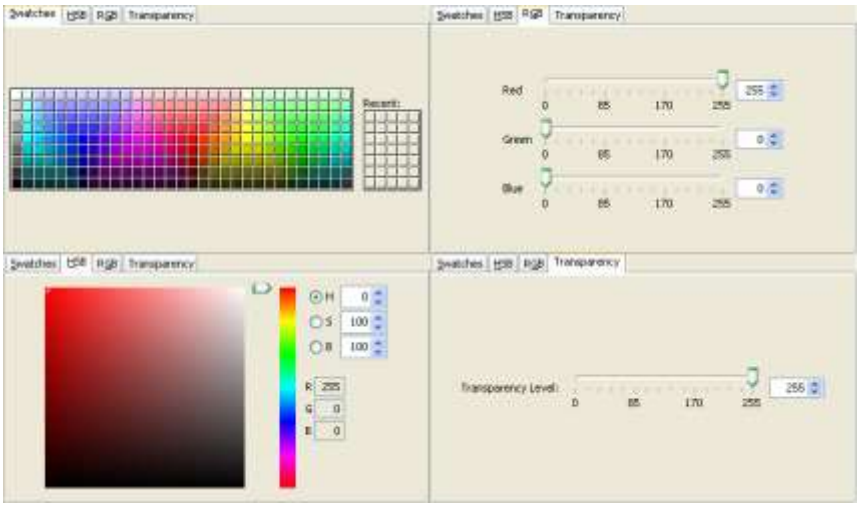


Figure 2-6: The four tabbed panels used to specify the color.

2.4 *Table Delete and Status Columns*

Throughout the **GraphGen Editor Panel**, plug-ins and time series are listed in tables. In most cases, the tables have the following as the first two columns:

- "Delete": Displaying the icon, , when a cell of the column is clicked, the corresponding table row is removed, along with the plug-in, parameters, arguments, or time series it represents.
- "Status": Displays the status of the plug-in or argument by showing one of two icons:

  If the status is good, meaning the plug-in can be executed or the argument is used and specified.
  If the status is bad, meaning there is an error attempting to apply the plug-in or the argument is used but a value is not specified.

If a table includes these two columns, it will be stated when described in a later section.

2.5 *Chart and Table Panel*

In the **GraphGen Editor Panel** and **GraphGen Viewer Panel**, charts are displayed using a standard **Chart and Table Panel**. The panel displays the graphical chart product on the right, with an optional **Data Table** displayed on the left; for example:

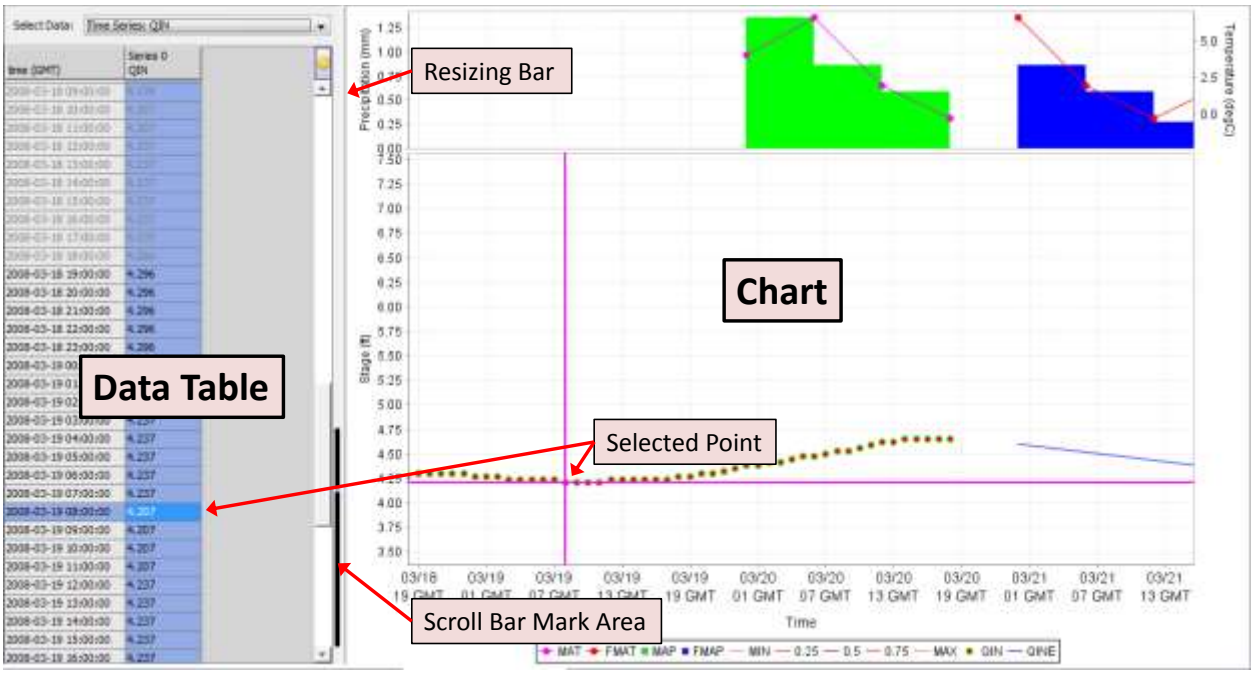
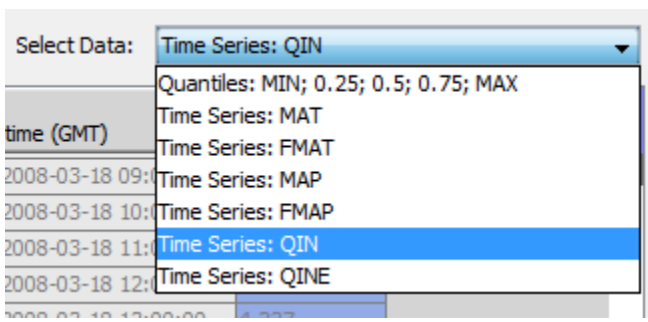


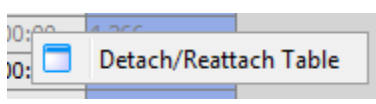
Figure 2-7: The GraphGen Viewer Panel that displays the graphical chart products on the right with the Data Table displayed on the left.

The **Data Table** displays the data for one set of chart series (i.e., one defined calculator) for which data was computed and displayed in the chart. To change the viewed chart series, select from the **Select Data Choicebox** above the **Data Table**:



The name listed in the choice box specifies the calculator that computed the chart series and the legend names for the series (see Section 8).

To detach the table from the panel and display it within a separate frame, right click on the table and select the **Detach/Reattach Table** menu item:



The **Data Table** can be reattached by either clicking on the **Detach/Reattach Table** menu item again or by closing the frame that displays the **Data Table**.

The **Data Table** is interactive with the chart. First, if a cell is selected, crosshairs will be drawn on the chart showing where that point is; see the image in Figure 2-7 The reverse is also true: if a point on the chart is clicked, the table will be updated to select the appropriate source from the **Select Data Choicebox** and the cell corresponding to the point in the **Data Table** (resulting in crosshairs). Second, a scroll bar mark area is provided to the right of the vertical scrollbar and below the horizontal scroll bar (not shown in Figure 2-7. For the vertical scroll bar, a black mark will be shown for any rows for which data is visible using the current axis limits of the chart. For the horizontal scroll bar, black marks will be shown for any column for which at least one value is visible using the current axis limits. Third, when zooming in on the chart or panning the chart (see Figure 2-8, Figure 2-9, and related text below), the table scrollbars will adjust to display the first cell starting from the upper left corner for which data is visible within the chart's new axis limits.

A popup menu opened by right clicking on the chart controls if the table is displayed and provides other controls similar to those provided by the standard CHPS time series displays:

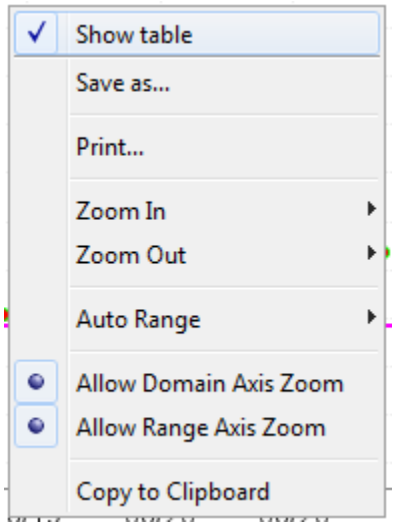


Figure 2-8: The popup menu when clicking on the chart controls. The Show table menu option has been checked.

The table will be shown if the **Show table** menu option is checked. Zooming in on the chart is done in the same manner as for CHPS time series displays: select the **Allow Domain Axis Zoom** and **Allow Range Axis Zoom** menu items as needed and draw a rectangle on the chart from the upper left corner to the lower right:

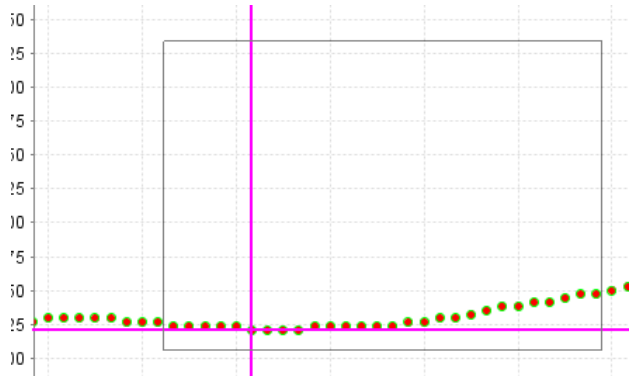


Figure 2-9: This chart shows a rectangle is being drawn by dragging the mouse while holding down the left button. After releasing the mouse button, the chart will be zoomed to the ranges defined by the rectangle.

To zoom out to the original axis limits, left click the mouse over the chart, then move the mouse to the left, and release the button.

3 GraphGen Tree Panel

The **GraphGen Tree Panel**, shown to the right, is usually displayed on the left side of the CHPS graphics interface and is opened by clicking on the appropriate tab in the CHPS interface. The panel provides a listing of all of the Graphics Generator templates stored in the CHPS database using a tree structure. The first level of the tree displays segment or product group IDs and second level displays template IDs. This panel also provides access to two other key components:

1. The **Product and Template Manager Dialog**, which allows for removing, importing, and exported templates.
2. The **Modify Settings Dialog**, which allows for modifying Graphics Generator settings (see the *Graphics Generator Getting Started Manual*).

The section describes the components and usage of the **GraphGen Tree Panel**, the **Product and Template Manager Dialog**, and the **Modify Settings Dialog**.

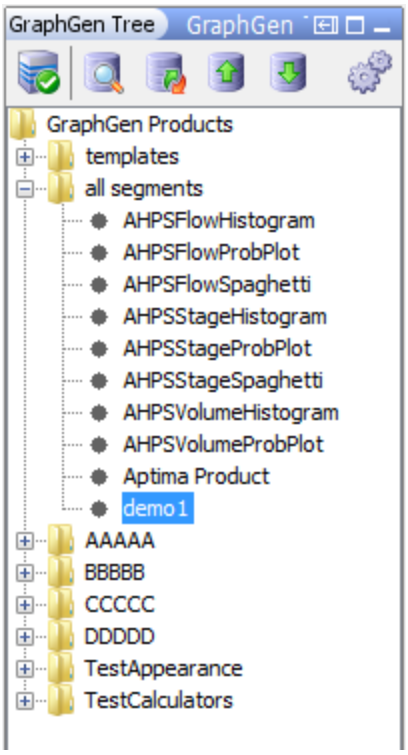


Figure 3-1: The GraphGen Tree Panel.

3.1 *Components*

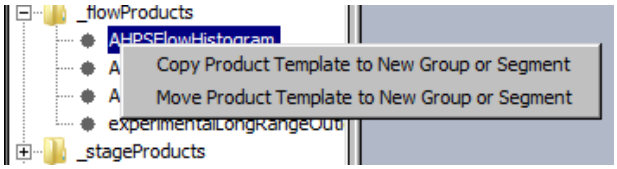
The following describes the **GraphGen Tree Panel** components:

- **Tree**: Displays all templates by segment id (or product group id) and product id. The segment ids are displayed as "nodes" or "branches" that can be clicked on and expanded. The product ids are displayed as selectable "leaves". The "templates" node lists all templates and the "all segments" node lists templates that are defined to be displayed for all segments. Both nodes will exist even if there are no leaves below them. Templates are selected for editing in the **GraphGen Editor Panel** by selecting the appropriate template id leaf. If more than one leaf is selected, only the first selection is communicated to the editor. Product templates can be moved or copied between groups/segments by dragging-and-dropping; to copy, press and hold the <Ctrl> key when the template is dropped (i.e., mouse button released). Templates can be deleted by selecting templates or groups/segments and pressing the <Delete> key. Product templates may be moved or copied to new groups/segments by selecting them and right-clicking on the **Tree** (see below).

Referenced templates may never be moved or copied to groups or segments via the **Tree**.

- **Reconnect to CHPS PI-service Button**: Click to open an **Enter Port Number Dialog** that allows for entering a port number to use for connecting to the PI-service; see the *Graphics Generator Tips and Troubleshooting Manual*. After modifying, all open panels associated with the Graphics Generator will be redrawn. If a **Graphics Generator Editor Panel** is open, the edited product will be redrawn, but the parameters of the template will not be changed. When the PI-service is not connected, any plug-in that requires the CHPS database will fail. A status icon is included within the larger icon, indicates a good connection, while indicates a bad connection.
- **Manage Products Button**: Click to open the **Product and Template Manager Dialog**, described below, centered over the panel.
- **Refresh Tree Button**: Click to force the tree to be reloaded from the templates and settings local area (see *Graphics Generator Getting Started Guide*) and redrawn in the interface.
- **Upload Products Button**: Click to copy the templates and settings defined in the local area to the central area; see Section 3.2.3. A **Confirm Dialog** will open upon clicking; click **Yes** to upload the changes.
- **Download Products Button**: Click to copy the templates and settings defined in the central area to the local area, replacing the templates and settings currently being modified within the CHPS stand-alone (essentially removing any changes and starting from scratch); see Section 3.2.3. A **Confirm Dialog** will open upon clicking; click **Yes** to download the templates and settings.
- **Change Default Settings Button**: Click to open the **Modify Settings Dialog**, described below, centered over the panel.

By selecting one or more nodes in the **Tree** and right-clicking on the **Tree**, a popup-menu allows for moving or copying templates into new groups or segments:

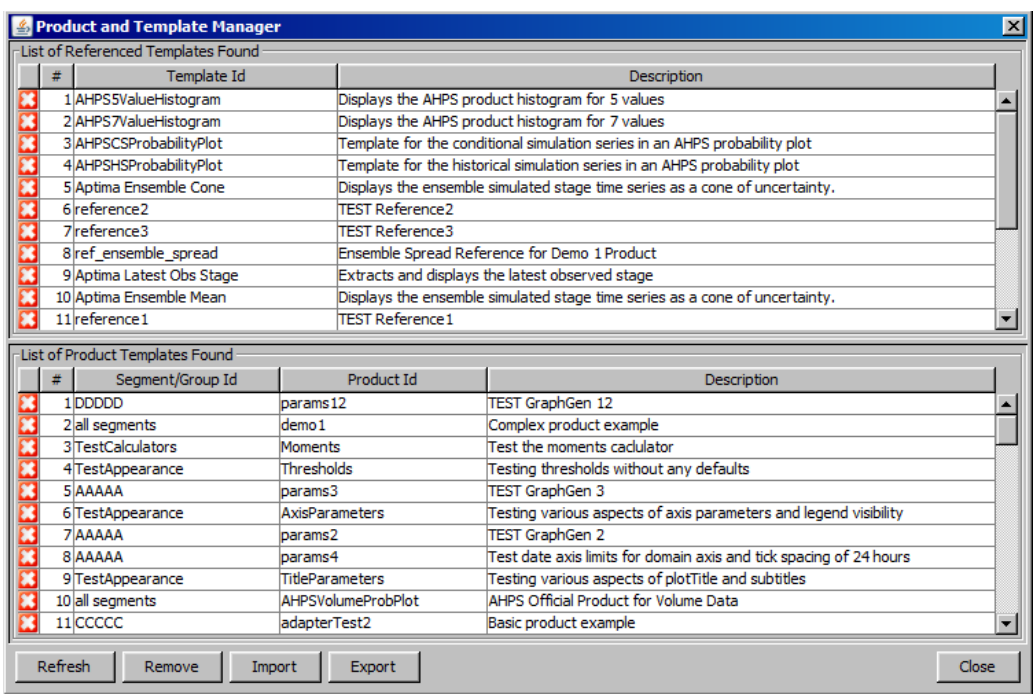


- **Copy Product Template to New Group or Segment Menu Item**: Select to copy the selected templates to a new group or segment. When selected, a **Specify Segment/Group Name Dialog** will open; specify the name of the new group or segment and click **OK** to copy the templates. If the specified name is for a group or segment that already exists, a **Group or Segment Already Exists** dialog will open requiring confirmation to continue with the copy. Selecting a group/segment node will result in all templates within that group or segment being copied.
- **Move Product Template to New Group or Segment Menu Item**: See **Copy Product Template to New Group or Segment Menu Item** description above. If this item is clicked, the templates are moved (i.e., they are removed from the groups or segments from which they were selected after being copied to the new group or segment).

3.1.1 Product and Template Manager Dialog

The **Product and Template Manager Dialog**, shown in Figure 3-1, allows for removing, importing, and exporting templates to and from the Pi-Service memory layer (see the *Graphics Generator Getting Started Manual*). The components are as follows:

- **List of Referenced Templates Found Table**: List of all referenced templates found in a table format, including a delete column, template id, and description. The table can be sorted by clicking on the header of the column on which sorting is to be based.
- **List of Product Templates Found Table**: List of all product templates found in a table format, including a delete column, segment id, product id, and description. The table can be sorted by clicking on the header of the column on which sorting is to be based.
- **Refresh Button**: Click to refresh both tables by reloading the information from the CHPS database.
- **Remove Button**: Click to remove all templates selected in either table. A **Confirm Delete Dialog** will open after clicking on the button; click on **No** to cancel the removal.
- **Import Button**: Click to import templates from a previously exported XML file. A file selection dialog will open allowing the user to select a file to import. Upon selecting a file, a dialog will open displaying the status of the import job and close when the job is completed.
- **Export Button**: Click to export templates to an XML file for later importing. A file selection dialog will open allowing the user to specify a file to export. Upon selecting a file, a dialog will open displaying the status of the export job and close when the job is completed.
- **Close Button**: Click to close the dialog.



#	Template Id	Description
1	AHPS5ValueHistogram	Displays the AHPS product histogram for 5 values
2	AHPS7ValueHistogram	Displays the AHPS product histogram for 7 values
3	AHPSCSProbabilityPlot	Template for the conditional simulation series in an AHPS probability plot
4	AHPSHSProbabilityPlot	Template for the historical simulation series in an AHPS probability plot
5	Aptima Ensemble Cone	Displays the ensemble simulated stage time series as a cone of uncertainty.
6	reference2	TEST Reference2
7	reference3	TEST Reference3
8	ref_ensemble_spread	Ensemble Spread Reference for Demo 1 Product
9	Aptima Latest Obs Stage	Extracts and displays the latest observed stage
10	Aptima Ensemble Mean	Displays the ensemble simulated stage time series as a cone of uncertainty.
11	reference1	TEST Reference1

#	Segment/Group Id	Product Id	Description
1	DDDDD	params12	TEST GraphGen 12
2	all segments	demo1	Complex product example
3	TestCalculators	Moments	Test the moments caclulator
4	TestAppearance	Thresholds	Testing thresholds without any defaults
5	AAAAA	params3	TEST GraphGen 3
6	TestAppearance	AxisParameters	Testing various aspects of axis parameters and legend visibility
7	AAAAA	params2	TEST GraphGen 2
8	AAAAA	params4	Test date axis limits for domain axis and tick spacing of 24 hours
9	TestAppearance	TitleParameters	Testing various aspects of plotTitle and subtitles
10	all segments	AHPSVolumeProbPlot	AHPS Official Product for Volume Data
11	CCCCC	adapterTest2	Basic product example

Figure 3-1: The **Product and Template Manager Dialog**.

3.1.2 Modify Settings Dialog

The **Modify Settings Dialog** allows for the user to set segment-specific settings of the Graphics Generator. Those settings include three items:

1. Included *product groups* (or segments; see the *Graphics Generator Getting Started Manual*)
2. Predefined arguments (see the *Graphics Generator Getting Started Manual*)
3. Products that are defined for the segment and all included product groups, including "all segments", that are to be included in the **GraphGen Thumbnail Viewer**

Three tabbed panels are used to specify these settings: **Included Groups Tabbed Panel**, **Predefined Arguments Tabbed Panel**, and **Products Visible as Thumbnails Tabbed Panel**, respectively. The components of the dialog and three panels are described herein.

The **Modify Settings Dialog** is shown in Figure 3-2. The components are as follows:

- **Groups/Segs With Defined Settings Table**: A table displaying those segments and product groups that have defined settings in alphabetical order. The first column is a delete column and the second column displays the segment id and is editable when double-clicked. The first row *always* displays the segment id "all segments", and cannot be changed. If a segment does not have defined settings, then the predefined arguments will be those included by default or defined for all segments, and all product templates defined for the segment, including those for all segments, will be displayed in the **GraphGen Thumbnail Viewer**. When one row is selected, the tabbed panels will be updated.
- **Add Button**: Click to create settings for a new group or segment. A **Specify Group/Segment Id Dialog** will open allowing for the group or segment id to be entered. The editing text field will be a choice box, listing existing groups or segments displayed in the **GraphGen Tree Panel** that are not included in the **Groups/Segs With Defined Settings Table**.
- **Copy Button**: Create a copy of the currently selected segments. The copies will be identical, but with a segment id that begins with "Copy of".
- **Remove Button**: Click to remove settings for the segments currently selected in the list.
- **Add from Topology Button**: Click to open a file-selection dialog to allow for opening a properly structured/formatted Topology.xml file defining the segments available for an RFC. Upon clicking **Open**, the contents of the file will be read and one row will be added for each segment id (i.e., the `id` attribute of each `node` XML element found in the file) to the **Groups/Segs With Defined Settings Table**.
- **Import Settings Button**: Click to import settings from an XML file. A file selection dialog will open allowing the user to specify the file to import. Upon clicking **OK**, the settings will be imported, overwriting existing settings where appropriate.
- **Export Settings Button**: Click to export the settings to an XML file. A file selection dialog will open allowing the user to specify the file to create. Upon clicking **OK**, the file will be exported.

- **OK Button**: Click to close the dialog and save the settings to the templates and settings local area for the CHPS stand-alone (see the *Graphics Generator Getting Started Guide*).
- **Cancel Button**: Click to close the dialog without saving changes.

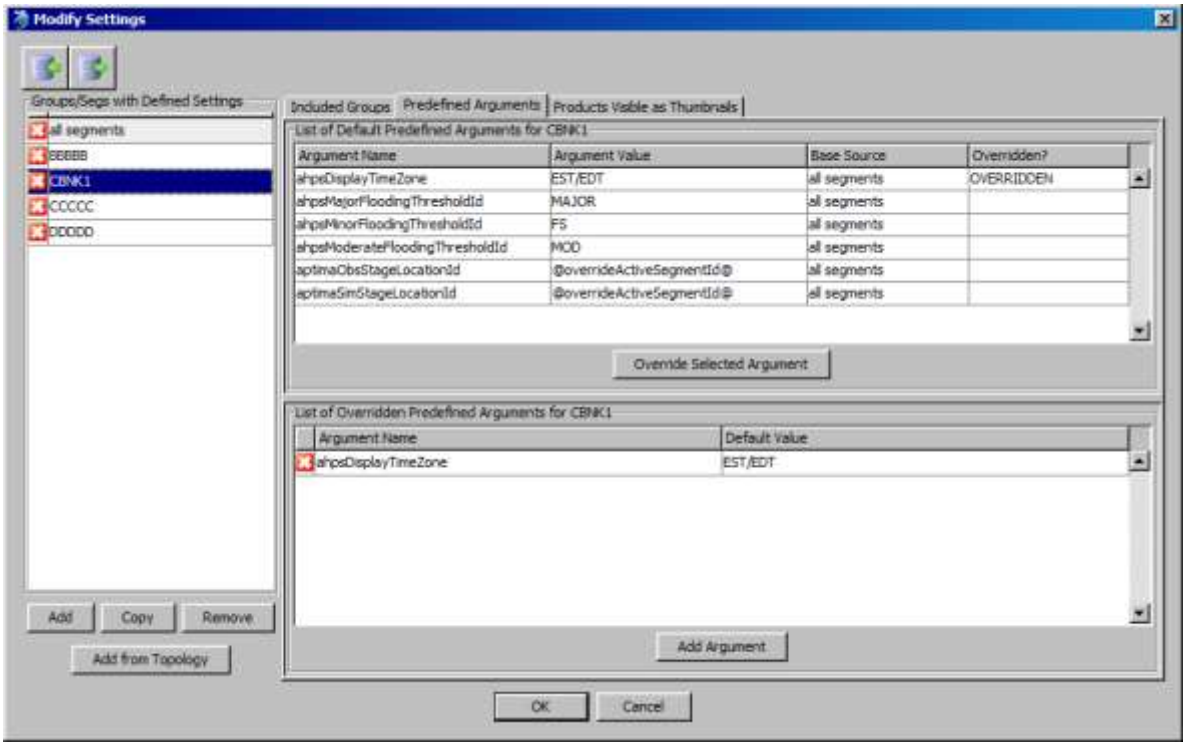


Figure 3-2: The **Modify Settings Dialog** after selecting "CBNK1" from the **Segs/Groups With Defined Settings Table**.

3.1.2.1 Included Groups Tabbed Panel

The components of the **Included Groups Tabbed Panel**, shown in Figure 3-3, are as follows:

- **Already Included List**: Displays those product groups (or segments) that have already been included for the group or segment currently selected via the **Segments with Defined Settings Table** (described in the previous section). The groups are listed in order of priority. For example, in the Figure, the settings for the segment ("CBNK1" in the Figure) override those for group "_flowProducts", which override those for group "_stageProducts", which then override those for "all segments". Settings for the group or segment itself are always given highest priority (i.e., the selected group or segment is always defined as the first in the list), while those defined are "all segments" are always given lowest priority. List items shown in **bold** are directly included and can be selected for removal. Those in a faint, gray font cannot be selected for removal. Any group or segment preceded by a hyphen, '-' (also in a faint gray font), is indirectly included via the first **bold** group above it; this means that the applicable **bold** group was defined such that the hyphenated group or segment was included in it. Hence, it is included in the displayed group or segment.

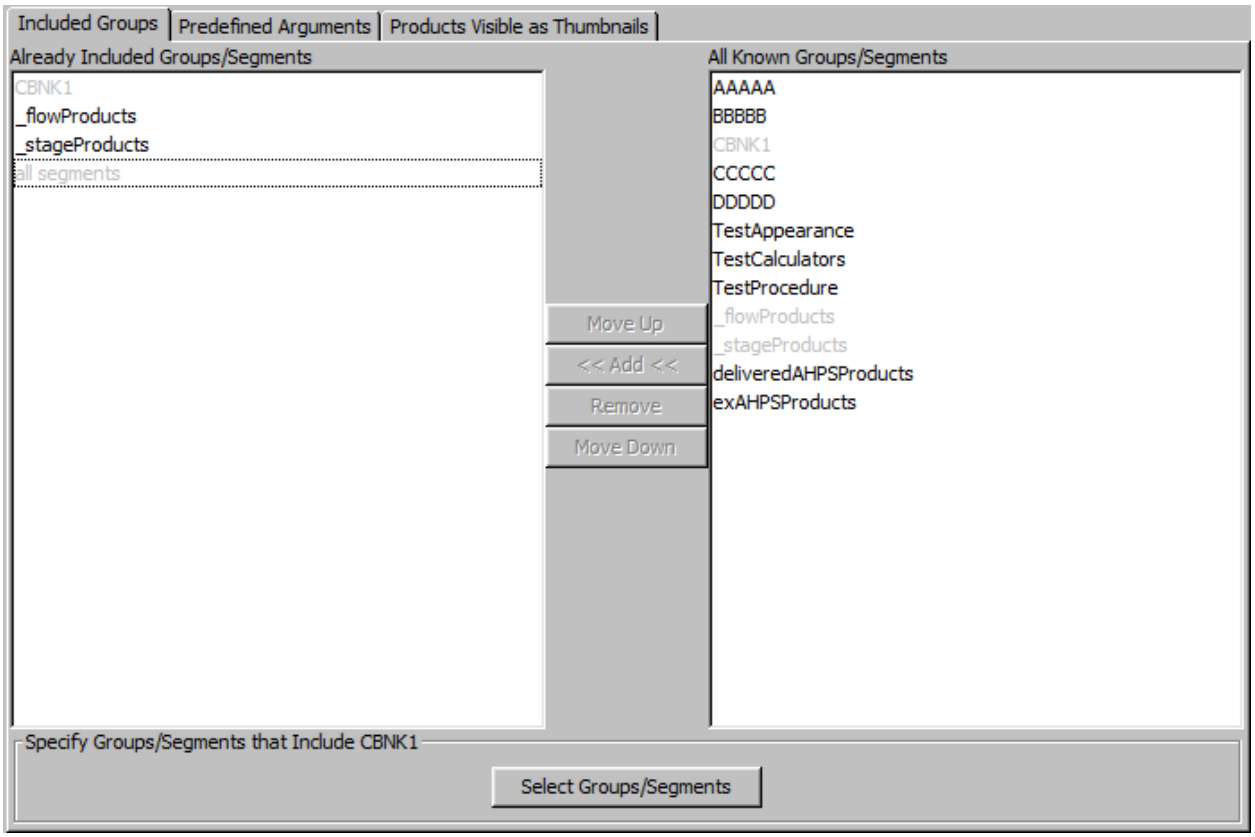


Figure 3-3: The **Included Groups Tabbed Panel**

- **All Known Groups/Segments List**: Displays a list of all known groups and segments. The list is constructed as a combination of those groups and segments for which settings are defined, shown in the **Segments With Defined Settings Table** (see above), and those that are visible in the current **GraphGen Tree Panel**. Items in **bold** have not yet been included either directly or indirectly and can be selected for addition. Those that are in a faint gray font have already been included either directly or indirectly and cannot be selected for addition.
- **Move Up**, **Add**, **Remove**, **Move Down Buttons**: Used to modify the list displayed in the **Already Included List**. When one item in the list is selected, the **Move Up Button** moves the item higher in priority (up in the list), the **Remove Button** removes it from the list, and the **Move Down Button** moves it lower in priority. If an item is selected in the **All Known Groups/Segments List**, clicking the **Add Button** adds that items to the **Already Included List**, inserting it in front of the currently selected list item, or at the bottom (above "all segments") if no list item is selected.
- **Select Groups/Segments Buttons**: Click to assign the group or segment currently selected via the **Segments with Defined Settings Table** (described in the previous section) to multiple groups or segments. When clicked, a **Select Groups/Segments to Include Dialog** opens (shown below in Figure 3-4. Check the rows that correspond to all groups or segments to include the currently selected group or segment and click **OK**. Upon clicking **OK**, the checked groups and segments will be updated to include the currently selected group or segment and a The buttons below the table are as follows:

- **Select All Button**: Selects all rows in the table.
- **Unselect All Button**: Clears the selection.
- **Check All Button**: Checks all rows in the table.
- **Uncheck All Button**: Unchecks all rows.
- **Check Selected Button**: Checks all selected rows.
- **Uncheck Selected Button**: Unchecks all selected rows.

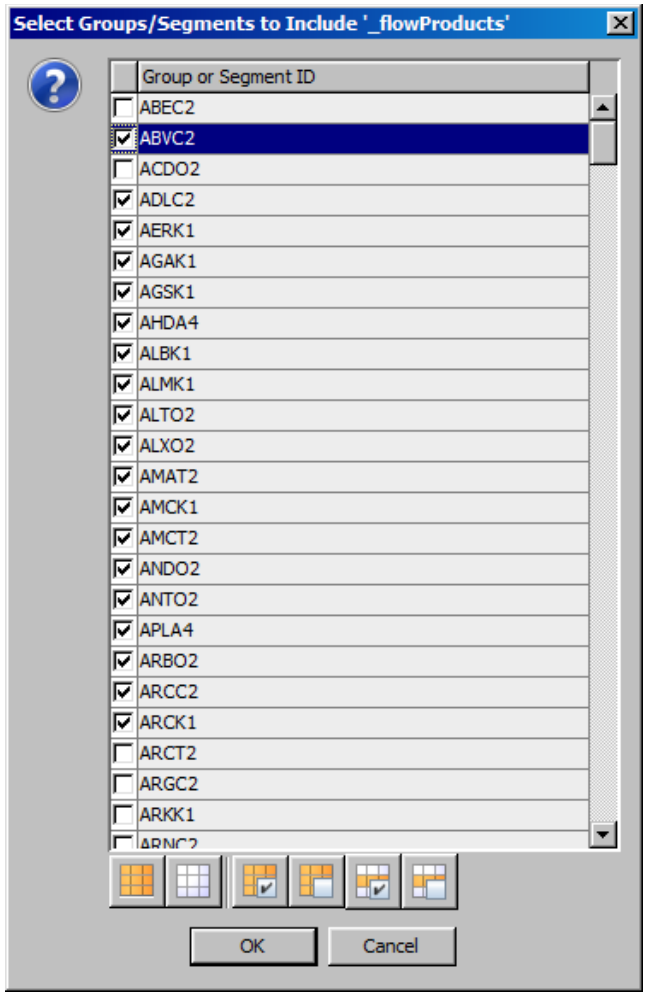


Figure 3-4: The **Select Groups/Segments to Include Dialog.**

3.1.2.2 Predefined Arguments Tabbed Panel

The components of the **Predefined Arguments Tabbed Panel**, shown in Figure 3-2 (Section 3.1.2) are as follows:

- **List of Default Predefined Arguments Table**: Displays the list of all predefined arguments, in addition to those provided by default (see the *Graphics Generator Getting Started Manual*), available for the group or segment currently selected via the **Segments With Defined Settings Table** (see above). The list is constructed by searching through each group or segment included as a *product group*, determining its list of predefined arguments, and combining them into one long list. If two included groups or segments include identical predefined arguments, then the one with higher priority is used (priority as shown in the **Already Included List** within the **Included Groups Tabbed Panel**). The first column displays the argument name and the second column the argument value. The third column, 'Base Source', displays the included group or segment that is the source of the default value for the argument. The last column displays if the default value is "OVERRIDDEN" or "SEGMENT SPECIFIC", meaning the argument is displayed in the **List of Overridden Predefined Arguments Table**. The contents of this table may not be directly edited!
- **List of Overridden Predefined Arguments Table**: Displays a list of all predefined arguments overridden or defined for the currently displays group or segment. The first column is a delete column. The second and third column display the argument name and default value. All editing for the predefined arguments must be done in this table!
- **Override Selected Argument Button**: If a row is selected in the **List of Default Predefined Arguments Table**, clicking on this button adds an entry in the **List of Overridden Predefined Arguments Table**, therefore allowing the value of the selected argument to be overridden.
- **Add Argument Button**: Click to add a new predefined argument. A **Specify Argument Name Dialog** will open allowing the user to either select one of the predefined arguments provided by default or specify a new one. Upon clicking **OK**, a new row will be added to the table.

3.1.2.3 Products Visible as Thumbnails Tabbed Panel

The components of the **Products Visible as Thumbnails Tabbed Panel**, shown in Figure 3-5, are as follows:

- **List of Product Templates Defined for Included Groups or Segments Table**: Displays the visibility status of all the products generated using templates defined for any included group or segment, such as the default product group "all segments". The first column, "Visible?", displays a choice box to enable selecting the visible status. If the product is visible, its background is green; otherwise its background is red (see the Figure). If the value is "Default >>", then the default product visibility is used, as shown in the second column (described next). If it is "Yes" or "No" then the visibility is overridden for the currently displayed group or product accordingly. The second column indicates the default visibility of the product. The product information is displayed by product id in the third column and product source (segment or group) in the last column.
- **List of Product Templates Defined for Segment Table**: Displays the visibility of products generated using templates defined specifically for the current group or segment (i.e., those products listed under the node with the current group or segment id within the

GraphGen Tree Panel; see above). The first column is a choice box allowing for selection of the default value, which is always "Yes", or "No". The other columns display the product's id and its source, which should always match be the current group or segment.

- **Select All Button**: Select all rows of the applicable table.
- **Deselect All Button**: Deselect all rows of the applicable table.
- **Default All Selected Button**: Set to use the default visibility for all selected rows.
- **Yes All Selected Button**: Set the visibility to "Yes" for all selected rows. This button is not available for the **List of Product Templates Defined for Segment Table**.
- **No All Selected Button**: Set the visibility to "No" for all selected rows.

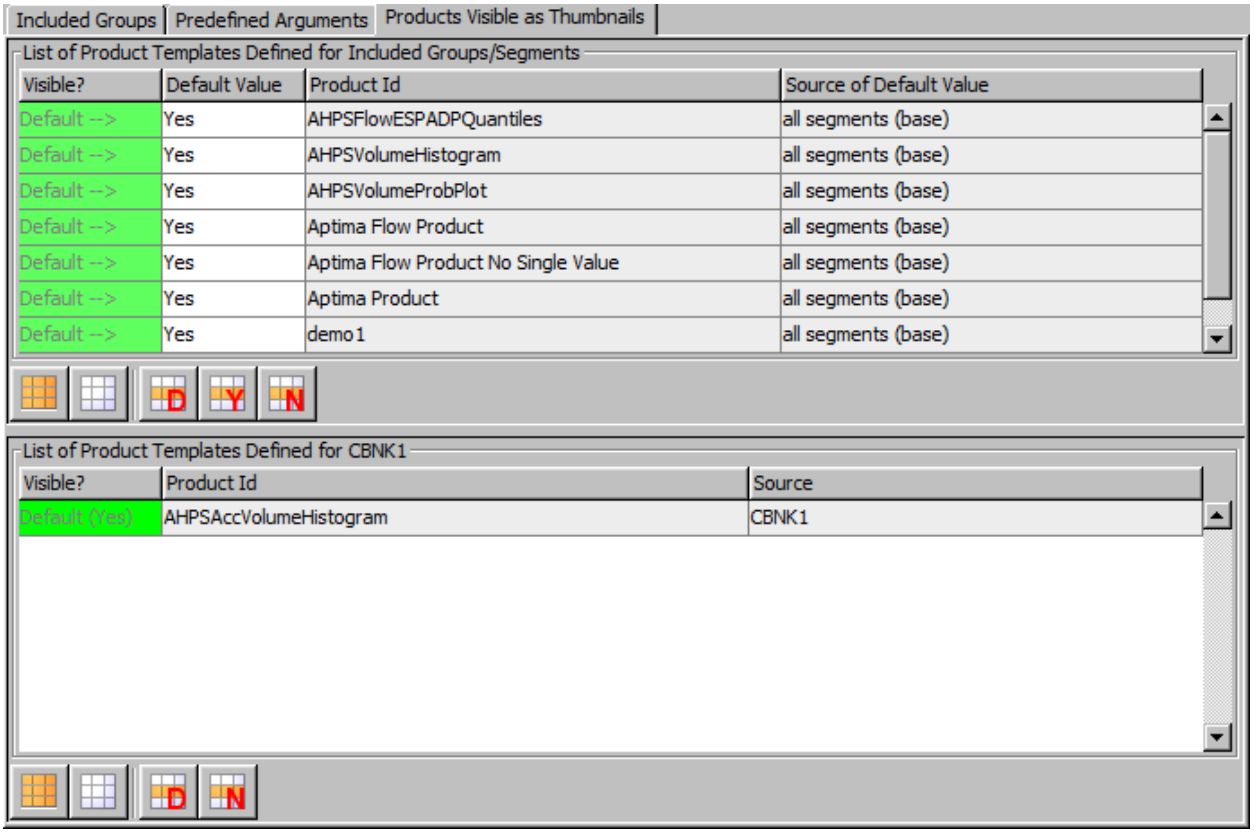


Figure 3-5: The **Products Visible as Thumbnails Tabbed Panel.**

3.2 *Usage*

3.2.1 Selecting a Product or Template for Editing

In the **GraphGen Tree Panel**, to select a product or template for editing, click on the '+' next to the node with the segment id of the product to be edited. This will expand that branch. Click on the product id of the product to be edited. To edit a template, click on the '+' next to the node labeled "templates" and select the id of the template to edit. If the **GraphGen Editor Panel** is

open, the actively edited product will be changed to the product selected in the tree. If not, then clicking on the **GraphGen Editor Button**, , in the CHPS toolbar will open up the editor initialized to edit the selected product or template.

3.2.2 Managing Templates

Clicking on the **Manage Products Button** opens up the **Product and Template Manager Dialog**, shown in Figure 3-1. The following tasks can be performed via the dialog:

- *Delete templates or products*: To delete a product or template, click on the delete column, , of the row corresponding to the product or template to be removed. This will force the **GraphGen Tree Panel** to refresh.
- *Export products*: To export products or templates, select entries from the tables displaying templates and click on the **Export Button**. From the **Export Selected Only Confirmation Dialog**, click either **Yes** or **No**, appropriately. Then specify a file name and click **Open**. If you do not select any rows in either of the tables of templates, then all templates are exported.
- *Import products*: To import templates, click on the **Import Button** and use the file browser that opens up to select the XML file that contains the desired products.

3.2.3 Uploading or Download Products and Settings

Clicking on the **Upload Products Button** will upload any changes made in the products and settings local area to the central area. It first completely overwrite the central area products, by copying the local area file over top of the central area, then a date-stamped copy of the central area file will be created:

OHD_GRAPHGEN_PRODUCTS_AND_SETTINGS.xml.yyyyMMdd_HHmmss

where the sting yyyyMMdd_HHmmsss stands for year, month, day, hour, minute, and seconds. Up to 50 such files may be recorded in the central area directory. See Section 2.4 of the *Graphics Generator Tips and Troubleshooting Guide* for details.

Clicking on the **Download Products Button** will remove changes made in the local area relative to the central area by copying the central area file over top of the local area file. See the *Graphics Generator Getting Started Manual* for a description of what is done when a button is clicked and guidelines to follow when uploading/downloading products and settings.

3.2.4 Adding a Product Group to a Segment

To allow for the products or settings from one product group (or segment) to be included in a segment (or group), click on the **Change Default Settings Button** to open the **Modify Settings Dialog**. From the **Groups/Segs With Defined Settings Table**, select the segment (or group) to which the product group (or segment) is to be added in the **Segs/Groups With Defined Settings Table**. If it does not exist, then add it by clicking on the **Add Button** or **Copy Button** and specifying the appropriate group or segment id. After the segment is selected, the tabbed panels

will update to display settings for the segment. Make sure the **Included Groups Tabbed Panel** is selected. Next, use the tools provided in the **Included Groups Tabbed Panel** appropriately: select the groups or segments from the **All Known Groups/Segments List** and click on the buttons as needed to add the groups or segments to the **Already Included List** and order them appropriately. Click **OK** when done or **Cancel** to close the **Modify Settings Dialog** discarding the changes.

3.2.5 Assigning a Product Group to Multiple Groups and Segments

To allow for the products and settings in a product group to be included in many groups and segments, do the following. First, open the **Modify Settings Dialog** and select the product group in the **Groups/Segs With Defined Settings Table**. Next, make the **Included Groups Panel** active by clicking on its tab and click on the **Select Groups/Segments Buttons** at the bottom of the panel. Finally, in the **Select Groups/Segments to Include Dialog** that opens, check the rows for all groups and segments to include product group and click **OK**. The settings for all of the selected groups and segments will be updated and a success dialog will be displayed. Click **OK** to close it.

If necessary, click the **Add from Topology Button** (see Section 3.1.2) to create settings for all segments defined in a Topology.xml file so that those segments can be selected above.

3.2.6 Defining Predefined Arguments for a Segment

To define, or override, predefined arguments for a segment (or product group), click on the **Change Default Settings Button** to open the **Modify Settings Dialog**. From the **Segs/Groups With Defined Settings Table**, select the desired segment (or product group). If the segment is not listed, click on the **Add Button** or **Copy Button** as needed to add the new segment (or product group) and set its name. After the segment is selected, the tabbed panels will update to display settings for the segment. Make sure the **Predefined Arguments Tabbed Panel** is selected. Arguments can be added by clicking on the **Add Argument Button**, removed by clicking on the delete column, , for the argument to remove, or edited directly in the **Default Value Column** of the **List of Overridden Predefined Arguments Table**.

Default predefined arguments when removed are reverted to their standard default value, if any. See the *Graphics Generator Getting Started Manual*.

3.2.7 Changing Products Displayed as Thumbnails for a Segment

To change which products are displayed as thumbnails within the **GraphGen Thumbnail Viewer** for a segment, click on the **Change Default Settings Button** to open the **Modify Settings Dialog**. From the **Segs/Groups With Defined Settings Table**, select the desired

segment (or product group). If the segment is not listed, click on the **Add Button** or **Copy Button** as needed to add the new segment (or product group) and set its name. After the segment is selected, the tabbed panels will update to display settings for the segment. Select the **Product Templates Visible as Thumbnails Tabbed Panel**. Use the tools provided in order to define the visibility of products as needed. Changes are made by clicking on the cells in the first column of either table, 'Visible?', and selecting the desired visibility setting.

4 GraphGen Thumbnails Panel

The **GraphGen Thumbnails Panel**, shown in Figure 4-1, is usually displayed on the right side and is opened by clicking on the appropriate tab in the CHPS interface. It displays thumbnails of all of the product charts generated using templates available for the currently active segment, as selected in the CHPS interface **Forecasts Panel**. It also provides access to the **Modify Settings Dialog** for the active segment.

The thumbnails will only update if the panel is showing. So if you do not want the thumbnails to update during operational forecasting, do not display the **GraphGen Thumbnails Panel**. In most cases, only the thumbnails for changed templates will update.

Figure 4-1: The upper portion of the **GraphGen Thumbnails Panel**.

4.1 *Components*

The components of the **GraphGen Thumbnail Panel** are as follows:

- **Thumbnail Scrollpane**: This component displays thumbnails of each of the Graphics Generator product templates available for the active segment in a panel with a scrollbar on the right. To remove a product from the **GraphGen Thumbnail Panel**, right click on the thumbnail and click the **Do Not Display Thumbnail Menu Item**. Note that this changes the settings for the active segment. Product templates can be included, again, by clicking on the **Change Default Settings Button** (below) and using the **Modify Settings for Segment Dialog** to include the removed product.
- **Refresh Thumbnails Button**: Click to reload and redraw the product charts for product templates defined for the active segment. Clicking this button will typically not be needed. At least one and sometimes all of the thumbnails will automatically refresh whenever one of the following occurs:

    1. One of the product templates is changed via the **GraphGen Editor Panel**.
    2. A change is made to a template affecting one of the displayed product charts via the **GraphGen Editor Panel**.
    3. The settings for the active segment are changed via the **Modify Settings Dialog**.
    4. Templates are imported via the **Product and Template Manager Dialog**.
    5. The active segment is changed via the CHPS interface **Forecasts Panel**.
    6. Templates are downloaded from the central area via a button in the **GraphGen Tree Panel**.
    7. The connection to the PI-service is reset.

- **Select First Thumbnail Button**: Selects the first (top) thumbnail in the list.
- **Select Previous Thumbnail Button**: Selects the previous thumbnail in the list.
- **Select Next Thumbnail Button**: Selects the next thumbnail in the list.
- **Select Last Thumbnail Button**: Selects the last (bottom) thumbnail in the list.
- **Change Default Settings Button**: Click to open the **Modify Settings for Segment Dialog** centered over the panel. The dialog allows for modifying the settings for the active segment, and is exactly identical to the tabbed panels portion of the **Modify Settings Dialog** shown in Figure 3-2. The dialog will only allow modification of settings for the active dialog. See Section 3.1.2 (pg. 21) for more details.

Note that the thumbnails are rendered in a background process. While the thumbnails are being drawn, the panel will display a message starting with "Building for <segment id>…" and a wait cursor will be displayed over the **GraphGen Thumbnail Panel**.

4.2 *Usage*

4.2.1 Selecting a Product for Viewing

To select a product to view, click on the thumbnail of the product so that it is bordered in red and click on the **GraphGen Viewer Button**, , in the CHPS tool bar. The **GraphGen Viewer Panel** will be opened in the center of the CHPS interface displaying the full version of the selected product.

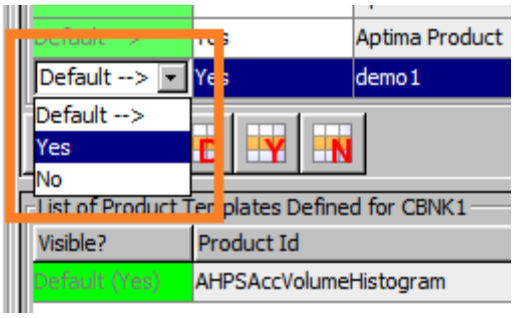
4.2.2 Defining Predefined Arguments for Active Segment

To define predefined arguments for the active segment, click on the **Change Default Settings Button** to open the **Modify Settings for Segment Dialog**. Make sure the **Predefined Arguments Tabbed Panel** is selected. Arguments can be added by clicking on the **Add Argument Button**, removed by clicking on the delete column, , for the argument to remove, or edited directly in the **Default Value Column** of the table.

Default predefined arguments when removed are reverted to their standard default value. See the *Graphics Generator Getting Started Manual*.

4.2.3 Changing Products Display as Thumbnails for a Segment

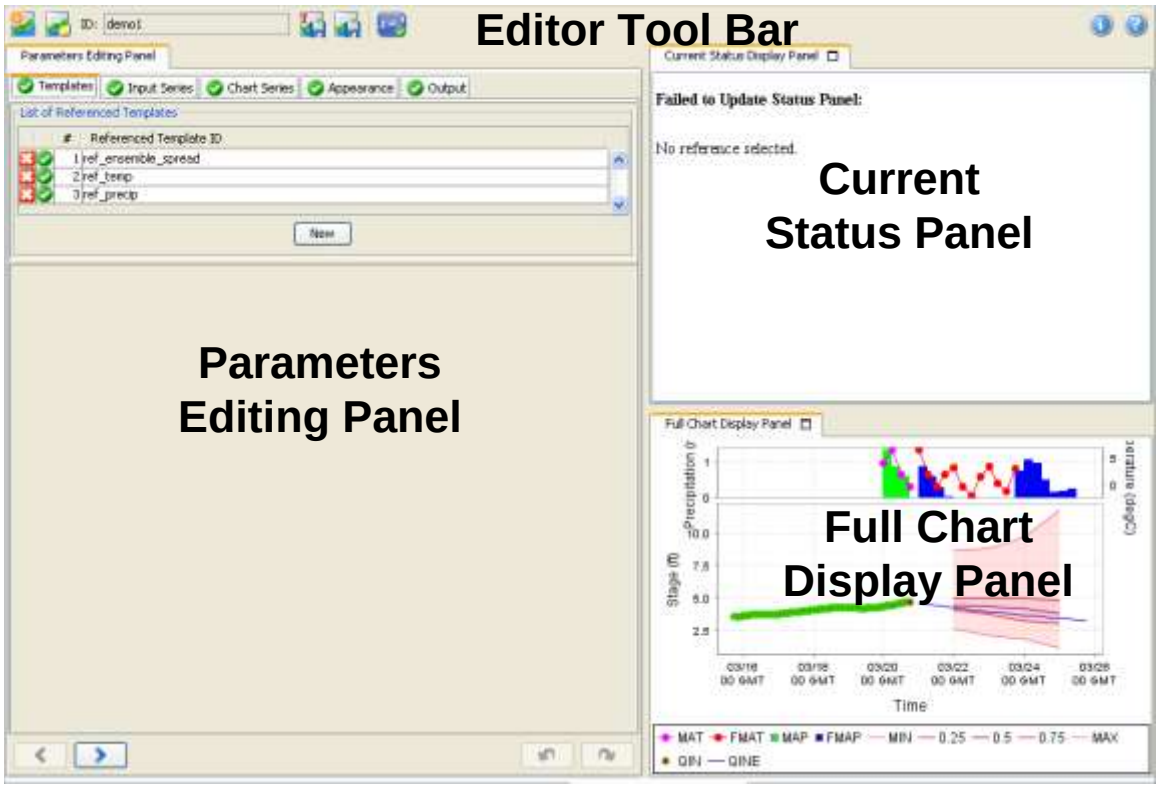
To change which product charts are displayed for the active segment, click on the **Change Default Settings Button**. Select the **Products Visible as Thumbnails Tabbed Panel**. Uncheck the rows for any product that is not to be included for the segment within the **GraphGen Thumbnail Panel**. Select "Yes" for any rows for product templates for which the product charts are to be displayed, if not already marked as "Yes":



Alternatively, to exclude a product, right click on the thumbnail and from the pop-up menu, select the **Do Not Display Thumbnail Menu Item**.

5 GraphGen Editor Panel

The **GraphGen Editor Panel**, shown below, allows the user to create new or edit existing templates. It is opened by clicking on the **GraphGen Editor Button**, , in the CHPS toolbar.



5.1 *Components and Layout*

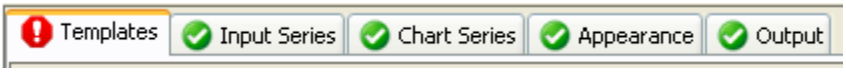
The layout of the **GraphGen Editor Panel** includes four components:

1. **Editor Tool Bar**: Tool bar above the other panels displaying buttons and a text field.
2. **Parameters Editing Panel**: On the left-hand side of the editor, used to edit parameters defining the template. It consists of five tabbed panels used to edit different types of parameters.
3. **Current Status Display Panel**: On the upper right of the editor, displays status information relative to the current active tabbed panel within the **Parameters Editing Panel**. This panel can be undocked from the main display by clicking on the ☐ next to the panel name in the title tab and docked by closing the resulting dialog.
4. **Full Chart Display Panel**: On the lower right of the editor, displays the full chart that would be rendered if the user were to save it as is, without any additional changes. This panel can be undocked from the main display by clicking on the ☐ next to the panel name in the title tab and docked by closing the resulting dialog.

Both the **Current Status Display Panel** and **Full Chart Display Panel** display error information. Each of the tabbed panels is described in later sections within this manual.

The following is a list of components that are present regardless of the active tabbed panel:

- **New Button**: Creates a new template for editing, closing the template currently being edited.
- **Open Button**: Opens a **Product and Template Manager Dialog** that allows the user to select a template to edit. See Chapter 4 for other features of this dialog.
- **ID Text Field**: Displays the template identifier for the template currently being edited.
- **Save as Referenced Template Button**: Opens a **Save Template Dialog** that allows the user to save the currently edited template as a referenced template.
- **Save as Product Template Button**: Opens a **Save Product Template Dialog** that allows the user to save the template currently being edited as a product template. Upon saving, the **ID Text Field** will display the new template id.
- **Managed Product Arguments Button**: Opens a **Customize Global Arguments Dialog** that allows the user to modify the global arguments for the current template. A status icon is included within the larger icon: indicates that all used arguments are specified, while indicates at least one used argument is not specified.
- **About Button**: Opens a dialog that displays version information.
- **Help Button**: Switches the interface to help mode. While in help mode, the user may left-click on a component within the **GraphGen Editor Panel** to open a help dialog that displays this reference manual at the section pertaining to the component. A pink box is drawn around the component corresponding to the current position of the mouse cursor. Right click anywhere in the panel to end help mode.
- **Tabbed Panel Tabs**: There are five tabs displayed in the **Parameters Editing Panel**; one for each of the tabbed panels that can be used to edit parameters:

  The tab displays the name of the tabbed panel, each of which is described later. Also displayed is a status for that tab: indicates that the parameters specified in the corresponding tabbed panel were successfully processed by the Graphics Generator engine to build the chart; indicates that a problem was encountered, the nature of which will be described in the **Current Status Display Panel** when that tab is active. The order of the tabs dictates the order used for the **Back** and **Next Buttons**, below.
- **Back Button**: Makes the previous tabbed panel active.
- **Next Button**: Makes the next tabbed panel active.
- **Undo Button**: Undo the last change made to the parameters of the edited template. This will change the active tabbed panel to be the one that was active when the change was made. The tabbed panel will be updated to the state of the panel immediately before the change was made. A history of up to 10 actions that can be undone is kept.

- **Redo Button**: Redo the last undone change made to the parameters.

5.1.1 Save Referenced/Product Template Dialogs

The **Save Product Template Dialog** and **Save Referenced Template Dialog**, shown in Figure 5-1 and Figure 5-2, respectively, are used to save a referenced or product template, allowing the user to specify a template id and group or segment id, if appropriate. The following are the components present in the dialogs:

- **List of Existing Product/Templates Table**: Provides a list of the existing products/templates. Note that clicking on will delete the corresponding product/template from the CHPS database.
- **One Segment/Group** and **All Segments Radio Buttons**: If the **All Segments Radio Button** is selected, then the product will be applied for "all segments". If the **One Segment Radio Button** is selected, then the product will be saved for one segment, and the **Segment Id Text Field** and **Active Segment Button** will both be enabled. This is only available in the **Save Product Dialog**.
- **Segment/Group Id Text Field**: Specifies the segment id to be used when saving a product. This is only available in the **Save Product Dialog**.
- **Active Segment Button**: Sets the **Specify Segment/Group Id Text Field** value to be the id of the currently active segment. This is only available in the **Save Product Dialog**.
- **Specify * Template Id Text Field**: Specifies the template id of the template being saved.
- **Enter Description Below Text Area**: Specifies a description of the template being saved.
- **OK Button**: Click to save the template.
- **Cancel Button**: Click to cancel the save action.

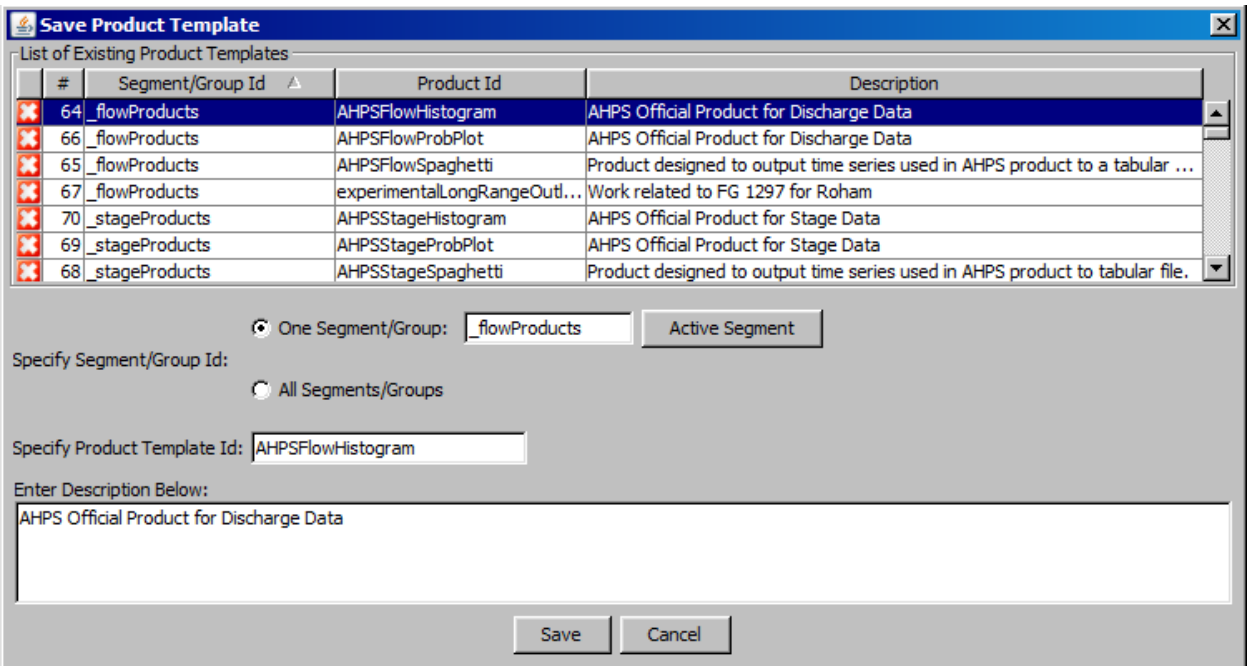


Figure 5-1: Save Product Template Dialog

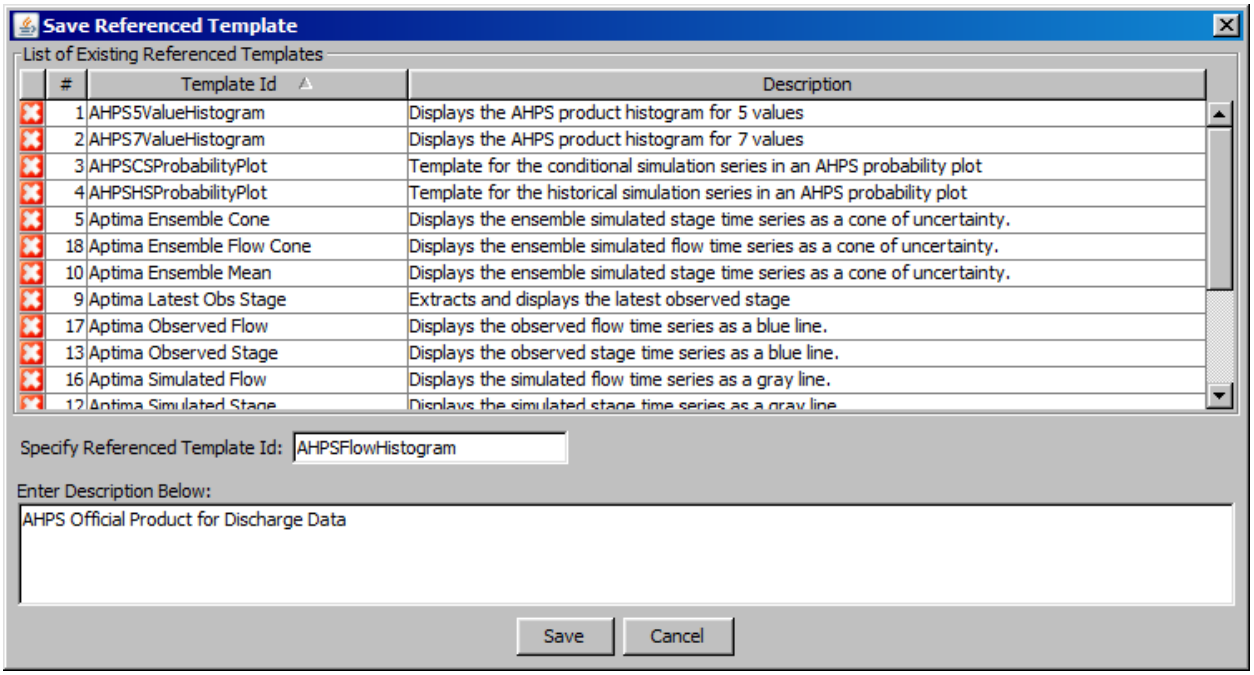


Figure 5-2: Save Referenced Template Dialog

5.1.2 Customize Global Arguments Dialog

The **Customize Global Arguments Dialog**, shown in Figure 5-3, is used to define new arguments or override existing arguments. The following are the components present in the dialog:

- **Override Predefined Arguments Table**: Lists arguments that are predefined for the active segment, allowing the user to override the argument value if desired. To override an argument, click on the checkbox in the "Override" column and set the value in the "Value" column. The value column is only editable when the override column displays a checkmark. The "Used" column specifies if the argument is used in the parameters. The status column (first column) displays a when a used argument is specified and a when a used argument is not specified (i.e. the value is "-undefined-").
- **Define Product Specific Arguments Table**: List other arguments that have been specified manually by the user. The format of the table is the same as the **Override Predefined Arguments Table**, except there is no override column, the status column is the second column, and the first column is a delete column.
- **New Button**: When clicked, a **Specify Argument Name Dialog** will open requesting a name for the new argument. Upon specifying a name and clicking **OK**, the dialog will close and a new argument by that name will be added to the **Specify Other Arguments Table**.
- **OK Button**: Closes the dialog.

Note that there is no cancel button or undo button associated with the dialog.

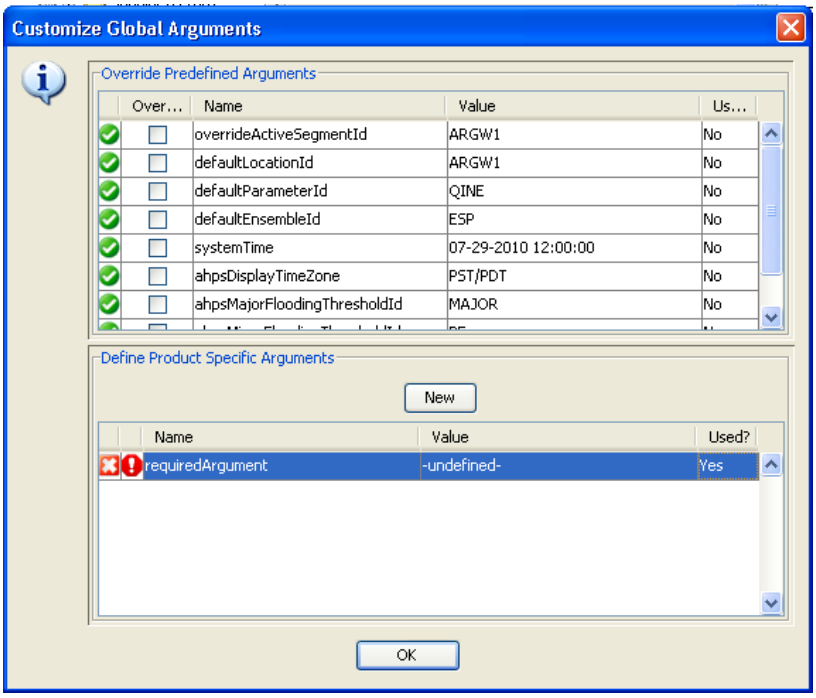


Figure 5-3: Customize Global Arguments Dialog

5.2 *Usage*

5.2.1 Building a Template from Scratch

To start the process, click on the **New Button** within the **Editor Tool Bar**. When building a new template, it is recommended that the user follow the order of the tabbed panels:

1. **Templates Panel**: Specify referenced templates to be applied in the product template.
2. **Input Series Panel**: Specify all input series that will be used in the calculations performed to construct the chart series displayed in the product chart.
3. **Chart Series Panel**: Specify the calculations made for each chart series to display in the product chart. This includes:
    a. selecting time series to use in the computations;
    b. aggregating those time series as needed;
    c. specifying the calculations to perform using the aggregated time series; and
    d. specifying the appearance of those chart series within the chart.
4. **Appearance Panel**: Modify other aspects of the appearance of the product chart, including the plot title, axis settings, legend, etc.
5. **Output Panel**: Specify output to generate if the product is built via the model adapter within a workflow (i.e. non-interactively). When building a template, skip this step, as templates can never specify output to be generated.

Once the parameters are specified for the template, save the template by clicking on the appropriate **Save as Button** (Section 5.1). Details about each step are provided in the usage sections of the sections describing the panels.

6 Editor: Templates Panel

The **Templates Panel**, shown in Figure 6-1, is used to specify referenced templates to apply when Graphics Generator builds a chart. See the *Graphics Generator Getting Started Manual* for a description of the template concept. A referenced template may require arguments in order to be constructed. Those arguments can be specified within the **Customize Global Arguments Dialog** or can be specified directly as "overridden" arguments to the referenced template. Overridden arguments take precedent over global arguments.

The **Current Status Display Panel** displays a chart as it would be constructed if it were built from the referenced template by itself. If an error occurs while building the chart, possibly due to missing required product specific arguments, a message will be displayed in the panel describing the error.

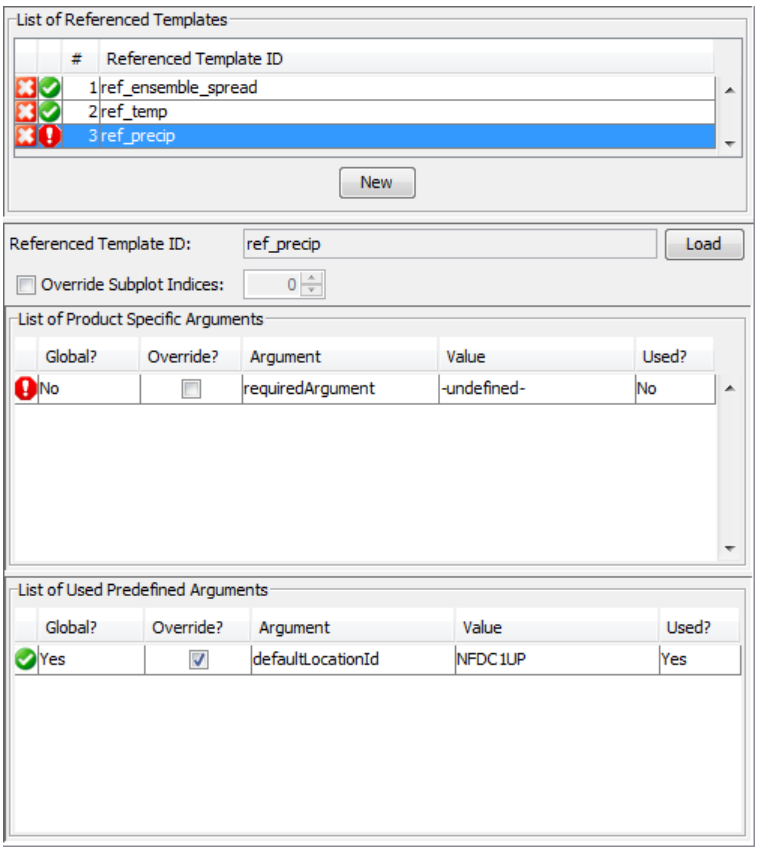


Figure 6-1: Templates Panel.

6.1 *Components*

The following describes the **Templates Panel** components:

- **List of Referenced Templates Table**: List of the referenced templates currently included within the edited template. The first column is a delete column. The second column

displays the status: if the template can be constructed or if the template cannot be constructed because of an error. When a row of the table is selected, the **Current Status Display Panel** will be updated to display the corresponding template.

- **New Button**: Adds a new referenced template to the edited template. This will result in a row being added to the table.
- **Referenced Template ID Text Field**: The identifier of the referenced template for the row selected in the **List of Referenced Templates Table**. This field can be edited only by clicking on the **Load Button**. This component is only visible when a row of the **List of Referenced Templates Table** is selected.
- **Load Button**: Opens an **Open Template Dialog**, displaying a **List of Existing Templates Table** identical to that in the **Product and Template Manager Dialog**, whose components are described in Section 3.1.1. The user can select a template from the list and click **OK**. This component is only visible when a row of the **List of Referenced Templates Table** is selected.
- **Override Subplot Indices Checkbox** and **Spinner**: Allows the user to specify the subplot on which to plot all components of the referenced template. If checked, then all chart series created by the referenced template will be plotted on the subplot indicated by the spinner value, regardless of the subplot index currently assigned to those chart series. See the components of the **Calculator Panel** described in Section 11.1 (page 59).
- **List of Product Specific Arguments Table**: List of arguments required for the template that are not predefined arguments, based on the **Customize Global Arguments Dialog** (Section 6.2.2). To override the value of an argument, click on the checkbox in the "Override?" column of the table and edit the "Value" column. This component is only visible when a row of the **List of Referenced Templates Table** is selected. The first column displays the status of the argument: if the argument is required and/or used but is not defined ("-undefined-"), or otherwise.
- **List of Used Predefined Arguments Table**: List of arguments that are predefined arguments, according to the **Customize Global Arguments Dialog**. To override the value of an argument, click on the checkbox in the "Override?" column of the table and edit the "Value" column. This component is only visible when a row of the **List of Referenced Templates Table** is selected. The first column displays the status of the argument: if the argument is required and/or used but is not defined ("-undefined-"), or otherwise.

6.2 *Usage*

6.2.1 Adding a Referenced Template

To add a referenced template to the template being edited, click on the **New Button** and then click on the **Load Button** to select the template. When the two tables are drawn in the lower half of the display, specify any arguments within the **List of Product Specific Arguments Table** for which the "Value" column is "-none-" or empty. Then specify any arguments within the **List of Used Predefined Arguments Table** for which the "Value" column is "-none-" or empty. After the arguments are fully specified, the **Current Status Display Panel** will display the template unless an error occurs, in which case it will display the error message.

7 Editor: Input Series Panel

The **Input Series Panel**, shown in Figure 8-1, is used to specify input time series that must be loaded from the CHPS database, a pi-timeseries XML file (i.e., an XML file used to specify a time series data following a schema developed by Deltares), or other location. Those input time series provide the data used within the Graphics Generator to calculate chart series that comprise the product chart. Input series are loaded by input series provider plug-ins and this panel allows the user to select plug-ins and specify parameters for the plug-ins.

The **Current Status Display Panel** displays the time series specified in the plug-in(s) that are currently selected in the **List of Input Series Providers Table**.

A list of available input series provider plug-ins is provided in Appendix A.

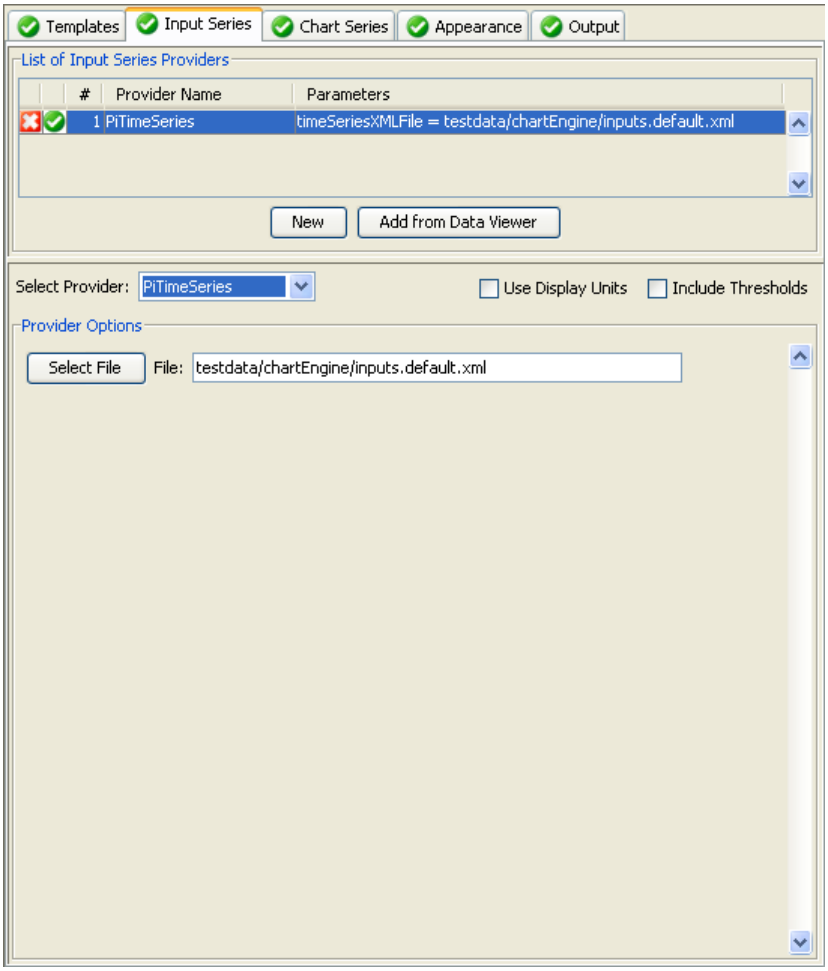


Figure 7-1: Input Series Panel

7.1 *Components*

The following is a description of the components of the **Input Series Panel**:

- **List of Input Series Providers Table**: List of the Input Series Provider Plug-ins currently included in the template. The first column is a delete column. The second column displays a status icon: if the input series can be loaded successfully or if the input series cannot be loaded. When rows of the table are selected, the **Current Status Display Panel** will be updated to display the time series loaded using the selected provider(s). When exactly one row is selected, the components below the table, including the **Select Provider Box**, two checkboxes, and **Provider Options Panel**, will be reconstructed to match the settings of the selected plug-in and allow for user editing. If no rows or multiple rows are selected, then those panel objects will not be displayed or will be disabled (only one plug-in can be edited at a time).
- **New Button**: When clicked, a new input series provider plug-in will be added to the template, using the default plug-in "PiTimeSeries" (see Section 7.3.2, pg 44).
- **Add From Data Viewer Button**: Button which adds a "SelectTimeSeries" plug-in with parameters specified according to user selections made within the **Data Viewer** panel of the CHPS interface.
- **Select Provider Choice Box**: Selectable list of available plug-ins. When selected, the **Provider Options Panel** will be updated to display a panel for editing the plug-in parameters.
- **Use Display Units Checkbox**: If checked, the units of the data loaded from the provider will be converted to the display units (English or metric) of the CHPS interface. If unchecked (default), it will be left in the stored units; typically metric.
- **Include Thresholds Checkbox**: If checked, then any thresholds associated with the loaded time series will be added to a list of thresholds that can be made visible on the chart via the **Appearance Panel** (see Section 12.2.8, pg. 81). The Graphics Generator obtains the thresholds via the time series loading mechanism when the time series comes from the CHPS database.
- **Provider Options Panel**: Displays a panel designed for editing the parameters of the plug-in. This panel is empty unless a row of the **List of Input Series Providers Table** is selected.

7.2 *Usage*

Each plug-in has an individual set of instructions described in Section 7.3 (pg. 42). Below is a description of how to add a "SelectTimeSeries" plug-in via the **Add From Data Viewer Button** that is part of the **Input Series Panel**.

7.2.1 Using the Add From Data Viewer Button

Make a complete selection within the **Data Viewer Panel** of the CHPS interface, selecting only "leaves" (i.e. entries with no subentries) within the tree interface. See Figure 7-2 at the end of this section. A complete selection will include one or more leaf nodes selected within each of the three panels. In the **Input Series Panel**, click on the **Add From Data Viewer Button**. This will add a "SelectTimeSeries" initialized for the selections in the **Data Viewer**.

7.2.2 Adding a Provider Plug-in

To add a provider plug-in, click on the **New Button**. Then select the provider via the **Select Provider Choice Box** and set the parameters in the **Provider Options Panel**.

7.3 *Plug-Ins*

An input series provider plug-in is required for providing time series to the Graphics Generator when computing chart series. The plug-ins released with Graphics Generator are described below.

7.3.1 ConfiguredQuery Plug-in

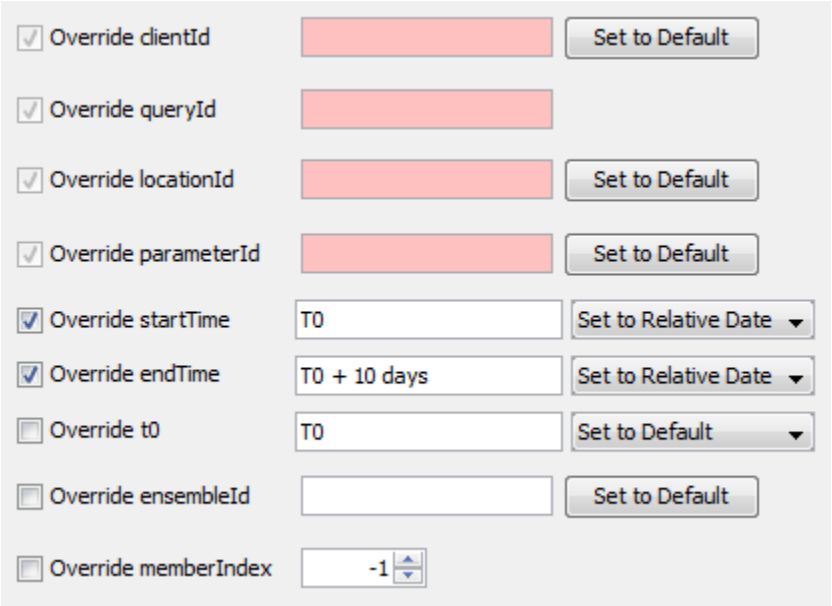
A ConfiguredQuery input series provider reads in time series from the CHPS database via a query configured within a file under Config/PiServiceConfigFiles. An example of a file defining user-configurable queries is provided within the file Config/PiServiceConfigFiles/GraphGen.xml delivered with the Graphics Generator. Here is part of that file:

```
<fewsPiServiceConfig>
   <general>
      <importIdMap>IdImportPiService</importIdMap>
      <exportIdMap>IdExportPiService</exportIdMap>
   </general>
   ...
   <timeSeries>
      <id>QINE ESP</id>
      <timeSeriesSet>
         <moduleInstanceSetId>QINE</moduleInstanceSetId>
         <valueType>scalar</valueType>
         <parameterId>QINE</parameterId>
         <locationSetId>RRS_Preprocessing</locationSetId>
         <timeSeriesType>simulated forecasting</timeSeriesType>
         <timeStep unit="hour" multiplier="6" timeZone="GMT-0"/>
         <readWriteMode>read only</readWriteMode>
         <ensembleId>ESP</ensembleId>
         <ensembleMemberIndexRange start="1949"/>
      </timeSeriesSet>
   </timeSeries>
   ...
</fewsPiServiceConfig>
```

The parameters of the plug-in are as follows:

- clientId: The client identifier of the query, which equals the name of the XML file under Config/PiServiceConfigFiles without the .xml extension. For example, clientId "GraphGen" identifies the file delivered with the software, GraphGen.xml.
- queryId: The id tag used to identify the query within the configuration file. In the example above, "QINE ESP" is a queryId.
- locationId: The location id of the time series to acquire. This parameter is required, because the FEWS PI-service requires it.
- parameterId: The parameter id of the time series to acquire. This parameter is required, because the FEWS PI-service requires it.
- startTime: Adjusts the time series acquired so that they start from the given start time.
- endTime: Adjusts the time series acquired so that they end at the given end time.
- T0: Sets the target system time, or T0, of the time series to acquire, allowing past time series to be retrieved. Currently, this is not used.
- ensembleId: The ensemble id of the time series to acquire. This works like the locationId, in that if a time series acquired via the query does not match this parameter id, then it will be discarded.
- memberIndex: The member index of the time series to acquire. This works like the locationId, in that if a time series acquired via the query does not match this parameter id, then it will be discarded.

Each parameter corresponds to components within the **Provider Options Panel**:



In each case, there is a check box that, if selected, indicates that the parameter is to be overridden and there is a field displaying the value. For the clientId, queryId, locationId, parameterId, and ensembleId, the field is an editable **Arguments Inserting Text Field** (Section 3.2.2, pg 10). If the field has a pink background, then it is a required parameter but no value is specified. The **Set**

to Default Button sets the field to be equal to the "GraphGen" for the clientId, "@defaultLocationId@" for the locationId, "@defaultParameterId@" for the parameterId, and "@defaultEnsembleId@" for the ensembleId. Use the **Customize Global Arguments Dialog** to view and set the argument values. For the startTime, endTime, and T0, a **Date Chooser Panel** (see Section 3.2.1, pg. 8) is used. Lastly, the memberIndex is an integer value and can be either typed into the corresponding field or by using the up/down arrows: .

7.3.2 PiTimeSeries Plug-in

A PiTimeSeries provider plug-in reads in time series from an XML file following the pi-timeseries XML schema. The only parameter of the plug-in is the XML file name, which is specified in the **File Field** within the **Provider Options Panel**:

It can be set manually or by using a standard file browser opened by clicking on the **Select File Button**: The **File Field** is an **Arguments Inserting Text Field** (Section 2.2, pg 10).

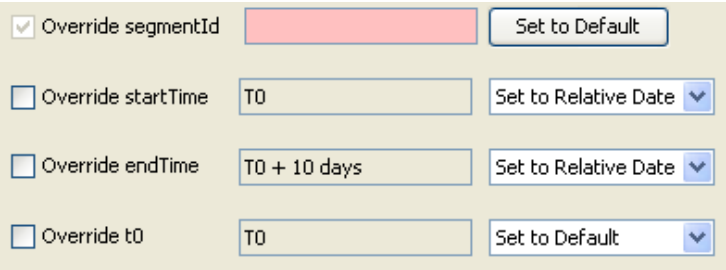
7.3.3 SegmentTimeSeries Plug-in

The SegmentTimeSeries provider plug-in reads time series from the CHPS database for a given segment id, as the data would be viewed within the **Plot Overview Panel** of the CHPS interface. This panel is configured via the Config/RegionConfig/DisplayGroups.xml file, and can display various time series of many data types for the active forecast segment. All displayed time series for a segment are to be loaded via this plug-in.

The parameters are as follows:

- segmentId: The segment id of the time series to acquire.
- startTime: Adjusts the time series acquired so that they start from the given start time.
- endTime: Adjusts the time series acquired so that they end at the given end time.
- T0: Sets the target system time, or T0, of the time series to acquire, allowing past time series to be retrieved. Currently, this is not used.

Each parameter corresponds to components within the **Provider Options Panel**:



In each case, there is a check box that, if selected, indicates that the parameter is overridden and there is a field displaying the value. For the segment id, the field is an editable **Arguments Inserting Text Field** (Section 3.2.2, pg. 10). A pink background indicates a parameter is required but has not been specified by the user. The **Set to Default Button** sets the field to be equal to the "@defaultSegmentId@". Use the **Customize Global Arguments Dialog** to view and set the argument value. For the startTime, endTime, and T0, a **Date Chooser Panel** (see Section 2.1, pg. 8) is used.

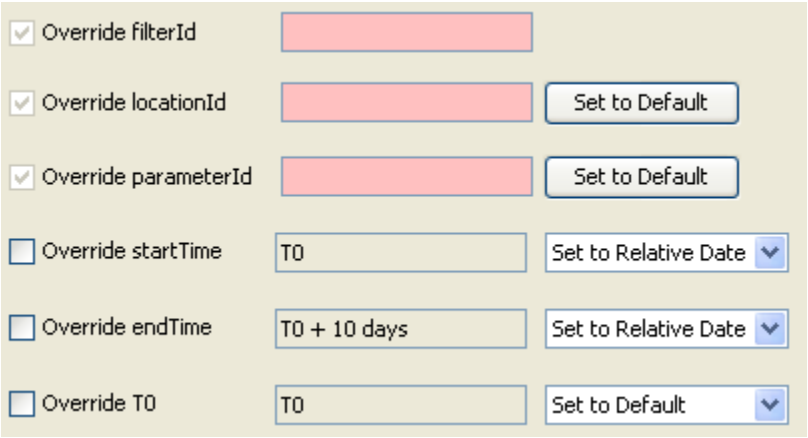
7.3.4 SelectTimeSeries Plug-in

The SelectTimeSeries plug-in reads time series from the CHPS database as configured in the Config/RegionConfig/Filters.xml file and displayed in the **Data Viewer Panel** of the CHPS interface (see the figure below list figure number). See Section 7.2.1 (pg 42) for how to add a SelectTimeSeries plug-in based on the **Data Viewer Panel**.

Plug-in parameters are:

- filterId: The identifier of the filter defined in the Filter.xml configuration file. Corresponds to the first panel in the **Data Viewer Panel**.
- locationId: The location id of the time series to acquire.
- parameterId: the parameter id of the time series to acquire.
- startTime: Adjusts the time series acquired so that they start from the given start time.
- endTime: Adjusts the time series acquired so that they end at the given end time.
- T0: Sets the target system time, or T0, of the time series to acquire, allowing past time series to be retrieved. Currently, this is not used.

Each parameter corresponds to components within the **Provider Options Panel**:



In each case, there is a check box that, if selected, indicates that the parameter is overridden and there is a field displaying the value. For the filterId, locationId, and parameterId, the field is an editable **Arguments Inserting Text Field** (Section 2.2, pg 10). If the background of the field is pink, then the parameter is required but has not been specified by the user. The **Set to Default Button** sets the field to be equal to the "@defaultLocationId@" for the locationId, and

"@defaultParameterId@" for the parameterId. Use the **Customize Global Arguments Dialog** to view and set the argument value. For the startTime, endTime, and T0, a **Date Chooser Panel** (see Section 2.1) is used.

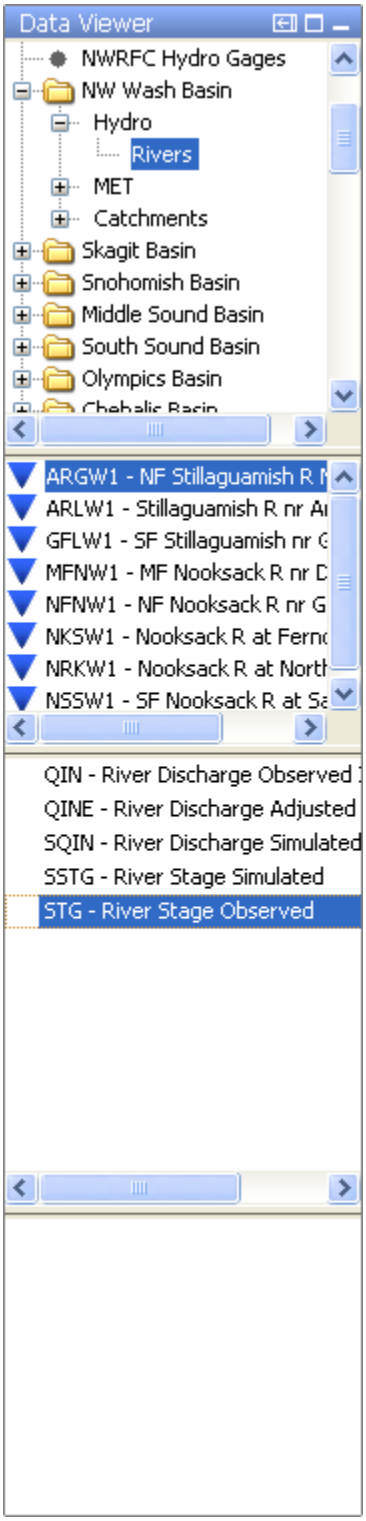


Figure 7-2: Data Viewer Panel with example selections made.

8 Editor: Chart Series Panel

The **Chart Series Panel**, shown in Figure 9-1, is used to specify series to be included in a Graphics Generator chart. Each set of chart series is added to the full chart in reverse order, so that the first set of chart series overlays the second set, and so forth. The parameters specifying a set of chart series include the following pieces of information:

1. Time series to use in the calculations.
2. Aggregations to perform on the time series, if any, before performing the calculations; specified by any number of aggregator plug-ins.
3. Calculations to generate the set of chart series; specified by a calculator plug-in.
4. Instructions for how to draw the chart series on the chart.

Each of the four items above is specified within tabbed subpanels:

1. **Select Time Series Panel**
2. **Aggregators Panel**
3. **Calculator Panel**
4. **Calculator Panel** (also)

The subpanels are described in Sections 9 (pg. 50), 10 (pg. 53), and 11 (pg. 58). The **Current Status Display Panel** summarizes the parameters and will be described with the subpanel. The **Full Chart Display Panel** is updated only when the **Update Full Chart Button** is clicked.

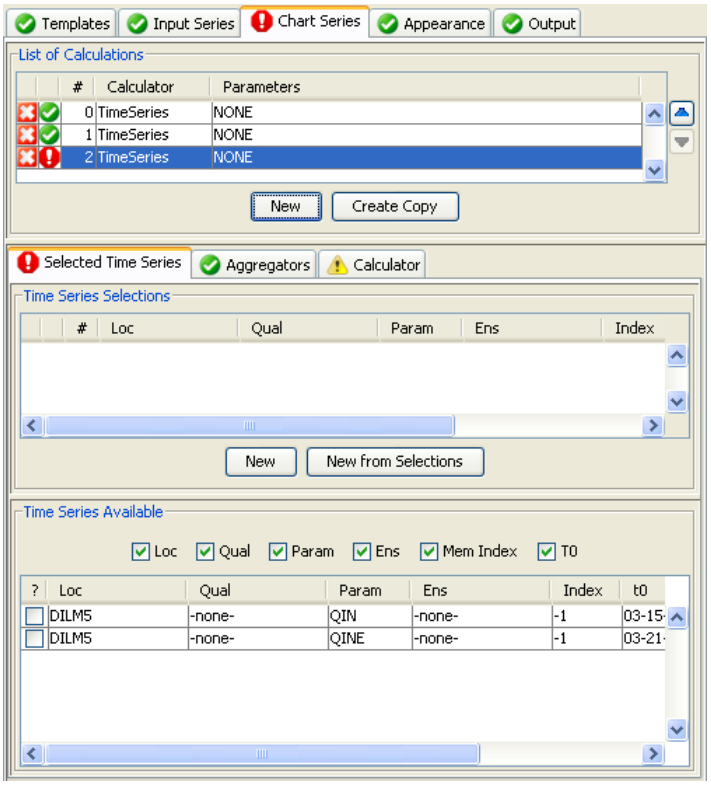


Figure 8-1: Chart Series Panel

8.1 *Components*

The following describes the **Chart Series Panel** components:

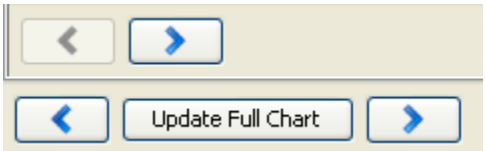
- **List of Calculations Table**: A list of the chart series to be displayed in the chart by calculator plug-in name. For each set of chart series to be added to the chart, there can be only one calculator plug-in specifying computations to perform. The name of the plug-in and a summary of the parameters are displayed in each row of the table. The first column is a delete column. The second column displays a status icon: if the chart series can be calculated or if the chart series cannot be calculated for any reason. When a row of the table is selected, the subpanel display will be updated for editing of the corresponding chart series parameters.
- **Move Item(s) Buttons**: Two buttons are provided that allow for reordering the chart series: the **Move Item(s) Up Button**, , and the **Move Item(s) Down Button**, . When rows of the **List of Calculations Table** are selected and either button is clicked, the selected rows will be moved in the table accordingly. Note that the order of the chart series in the table dictates the order in which they are drawn: series higher in the table are drawn on top of those lower in the table.
- **New Button**: Click on the **New Button** to add empty chart series parameters to specify a set of plot chart series.
- **Create Copy Button**: Click on the **Create Copy Button** to add new chart series parameters as a copy of the currently selected chart series parameters in the **List of Calculations Table**.
- **Chart Series Parameter Tabbed Panel**: Displays the tabbed subpanels used to specify how to compute a set of chart series for display. There are three subpanels: (1) **Select Time Series Panel**, (2) **Aggregators Panel**, and (3) **Calculator Panel**. Each is described in a later section.
- **Tabbed Subpanel Tabs**: There are three tabs displayed in the **Chart Series Parameter Tabbed Panel**; one for each of the tabbed panels that can be used to edit the chart series parameters:

  The tab displays the tabbed subpanel name and status: indicates that the parameters specified in the corresponding tabbed panel were successfully processed by the Graphics Generator; indicates that a problem was encountered, and is described in the **Current Status Display Panel**; indicates that errors in previous tabbed subpanels prevented processing so that the status is unknown. The order of the tabs, left-to-right, dictates the order used by the **Subpanel Back** and **Next Buttons**, described below.
- **Update Full Chart Button**: When clicked, the **Full Chart Display Panel** will be updated displaying the chart. The panel will update only when this button is clicked or the active panel is changed so that the **Chart Series Panel** is no longer active.

At the bottom of the **Chart Series Parameter Tabbed Panel** are two buttons used to navigate the tabbed subpanels. They appear exactly as other buttons used to navigate the tabbed panels within the **Parameters Editing Panel**. The buttons are as follows:

- **Subpanel Back Button**: Return to the previous tabbed subpanel.
- **Subpanel Next Button**: Move to the next tabbed subpanel.

These two buttons will be displayed *above* the similar buttons for the **Parameters Editing Panel Tabbed Subpanel**:



8.2 *Usage*

8.2.1 Adding and Editing a Set of Chart Series

To add a set of chart series, click on the **New Button** below the **List of Calculations Table**. If chart series parameters already exist and can serve as a starting point for the new chart series, select the chart series from the table and click on the **Create Copy Button**. A new chart series parameters object will be added to the table and selected for editing. At any time, to switch between chart series to be edited, select the appropriate row of the **List of Calculations Table**.

8.2.2 Removing a Set of Chart Series

To remove a set of chart series, click on the within the first column of the row within the **List of Calculations Table** that corresponds to the chart series. This will remove the row from the table and the corresponding chart series parameters from the chart.

9 Editor (Chart Series Panel): Selected Time Series Panel

The **Select Time Series Panel**, a subpanel within the **Chart Series Panel** shown in Figure 10-1, is used to select time series to be used in chart series calculations. Selections are made from those time series added via input series provider plug-ins. Each time series selection consists of a set of instructions specifying which time series should be included. Any time series matching at least one of the selections will be included.

The **Current Status Display Panel** displays all series selected within the **Time Series Selections Table**.

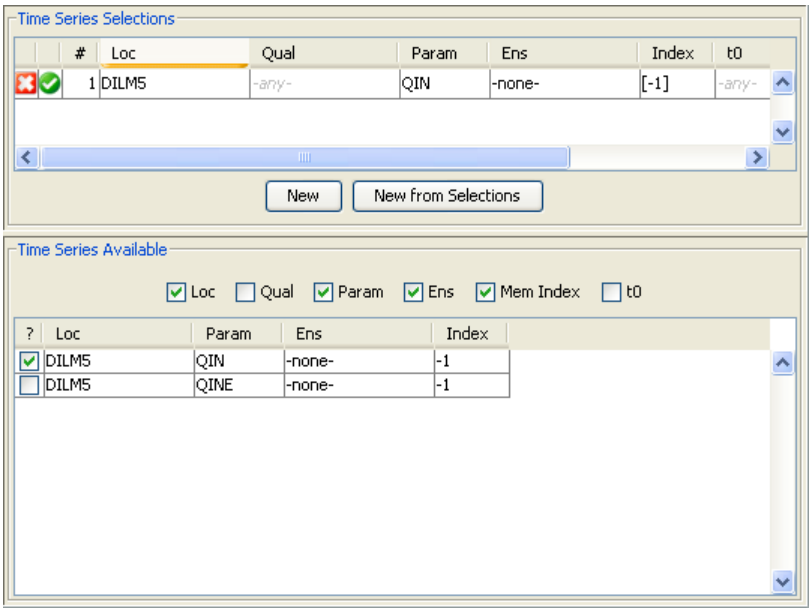


Figure 9-1: Selected Time Series Panel

9.1 *Components*

The following describes **Chart Series Panel** components:

- **Time Series Selections Table**: A list of the time series selections made. Each row of the table specifies the instructions for selecting time series. The table is described in the next section.
- **New Button**: Click to create a new time series selection in which all of the entries in the row are "-none-" or empty.
- **New from Selections Button**: Create a time series selection based on the rows selected within the **Time Series Available Table**.
- **Attribute Check Boxes**: A check box is provided for each of the attributes listed in the next section. When checked, the **Time Series Available Table** will include the column corresponding to the attribute and any selections made based on the table will include that attribute. When unchecked, the table will not include the column and selections will have values set to "-any-" for the unchecked attribute.

- **Time Series Available Table**: A list of the available time series, providing the attributes for each time series with columns dictated by the **Attribute Check Boxes**. Each row will only be included once, so that a row within the table may correspond to multiple time series. For example, if an ensemble is included in the provided time series with 100 members and the "Mem Index" **Attribute Check Box** is unchecked, then the row within the table will correspond to all 100 members.

9.2 *Time Series Selections Table*

The **Time Series Selections Table** provides a list of time series selections that, together, specify which time series are included in the calculations for the given chart series. Each row of the table specifies the instructions for selecting time series. The cells within each row correspond to one attribute of a time series:

1. location id ("Loc")
2. qualifier id ("Qual")
3. parameter id ("Param")
4. ensemble id ("Ens")
5. ensemble member index ("Index")
6. forecast T0 ("T0")

The location id, parameter id, ensemble id, and forecast T0 can all be edited via the table. Each cell when selected becomes a choice box where the user can either set the value manually (for a time series to be included, it must match the attribute exactly) and hit <Enter> or select one of the following:

- "Default": The corresponding default argument (open the **Global Arguments Dialog** to see the choices) is used. The default arguments are: location id – defaultLocationId; parameter id – defaultParameterId; ensemble id – defaultEnsembleId; and forecast T0 – "T0" (a relative date; see the *Graphics Generator Getting Started Manual*).
- "Any": Any value is allowed for that attribute. The cell will display "-any-".
- "None" The value is expected to be empty. This is only useful for ensemble id, as the other attributes cannot be empty. The cell will display "-none-".

For the column "T0", the choice box option "None" is not available. Instead, the following options are available:

- "Fixed Date": Set the date as a fixed date, opening a **Choose Date/Time Dialog** (Section 3.2.1.1, pg 8) to allow the user to set the date.
- "Relative Date": Set the date as a relative date, opening a **Choose Relative Date/Time Dialog** (Section 3.2.1.2. pg. 9) to allow the user to set the date.

The qualifier id and ensemble member index cannot be specified manually. Instead, they must be specified by selecting the appropriate rows within the **Time Series Available Table** with the appropriate checkbox selected and clicking on the **New from Selections Button**.

- Setting the ensemble id column to “main” is equivalent to selecting “None”. In fact, if an argument is used for ensemble id and the user wants to select time series with no ensemble id, then the argument’s value must be set to “main”.

- As a general rule, make the smallest number of specifications possible in order to define a time series selection. For example, if parameter id is sufficient to identify the appropriate time series, then do not include the location id. This will make the product more easily applicable to other locations when building templates.

9.3 *Usage*

9.3.1 Selecting Time Series to Include in the Calculations

To add a time series selection based on one row within the **Time Series Available Table**, click on the checkbox in the first column of that row. To add time series selections based on multiple rows within the table, either (1) select the rows within the table while holding down the <Ctrl> key and click on the **New from Selections Button**, or (2) click on the check box for each row to be selected. To add time series selections from scratch, click on the **New Button** and edit the cells within the row.

When adding selections based on rows of the **Time Series Available Table**, the **Select Time Series Panel** will combine selections, if possible. This affects the member indices and qualifier ids specifically, as the selection is defined by a list for those two attributes.

10 Editor (Chart Series Panel): Aggregators Subpanel

The **Aggregators Panel**, a subpanel within the **Chart Series Panel** and shown in Figure 10-1, is used to specify a sequence of aggregations to perform on the selected time series prior to performing the chart series calculations.

See Appendix A.1 for details about aggregations and the required parameters.

The **Current Status Display Panel** shows the time series that result from performing all of the aggregations on the selected time series.

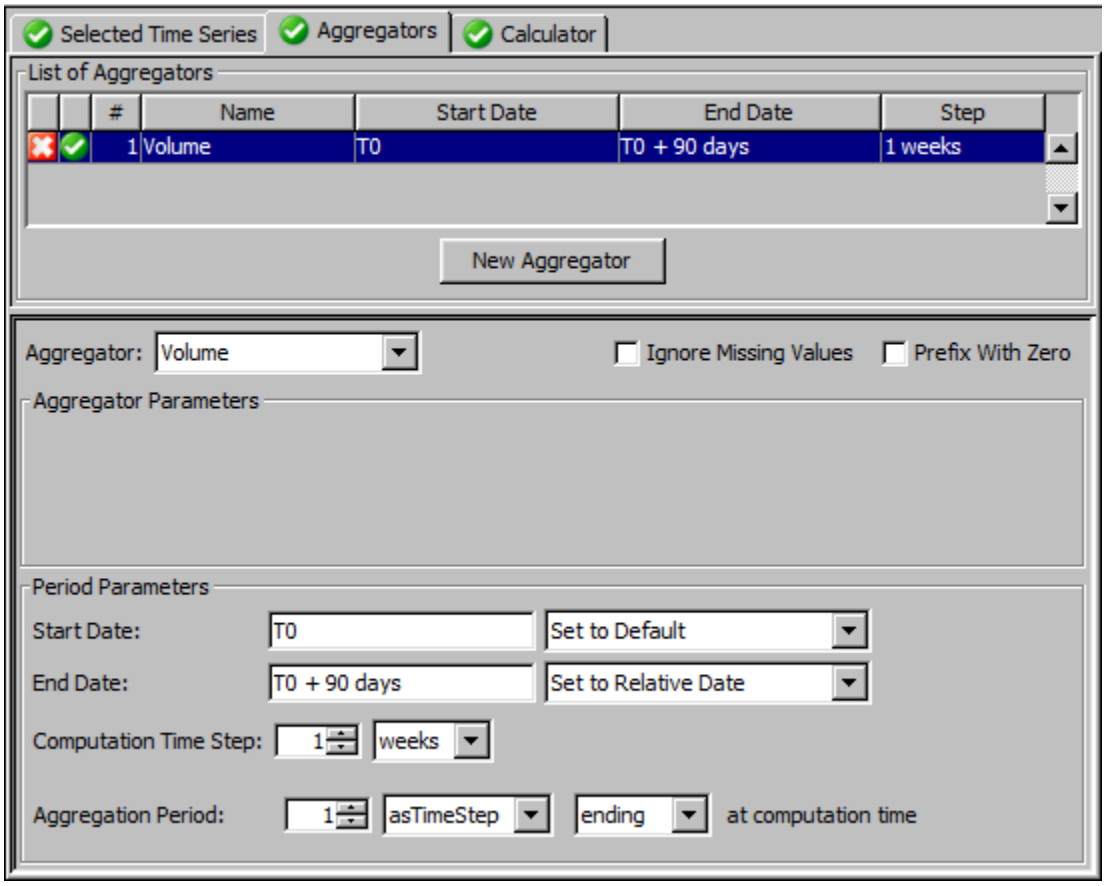


Figure 10-1: Aggregators Panel

10.1 *Components*

The following describes the **Aggregators Panel** components:

- **List of Aggregators Table**: A list of the aggregations to perform on the selected time series in order of application. The "Name" column provides the name of the aggregator plug-in to perform, while the "Start Date" and "End Date" columns specify the aggregation time period and "Step" column specifies the time step. The first column is a

delete column. The second column displays a status icon: if the aggregator was successfully executed or if the aggregator plug-in failed for any reason.

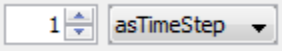
- **New Aggregator Button**: Click on the **New Button** to add a generic "Mean" aggregator with the start time and end time initialized to the start and end time of the first found selected time series and a time step of "1 day".
- **Aggregator Choice Box**: A selectable list of aggregator plug-ins.
- **Ignore Missing Values Checkbox**: Check the checkbox to instruct GraphGen aggregators to ignore missing values during aggregation. When unchecked, if a value during a specific aggregation computation time step is missing, the value for that time step is set to missing. When checked, the missing value will be skipped and the aggregation will be performed using the non-missing values.

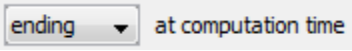
Consider carefully before checking the **Ignore Missing Values Checkbox**, because it can lead to incorrectly computed aggregations. For example, consider a three-month volume computation. If data is missing intermittently throughout the period, then the volume will be smaller than it should, which may be misleading. However, suppose your forecast time (T0) is at the end of the first of those three months, so that data is missing (and expected to be missing) for the first month of the aggregation period. Then the aggregation will result in a *residual volume*, showing how much volume will be contributed over the remaining two months of the three month period.

- **Prefix with Zero Checkbox**: Check the checkbox to instruct GraphGen aggregators to add a zero at the beginning of the aggregated time series, one time step before the first computed time. This can allow for charts to be constructed in which the displayed time series all appear to start from the same value at the forecast time (T0).

Prefixing zero to the beginning of an aggregated time series is only appropriate in some cases. For example, if the aggregation is to yield an accumulation (e.g., accumulated total rainfall from T0 through the end of an aggregation period), then appending zero makes sense, as the value at T0 would then be zero. However, if the aggregation is a daily mean streamflow, then appending zero does not make sense, as the daily mean streamflow at T0, in most cases, will not be zero. In that instance, the input time series should be configured to include observed data prior to and at T0 and the aggregation should be set to start one computation time step <u>before</u> T0, so that a value can be explicitly calculated that will denote the latest observed value at T0.

- **Aggregator Parameters Panel**: A panel used to edit the parameters of the selected aggregator plug-in. It updates whenever a change is made in the **Aggregator Choice Box**. For most aggregator plug-ins, this panel is empty.
- **Start Date Field**: The start time of the overall period of aggregation. Editing is done via a generic **Date Chooser Panel** (see Section 2.1, pg 8).
- **End Date Field**: The end time of the overall period of aggregation. Editing is done via a generic **Date Chooser Panel** (see Section 2.1, pg 8).

- **Computation Time Step Panel**: A text field and choice box that allow the user to specify a quantity and unit for the computation time step of aggregation, specifying the times at which aggregated values are computed. The quantity can be specified by typing it in or clicking on the up/down arrows, , to increase or decrease the value by a single step. The unit can be specified by selecting from the choice box, which includes all units available: "hours", "days", "weeks", "months", "years", or "period". A selection of "period" sets the computation time step to be the entire period of aggregation, so that each time series yields only one value computed at the end of the period.
- **Aggregation Period Panel**: Used to specify the size (width) of the period over which the aggregated value is computed for each computation time step; see Appendix A.1. The first two components, 

, are identical to the **Computation Time Step Panel** components, except that the available time steps are "hours", "days", "weeks", "months", "years", "accumulated", or "asTimeStep" (default). If "asTimeStep" is selected, the size of the aggregation period is identical to the size of the computation time step. The last components, 

, specifies the period anchor for each aggregation computation relative to its computation time step. Each period can either end (default) at the computation time step or be centered at the computation time step. Again, see Appendix A.1 for details.

Earlier versions of Graphics Generator did not separate between the computation time step and aggregation period. Using the default values for the **Aggregation Period Panel** (i.e., not changing any settings) will cause the aggregations to be computed as was done for that earlier version (CHPS 4.0.1 and earlier).

10.2 *Usage*

10.2.1 Specifying Aggregations to Perform

To add an aggregation to perform on the selected time series, click on the **New Button**. Next, select the aggregator to apply from the **Aggregator Choice Box** and specify the overall aggregation period in the **Period Start Field** and **Period End Field**. Then specify a computation time step, and define the size of each aggregation subperiod associated with a computation time and whether that subperiod ends at or is centered on the computation time. This is all specified in the **Period Parameters Panel**. With any change, the **Current Status Display Panel** will be updated to display the new set of aggregated time series in graphical form. When the aggregator plug-in fails to compute, an error message is displayed.

10.3 *Plug-Ins*

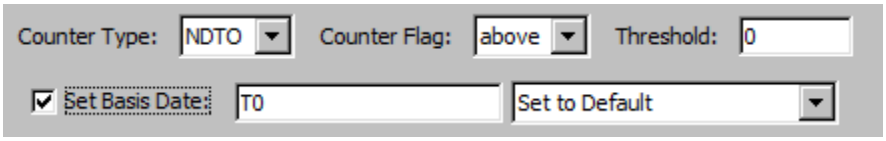
An aggregator plug-in takes a time series and aggregates the data according to parameters, including the period of aggregation, time step, aggregation plug-in, and plug-in specific parameters. There are six input series provider plug-ins released with Graphics Generator.

10.3.1 Counter Plug-in

The counter plug-in counts the number of occurrences of an event to occur in the period of aggregation within the time series. The counter and event is defined by four parameters:

1. Counter Type: The following types of counts may be performed:
   - "NDTO" for the number of time series time steps to the first occurrence of an event (above or below a threshold) within the current aggregation step.
   - "NDIS" for the total number of time series time steps for which the event (above or below a threshold) occurs.
   - "NDMN" for the number of time series time steps to the minimum of the time series within the current aggregation step.
   - "NDMX" for the number of time series time steps to the minimum of the time series within the current aggregation period.
2. Counter Flag: Either "above" or "below"; it defines what comparison will be made with the threshold to be defined. This is not used with the "NDMN" or "NDMX" counter types.
3. Threshold: The value against which to do comparisons. This is not used with the "NDMN" or "NDMX" counter types.
4. Basis Date (optional): The date from which counting should begin. If left unspecified, the default basis date is the start date defined for the aggregation.

The event is specified by the counter flag and threshold; for example "above 10.0" might be an event. The components of the panel for editing the parameters are as shown:



The **Counter Type Choice Box** is used to select the counter type and the **Counter Flag Choice Box** is used to select the flag. The threshold must be entered manually into the **Threshold Field**. If the "NDMN" or "NDMX" counter type is selected, the **Counter Flag Choice Box** and **Threshold Field** will be disabled. The basis date is set via the standard **Date Chooser Panel** (see Section 2.1) and is only used if the **Set Basis Date Checkbox** is checked. If unchecked, the panel will be disabled so that the date cannot be chosen.

10.3.2 Instantaneous Plug-in

The instantaneous plug-in extracts from the input time series the value that applies to a computation time. No parameters are required.

10.3.3 Maximum Plug-in

The Maximum aggregator plug-in computes the maximum of the time series over each aggregation sub-period. No parameters are required.

10.3.4 Mean Plug-in

The Mean aggregator plug-in computes the mean of the time series over each aggregation sub-period. No parameters are required. If the input to the aggregator has units of CFS or CMS and a daily (24-hour) aggregation is performed, then the output will have units of CFSD or CMSD, respectively. Otherwise, the output units equal the input units.

10.3.5 Minimum Plug-in

The Minimum aggregator plug-in computes the minimum of the time series over each aggregation sub-period. No parameters are required.

10.3.6 Sum Plug-in

The Sum aggregator plug-in computes the weighted-sum of all of the values of the time series within each aggregation sub-period weighted by the proportion of the values affected window included in the aggregation sub-period . No parameters are required.

10.3.7 Volume Plug-in

The Volume aggregator plug-in computes volume of a streamflow time series within each time step. No parameters are required, however, the input time series to the aggregator must be mean daily (24-hour) streamflow, having a unit of CFSD or CMSD. If CFSD, then the volume is computed in acre-feet (ACFT), otherwise it is computed in cubic meters (M3). If using instantaneous flow values at a time step of less than 1 day as input to the Volume aggregator, you will first need to add a Mean aggregator plug-in with a 24-hour time step. For example:

List of Aggregators

#	Name	Start Date	End Date	Step
1	Mean	T0	T0 + 90 days	1 day
2	Volume	T0	T0 + 90 days	1 weeks

11 Editor (Chart Series Panel): Calculator Panel

The **Calculator Panel**, a subpanel within the **Chart Series Panel** shown in Figure 11-1, is used to specify the calculator plug-in to use in computing chart series. It is also used to set the appearance of the chart series within the chart.

The **Current Status Display Panel** shows the chart series that result from performing the calculations using as input the aggregated time series as computed based on the **Aggregators Panel**.

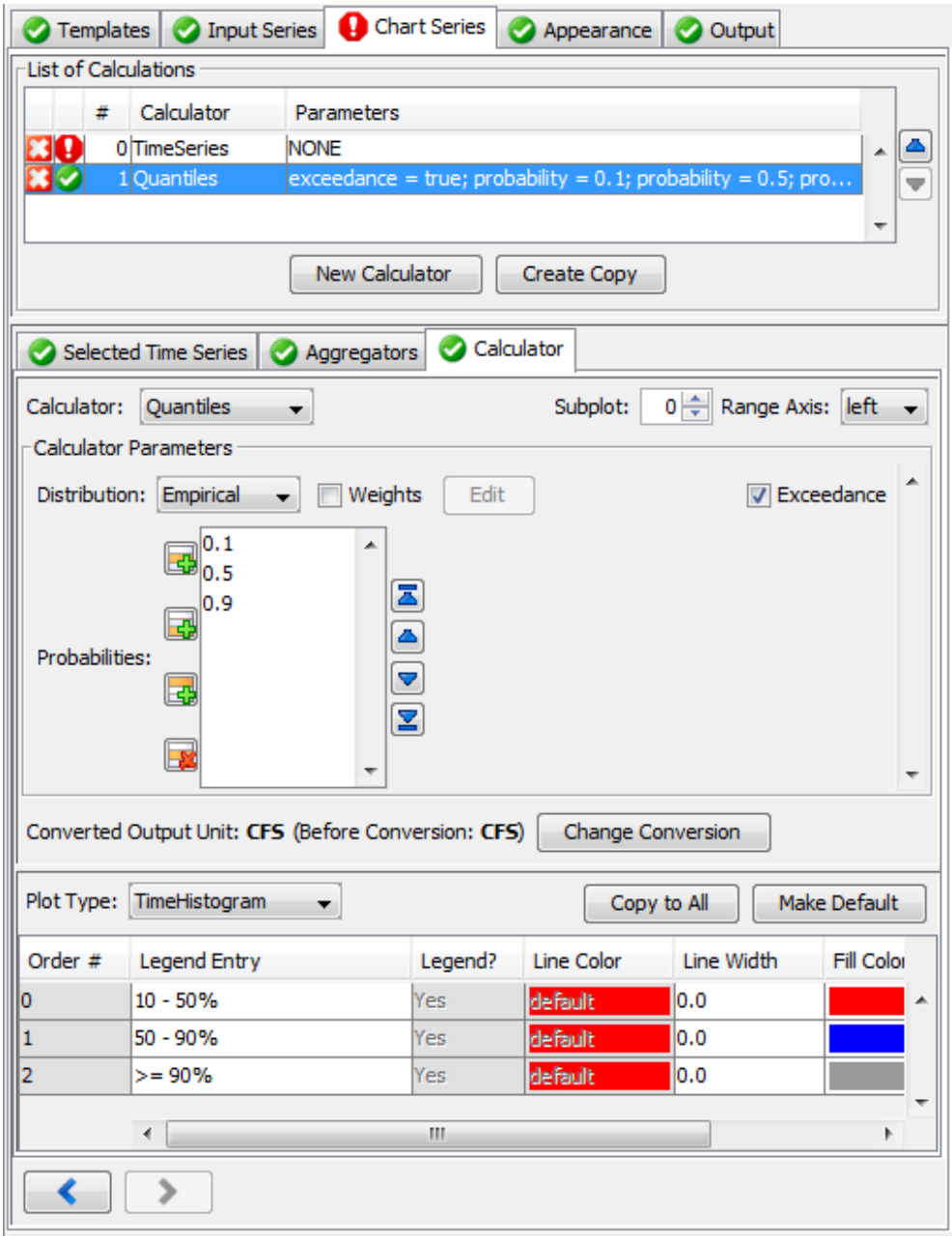


Figure 11-1: Calculator Panel

11.1 *Components*

The following describes the **Calculator Panel** components:

- **Calculator Choice Box**: A selectable list of calculator plug-ins.
- **Subplot Spinner**: Specifies the index of the subplot on which the chart series will be plotted. 0 is the top subplot, 1 is the next one from the top, and so on. The field can be set by typing in the value or using the up/down arrows, .
- **Range Axis Choice Box**: A selectable list of range axis against which to plot the chart series. The list contains "left" and "right".
- **Calculator Parameters Panel**: Displays a panel for editing the parameters for the calculator plug-in and will vary in appearance by calculator. It will update when a change is made in the **Calculator Choice Box**.
- **Unit Conversion Panel**: Allows for user specification of a unit conversion to be applied *after* the computations for the calculator are performed. It displays the output unit after unit conversion, the base unit of the data before unit conversion, and a **Change Conversion Button**. Click on the button to open the **Specify Unit Conversion Dialog**:

  Select the first option, "No unit conversion", to remove unit conversion and use the base units. Select the second option, "Convert to standard unit", in order to select from a list of standard units known to be compatible with the data's base unit. The **Standard Unit Choice Box** will not be enabled until the corresponding radio button is selected. Select the third option, "Define custom conversion", to define a custom linear unit conversion by filling in the **Name Field**, **Coefficient Field**, and **Constant Field**.
- **Plot Type Choice Box**: A selectable list of plot types that can be used to draw the chart series on the chart. The plot types are described in Section 12.4 (pg. 61).
- **Copy to All Button**: Click to apply the value of the current selected cell within the **Series Drawing Parameters Table** to all cells within that column.
- **Make Default Button**: Click to set all the selected cells within the **Series Drawing Parameters Table** to their default values, as computed in the calculator.
- **Series Drawing Parameters Table**: Described in the next section.

11.2 *Series Drawing Parameters Table*

The **Series Drawing Parameters Table** is used to set the parameters of the series drawn on the chart. By default, the appearance of each series is specified by the calculator plug-in. Via this table, the user may override individual settings to customize the appearance of the series. The columns of the table correspond to the series drawing parameters and vary depending on which plot type is selected from the **Plot Type Choice Box**; only those parameters that affect the appearance of the series based on the plot type will be included. For example, when using a box-whisker plot type, the shape parameter is ignored and will not be included in the table because shapes are not drawn for that plot type.

The table columns are:

- "Legend Entry": The name given to the series in the chart legend. This can include arguments (see the *Graphics Generator Getting Started Manual*).
- "Legend?": Flag indicating if the series should be displayed in the legend.
- "Line Color": Color of the line used; also the color used to draw shape outlines.
- "Line Width": Width of the line in pixels.
- "Shape": Shape to use for data points.
- "Shape Size": The size of the shape to use; it is a scalar that multiplies a default shape size (default shape is defined when the size is 1.0).
- "Fill?": Flag indicating if a fill color should be applied to shapes, areas, or boxes.
- "Fill Color": Fill color to use for shapes, areas, and boxes.
- "Box Width": The width of a box in a box-whisker diagram in pixels.
- "Bar Width": The width of a bar in a histogram plot as a proportion of available space.

Each cell value can be edited manually or by selecting from a choice box that appears when the cell is clicked on. The exceptions are the color cells, which can only be edited by clicking on the cell and selecting "Edit Color" from the drop-down choices. The choices in the choice box vary by cell, but will include "default" and "to all", which mimic the function of the **Make Default Button** and **Copy to All Button**, respectively. When editing the "Legend Entry" column, arguments can be included similar to an **Argument Inserting Text Field** (Section 2.2, pg 10).

When a parameter is a default value, the background color of the cell will be gray and the foreground color will be dark gray. If the parameter is not a default value, then the background color of the cell will be white and the foreground color will be black.

The order of the series in the table corresponds to the order in which the series are drawn on the chart, with earlier series drawn on top of later series, and the order in the legend.

11.3 *Usage*

11.3.1 Specifying Calculation to Perform and Series Drawing Parameters

To specify the calculations to perform to compute a chart series and the appearance of that chart series, first select the calculator plug-in from the **Calculator Choice Box**. Then, set the subplot and range axis via the **Sub Plot Field** and **Range Axis Choice Box**. Next, set the parameters of the calculator plug-in via the **Calculator Parameters Panel**.

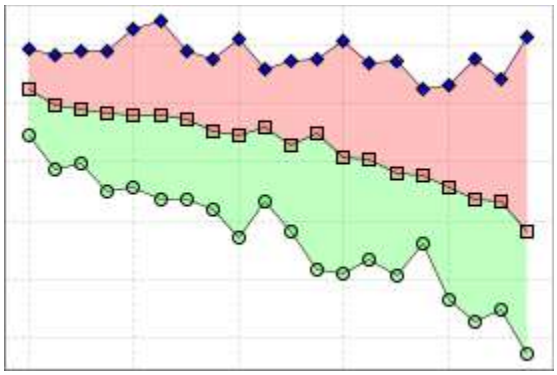
After the calculations are set, modify the appearance of the chart series via the **Series Drawing Parameters Table**. When doing so, be sure to click the **Update Full Chart Button** regularly to view the series in the context of the entire chart.

As changes are made, the **Current Status Display Panel** will be updated to display the series. The **Current Status Display Panel** will only display the chart series being edited; not the full chart.

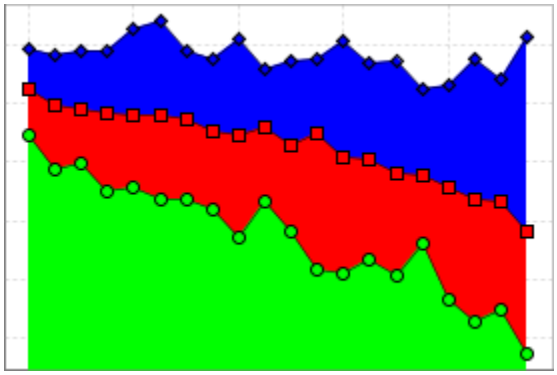
11.4 *Plot Types*

The following plot types can be selected from within the **Plot Type Choice Box**:

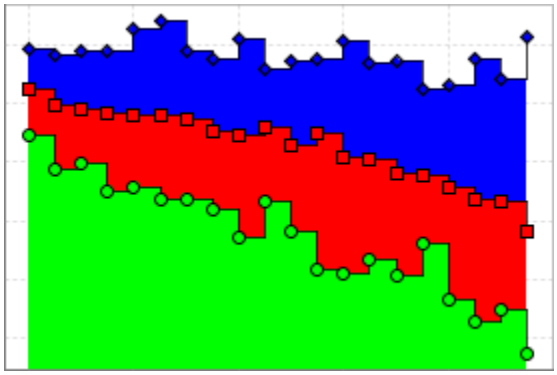
- AreaBetweenLines: Lines and shapes are drawn with areas filled in between the lines. The fill color for the first series listed in the **Series Drawing Parameters Table** applies to the area between the first and second series. The fill color for the last series is only used to fill shapes.



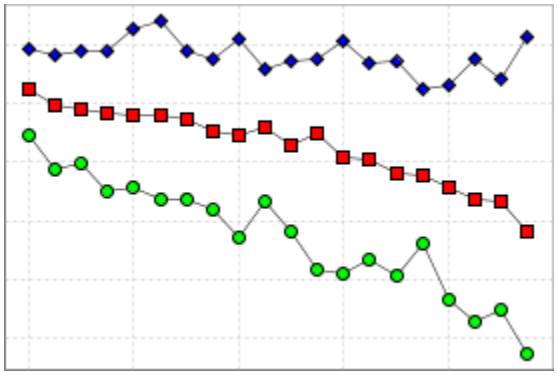
- AreaUnderLines: Lines are drawn with areas filled underneath down to the horizontal axis. The last series in the **Series Drawing Parameters Table** is drawn first, with the preceding series drawn on top of it, and so on, so that the first series is drawn on top.



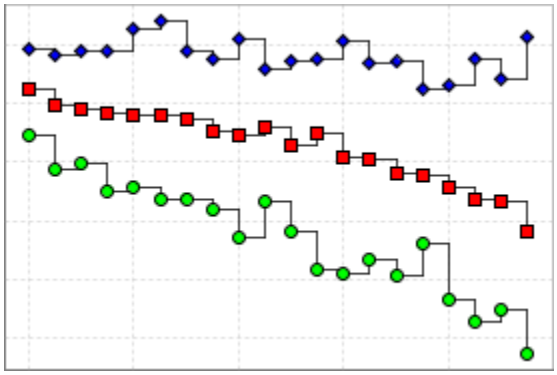
- AreaUnderSteps: A step plot is drawn, such that a value is extended to the next time in the time series at which it steps down or up to the next value. This plot should only be used for instantaneous data. If the data is aggregated, use the TimeHistogram plot. As shown in the example, the plot type can includes shapes at each computational point in the step plot, which will be filled with the same color as the area.



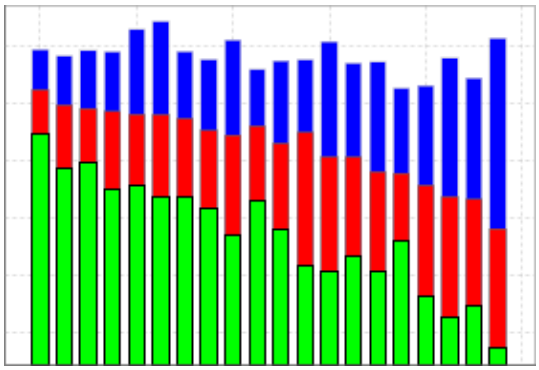
- LineAndScatter: Values are plotted as points connected by lines.



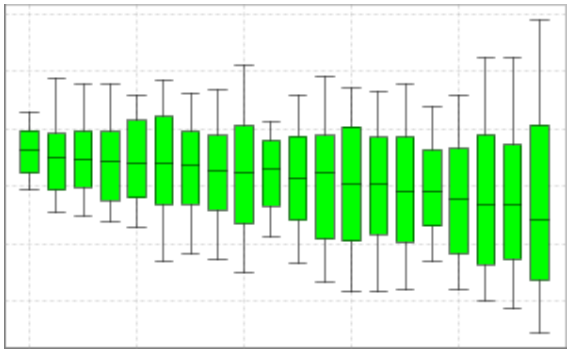
- Step: Identical to an AreaUnderSteps plot, but without areas being filled.



- TimeHistogram: Values are plotted such that a value within the time series is displayed as a bar spanning the area between the start of time step associated with the value and the end of the time step. For instantaneous data, the time step associated with a value is centered around the time of the value. For aggregated (i.e., accumulated) data, the time step associated with a value ends at the time of the value (i.e., the time of the value is associated with the end of the aggregation time step). The width of the bars are specified as a proportion of available space between bars, and is specified by the bar width of the first series listed in the **Series Drawing Parameters Table**.



- XYBoxWhisker: A box-and-whisker diagram is drawn, which is only valid if either 3 or 5 series are calculated via the calculator plug-in. The appearance of the box-and-whisker items is specified by the first series listed in the **Series Drawing Parameters Table**.



11.5 *Plug-Ins*

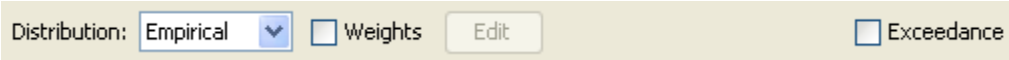
A calculator plug-in takes a set of time series, possibly an ensemble, and computes displayable chart series. There are six calculator plug-ins provided with the release of Graphics Generator. All probability based plug-ins use certain standard parameters and panel components, which are described next.

11.5.1 General Probability-Based Plug-in

A probability-based plug-in treats the set of time series input to the plug-in as an ensemble in order to compute a cumulative distribution function describing the uncertainty in the input. All probability based plug-ins employ the following parameters in addition to plug-in specific parameters:

- Distribution to Fit: Identifies which distribution to fit to the data, with empirical distribution being the default.
- Probability Manual Weights: Weights to apply to each ensemble member for calculating the cumulative probability distribution. Appendix A Section A.2 describes how empirical distributions are computed and weights are applied.
- Exceedance Flag: Flag that indicates if exceedance or non-exceedance values are desired.

These parameters are edited via a common parameters panel:



The components of this panel are as follows:

- **Distribution Choice Box**: Selectable list of available distributions. Note that the Wakeby distribution requires an optimization to estimate its parameters which can sometimes fail to find a solution.
- **Weights Check Box**: If checked, manual weights are used.
- **Edit Weights Button**: When clicked, an **Edit Member Weights Dialog** is opened, which is described in the next section. This button is enabled only when the **Weight Check Box** is checked.
- **Exceedance Check Box**: If checked, exceedance values are displays. If left unchecked, non-exceedance values are displayed.

11.5.1.1 Edit Member Weights Dialog

The **Edit Member Weights Dialog**, shown in Figure 11-2, allows the user to modify weights that are employed when computing the empirical distribution. Within the dialog, the user must specify a range of member indices and then specify weights for each of the members. The components are as follows:

- **Start Member Index Field**: Used to specify the starting member index either by typing the value into the field or by using the up/down arrows, . This start value must be less than the end member index.
- **End Member Index Field**: Used to specify the ending member index either by typing the value into the field or by using the up/down arrows, . This end value must be greater than the start member index.
- **Weights by Member Index Table**: Lists the weights to be applied by member index. The "Normalized" column displays the normalized weights (i.e. weights adjusted to sum to 1), as computed based on the value in the "Weight" column. Only the "Weight" column is editable. There is one row per member index ranging from the starting member index to ending member index.
- **Reset Button**: Click to set all of the weights to 1.
- **OK button**: Click to accept the changes and close the dialog.
- **Cancel Button**: Click to discard the changes and close the dialog.

Weights can only be used if the following is true:

1. all time series within the input time series set have member indices,
2. the smallest member index is not smaller than the starting member index parameter, and
3. the largest member index is not larger than the ending member index parameter.

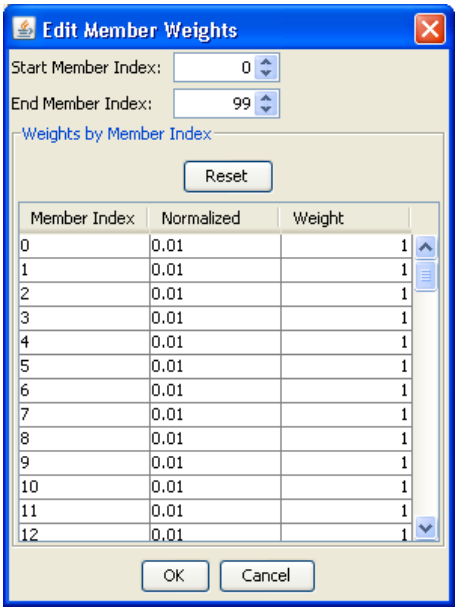
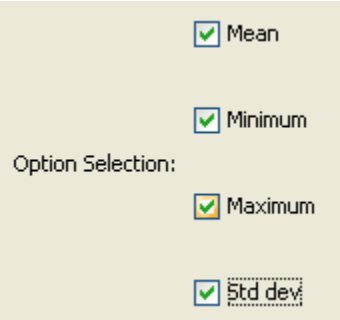


Figure 11-2: Edit Member Weights Dialog.

11.5.2 Moments Plug-in

This plug-in calculates the mean, ±1 standard deviation, minimum, and maximum determined from the given set of time series at each time step. One time series is yielded per desired value. The parameters of the plug-in specify which values are calculated, and are edited via this panel:

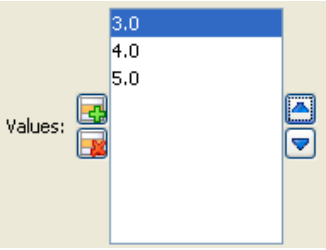


The order in which the check boxes are checked dictates the order in which the series are computed (which dictates which series are drawn first on the chart). Checking the "Std dev" box will yield two individual series within the computed chart series for the calculator: the mean minus one standard deviation (default series legend entry "Mean – Stdev") and the mean plus one standard deviation (legend entry "Mean + Stdev").

11.5.3 Probabilities Plug-in

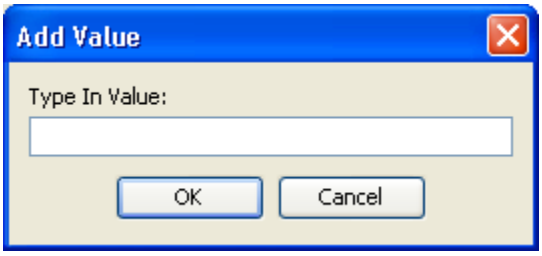
This is a probability-based plug-in. For each value given in a set of values, the plug-in calculates the probability of exceedance or non-exceedance for that value for each time step, depending on the exceedance flag parameter. It yields one time series of probabilities for each given value.

The plug-in parameters specify the values, and are edited via this panel:



The components of the panel are as follows:

- **Add New Value Button**: Click to open an **Add Value Dialog** in which a new value can be entered:

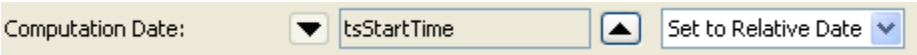


  Enter the value into the **Type In Value Field**, which is an **Argument Inserting Text Field** (Section 2.2, pg 10), and click **OK**.
- **Delete Selected Value Button**: Click to remove all values currently selected in the **Values List**.
- **Values List**: A selectable list of the probabilities currently included.
- **Move Item(s) Up Button**: Click to move the values selected in the **Values List** up one in the order.
- **Move Item(s) Down Button**: Click to move the values selected in the **Values List** down one in the order.

As implied by the components, the order of the values dictates the order of the computed series within the chart series output by the Probabilities calculator plug-in.

11.5.4 Probability Plot Plug-in

This is a probability-based plug-in. This plug-in displays the exceedance or non-exceedance (cumulative distribution) function, depending on the exceedance flag parameters, for each time step of the input time series. It assumes that the first time series in the input set specifies the start time, end time, and time step of all input time series. In addition to the probability-based plug-in parameters, it also includes a single parameter specifying the computation date, or the date for which to compute the function. This date is edited via the following panel:



This panel is a slight variation on the **Date Chooser Panel** (Section 2.1, pg 8), with an **Up Arrow Button**, , and a **Down Arrow Button**, , included to allow for moving to the next or previous time step in the time series, respectively. By default, the computation date is set to the "tsStartTime", which is a relative date (see the *Graphics Generator Getting Started Manual*). If the distribution selected in the **Distribution Choice Box** is not "Empirical", then both the empirical distribution and fitted distribution, based on that selected in the choice box, will be displayed with the fitted drawn on top.

- For this plug-in, the **Distribution Choice Box** will also display a measure of fit, the largest absolute difference (Kolmogorov-Smirnov test statistic) between the empirical and fitted distribution, for each distribution in the list.

- The Probability Plot plug-in yields a numerical domain (x) axis, and is the only one within the Graphics Generator release that does so. This means that it cannot be displayed on the same chart with other calculated chart series that use a time-based domain axis (all other calculator plug-ins yield a time-based domain axis).

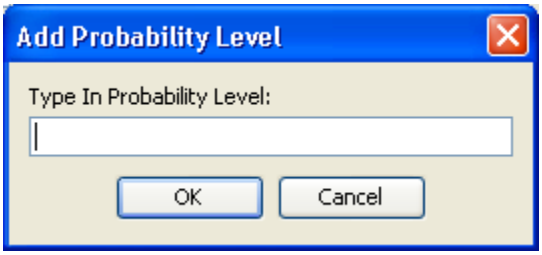
11.5.5 Quantiles Plug-in

This is a probability-based plug-in. For each probability given in a set of probabilities, the plug-in calculates the value for which the probability of exceedance or non-exceedance equals the given probability for each time step, depending on the exceedance flag parameter. It yields one time series of values for each given probability. Note that "MIN" (minimum) or "MAX" (maximum) can also be specified in the list of probabilities, and instruct the calculator to generate a time series of minimum or maximum values among the set of input time series at each time step.

The plug-in specific parameters specify the probabilities, and are edited via this panel:

The components of the panel are as follows:

- **Add New Probability Level Button**: Click to open an **Add Probability Level Dialog** in which a new probability can be entered:



  Enter the value into the **Type In Probability Level Field** and click **OK**.
- **Add Minimum Button**: Click to add "MIN" to the **Probabilities List**.

- **Add Maximum Button**: Click to add “MAX” to the **Probabilities List**.
- **Delete Selected Value Button**: Click to remove all probabilities currently selected in the **Probabilities List**.
- **Probabilities List**: A selectable list of the probabilities currently included.
- **Move Item(s) Up Button**: Click to move the values selected in the **Probabilities List** up one in the order.
- **Move Item(s) Down Button**: Click to move the values selected in the **Probabilities List** down one in the order.

As implied by the components, the order of the probabilities dictates the order of the computed series within the chart series output by the Quantiles calculator plug-in.

11.5.6 Spaghetti Plug-in

The Spaghetti calculator plug-in outputs one series per time series in the input set. Each series has a default legend entry equal to its member index and a color based on a graduated color scheme that starts with blue and moves to red via green. This plug-in is useful if the member indices correspond to climatic years.

11.5.7 Time Series Plug-in

The Time Series calculator plug-in outputs one series per time series in the input set. Only one legend entry, “Series”, is displayed in the chart legend by default, and all time series are red.

12 Editor: Appearance Panel

The **Appearance Panel**, shown in Figure 12-1, is used to specify appearance modifier plug-ins to apply to the chart which will adjust its appearance but not change the chart series. The default appearance of the chart is dictated by two things:

1. Default appearance parameters determined based on the plotted data and hardcoded internal settings.
2. Appearance modifier plug-ins specified in referenced templates.

For a specific template, the Graphics Generator builds the chart based on chart series calculated from referenced templates and chart series calculated specifically for the template and specified in the **Chart Series Panel**. Then appearance modifiers specified in the templates are applied to the chart in the order of the templates. The resulting chart is the *default chart*, whose appearance is modified via appearance modifier plug-ins.

The **Current Status Display Panel** displays the appearance of the base chart.

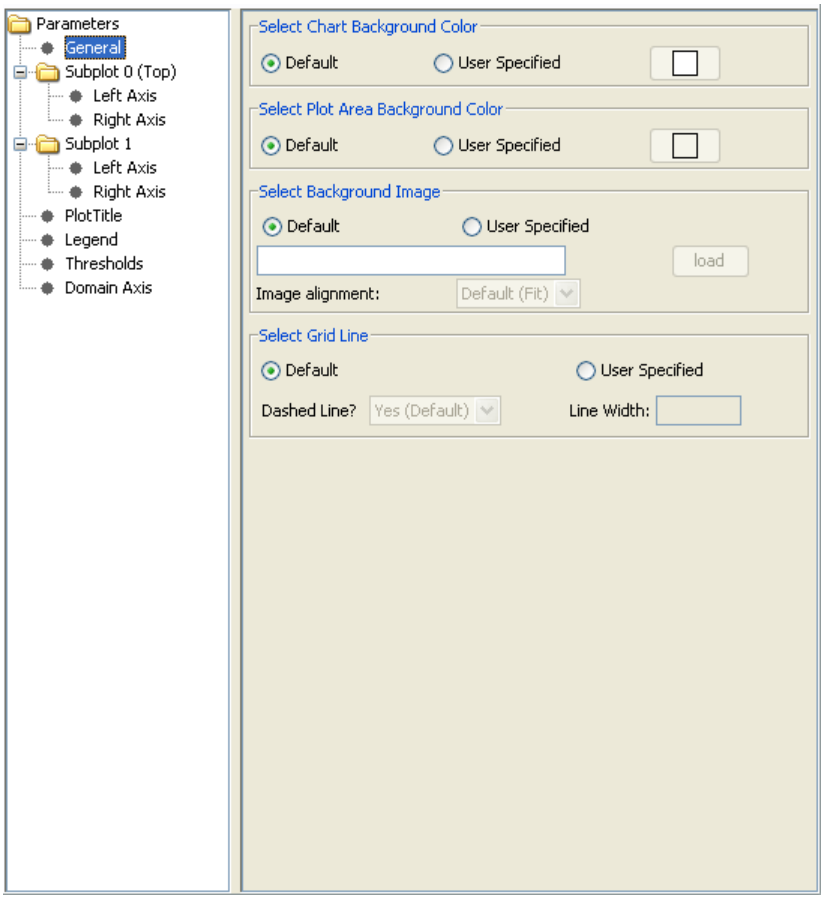


Figure 12-1: Appearance Panel

12.1 *Components*

The following describes **Appearance Panel** components:

- **Plug-in Tree**: Lists all of the appearance modifiers available for the chart in a tree format showing that a modifier can have other modifiers nested within it. Every element in the tree can be selected, except the top level "Parameters" node.
- **Parameters Editing Panel**: Displays a panel for editing the parameters of the modifier and updates any changes in the **Plug-in Tree**.

12.2 *Plug-Ins*

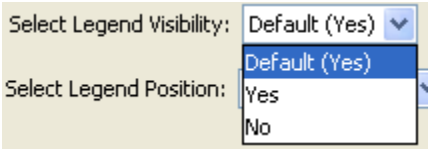
An appearance modifier plug-in changes the appearance of part of the Graphics Generator chart (using JFreeChart). Each of the modifiers is described below. First, however, two subpanels used within some of the plug-in panels are described: (1) a component used to specify if the modifier should be left as its default value, and (2) a component used to modify label text and font.

12.2.1 Default and User Specified Modifiers

Every modifier consists of one or more parameters devoted to modifying one aspect of the corresponding chart component's appearance. For example, the Plot Title modifier includes text and font parameters. Each parameter has a default value determined as described above. The user may choose to use the default value or specify an override value. This is typically done by one of two mechanisms. The first are **Default/User Specified Radio Buttons**:

When the **Default Radio Button** is selected, the default value is used with the rest of the corresponding subpanel being disabled. When the **User Specified Radio Button** is selected, the rest of the subpanel will be enabled allowing the user to specify a value.

The second mechanism used is a **Default/User Specified Choice Box** (selectable list):



Here the legend visibility parameter can be set to "Yes" or "No". The default value is "Yes". When you select "Default…", the default value is used. Note that the "Default…" item in the list will be followed by the default value for the current template, such as "Default (Yes)". However, when either "Yes" or "No" is selected, a user specified override is being used, forcing the flag to be either "Yes" or "No", regardless of the default.

12.2.2 Text and Font Modifier Component

When a modifier includes the capability of modifying text or font, such as those that modify a chart label, the standard text and font modifying component, shown in Figure 12-2, is used. There are two subpanels: **Select Font Panel** and **Select Text Panel**. Each includes **Default/User Specified Radio Buttons**. Additionally, the **Select Font Panel** contains these components:

- **Font Name Choice Box**: A list of available fonts.
- **Font Size Field**: Specifies the size of the font. The size can be entered directly or clicking on the up/down arrows, .
- **B Button**: Sets the font to bold.
- ***I* Button**: Sets the font to italicized.
- **Color Button**: Set font color. Open up a **Color Chooser Dialog** to select a font color.

The **Select Text Panel** displays a **Text Area** which can be edited by the user and displays the user specified text in the font dictated by the settings in the **Select Font Panel**. The **Text Area** is an **Argument Inserting Text Area** (Section 2.2, pg 10).

For both panels, when the user clicks on the **Default Radio Button**, the panel is reset to display the default value, which may vary depending on the modifier plug-in.

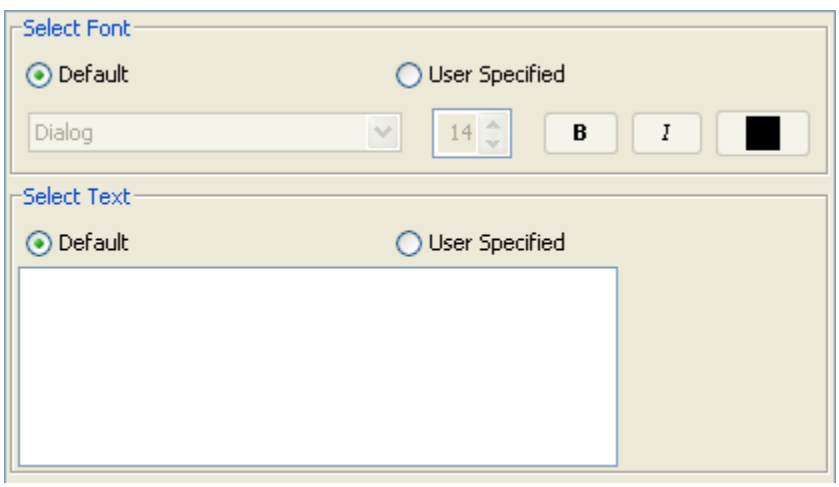


Figure 12-2: The standard text and font modifying component.

12.2.3 General Appearance Modifier

A General appearance modifier plug-in, displayed in Figure 12-3, is used to specify various features about the chart that are not specific the data. The features are as follows:

- Chart Background Color: The background color used for the chart. White, by default.
- Plot Area Background Color: The background color used for plot areas within the chart. White and transparent, by default.

- Background Image: The background image of the chart. The image is specified by providing an image file name and can be left justified, right justified, centered, or stretched to fit the chart (default). An example background image, a NOAA watermark, is included in the installation (see Chapter 2 list page number).
- Grid Line Settings: The grid line appearance for all subplots within the chart. The grid lines can be either dashed lines (default) or solid lines, and the width of the lines can be specified (0.5 by default).
- Default Time Zone: The default time zone used in the chart; for example, in tick marks along the domain axis of a time series plot.

For the background colors, **Default/User Specified Radio Buttons** are used to specify if the user is overriding the default colors, and a **Select Color Button** is provided displaying the currently selected color (default or overridden). Clicking on the button opens a **Choose Color Dialog** to select a color.

For the background image, **Default/User Specified Radio Buttons** are used to specify if the user is overriding the default background image, which is none. If overridden, the user can click on the **Select Image File Button** to specify an image file using a standard file browser. The image alignment is specified in the **Image Alignment Choice Box**.

For the grid line appearance, **Default/User Specified Radio Buttons** are used to specify if the user is overriding the grid line appearance. If overridden, the user can specify whether or not the line is dashed by selecting from the **Dashed Line Choice Box**, which includes a default option. The line width is specified in the **Line Width Text Field** and must be a decimal number.

For the time zone, **Default/User Specified Radio Buttons** are used to specify if the user is overriding the default, which is the time zone used in CHPS. If overridden, the user can specify the time zone via the **Time Zone Choice Box**, which is an **Argument Inserting Choice Box**.

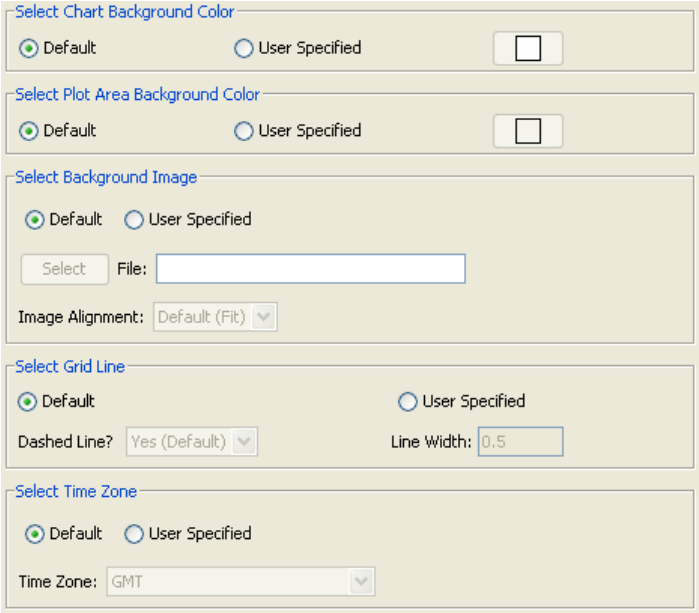
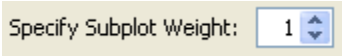


Figure 12-3: General appearance modifier editing component.

12.2.4 Subplot Appearance Modifier

A Subplot appearance modifier plug-in, displayed in Figure 13-4, is used to specify the weight given to the subplot, whether to reverse the rendering order of the series and data sets drawn on a plot, and the background image and color for the subplot. It also contains two axis appearance modifiers, described later. There is one subplot appearance plug-in defined per subplot within the overall chart.

The subplot weight parameters specify the weight to give the plot when determining the heights of each plot in the generated chart. For example, if there are two subplots, the first having weight 1 and the second having weight 2, then the second subplot will be twice as tall as the first subplot within the overall chart. The subplot weight parameter is specified via the **Specify Subplot Weight Field**:



The subplot weight is initialized to 1. A user can change the value by entering a value or clicking on the up/down arrows, .

Whether to reverse the rendering order is specified in the **Select Reverse Rendering Choice Box**, with "No" being the default. Normally, the first series displayed in the legend (if one) is drawn on top of the second series, and the second on top of the third, and so forth. By reversing the order, the last series is drawn on top of all others. This may be important for histograms or area plot types. This flag reverses both the drawing order of the output from all calculators plotted on a single subplot and the drawing order of the series output within each of those calculators.

The **Select Reverse Legend Item Order Choice Box** allows for the ordering of the items in the legend to be reversed relative to the drawn order of the series. The default legend item ordering is dictated by the setting of the **Select Reverse Rendering Choice Box** just described.

The background image and color are specified via components identical to that used in the General Appearance Modifier editing components (Section 12.2.3, pg 72).

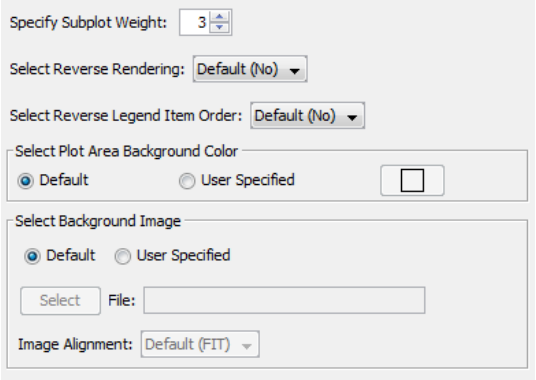


Figure 12-4: The subplot appearance modifier plug-in editing component.

12.2.5 Axis Appearance Modifier

An Axis appearance modifier plug-in, shown in Figure 12-5, exists for the domain (x) axis and the left and right range (y) axis of each subplot. It is used to specify the following:

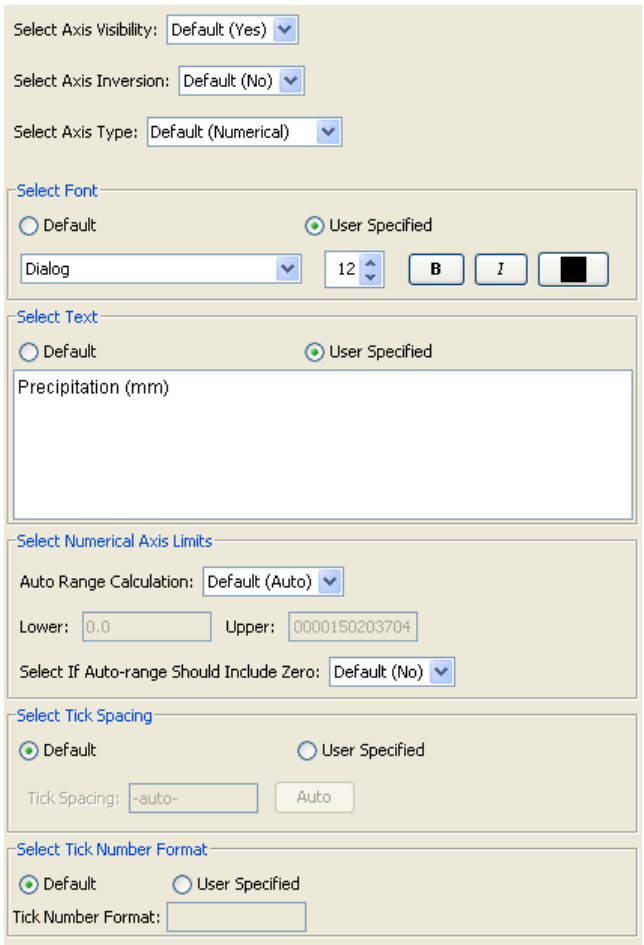


Figure 12-5: The axis appearance modifier plug-in editing component.

- Axis Visibility: Specifies if axis should be displayed.
- Axis Inversion: Specifies if axis should be inverted, meaning that, for example, if the axis is vertical then it and any corresponding plotted chart series will appear upside down (larger values toward the bottom of the axis).
- Axis Type: Specifies the type of axis, and can be one of the following:
    - "Numerical": A linear axis with limits determined based on the plotted data.
    - "Logarithmic": A logarithmic axis in which the plotted values are transformed prior to plotting. Limits are determined based on the plotted data.
    - "Probability": A linear axis with a minimum of 0, maximum of 1, and tick marks spaced 0.1 apart.
    - "Normalized Probability": A probability axis that has been transformed via a normal distribution. See Appendix A Section A.3.

    - “Time”: A temporal axis, only appropriate for the domain (x) axis when time series are plotted.
    - “Translated”: A numerical axis computed based on the opposite axis. Only applicable to a range (y) axis that does not have any data plotted against it.
- Label Font: Specifies the font for the axis label.
- Label Text: Specifies the text for the axis label.
- Axis Limits: Specifies the lower and upper bounds of the axis.
- Tick Spacing: Specifies the spacing between tick marks along the axis.
- Decimal Places (numerical axis only): Specifies the decimal places to display in a numerical tick mark.
- Date Tick Format (time axis only): Specifies the format of tick marks for a time axis.
- Initial Hour for Date Ticks (time axis only): Specifies the hour of the first tick mark placed along a time based axis.

Standard **Default/User Specified Choice Boxes** are used for the visibility, inversion, and axis type, whereas **Default/User Specified Radio Buttons** are used for the remaining components. The label text and font are specified via standard text and font modifier components.

12.2.5.1 Numeric Axis Parameters

Displayed in Figure 12-5 are the editing components for the axis range, tick spacing, and tick label format for a numerical axis, including logarithmic, probability, and normalized probability axis. The tick spacing and tick number format of the components uses **Default/User Specified Radio Buttons**, while the limits uses an **Auto Range Calculation Choice Box**, with selections of “Default”, “Auto”, and “Manual”. The axis limits are specified within the **Lower Field** and **Upper Field**, both of which must be numbers. The two fields are updated to show the manually specified or automatically calculated limits whenever a choice is made from the **Auto Range Calculation Choice Box**. The tick spacing is specified within the **Unit Spacing Field** which must be either “-auto-” to use the automatically computed value or a number. Click on the **Auto Button** to set the field to “-auto-”.

The format of the tick labels is specified via a format *number format pattern*, provided in the **Tick Number Format Field**. The number format pattern is defined by a sequence of characters, each of which is defined in Table 12-1. Examples of possible number formats are provided in Table 12-2, which displays example tick mark labels for four numbers shown at the top of each column and for patterns shown in the first column:

For more details, see
http://download.oracle.com/javase/tutorial/i18n/format/decimalFormat.html.

Table 12-1: Characters that can be used in the number format pattern.

Symbol	Description
0	a digit
#	a digit, zero shows as absent
.	placeholder for decimal separator
,	placeholder for grouping separator
E	separates mantissa and exponent for exponential formats
;	separates formats
-	default negative prefix
%	multiply by 100 and show as percentage
?	multiply by 1000 and show as per mille
X	any other characters can be used in the prefix or suffix
'	used to quote special characters in a prefix or suffix

Table 12-2: Example labels generated for four numbers using example patterns.

Pattern	1000	1	0.1	0.01
<nothing>	10	1	0.1	0.01
0.000	1000.000	1.000	0.100	0.010
#.###	1000	1	0.1	0.01
0000	1000	0001	0000	0000
####	1000	1	0	0
##%	100000%	100%	10%	1%
###,###.00%	100,000.00%	100.00%	10.00%	1.00%

12.2.5.2 Time Axis Parameters

If the axis is time-based, then the numerical axis editing components are replaced by those shown in Figure 12-6. The components for editing the tick spacing, tick label format, and initial hour for date ticks use **Default/User Specified Radio Buttons**, while the editing component for axis limits uses the **Auto Range Calculation Choice Box** with selections of “Default”, “Auto”, and “Manual”. The lower and upper bounds for the axis are displayed in the **Lower Bound Panel** and **Upper Bound Panel**, respectively, which allows for modifying the dates via **Date Chooser Panels** (Section 2.1, pg. 8). The tick spacing is specified via an **Auto Checkbox**, and a **Unit Spacing Spinner** and **Choice Box**. If the **Checkbox** is checked, then the limits are automatically calculated, otherwise they are manually specified using the **Spinner** to specify the quantity and **Choice Box** to specify the time unit. The tick spacing editing components are updated whenever a choice is made from the **Auto Range Calculation Choice Box** to reflect the selected values. The date tick format is specified in the **Date Tick Format Text Area** and must use the same format as that format string described in Section 2.2.1.1 (pg. 11). The initial hour for date ticks is specified via the **Hour of Day (0-23) Spinner**, and is always specified in GMT, regardless of the axis displayed time zone.

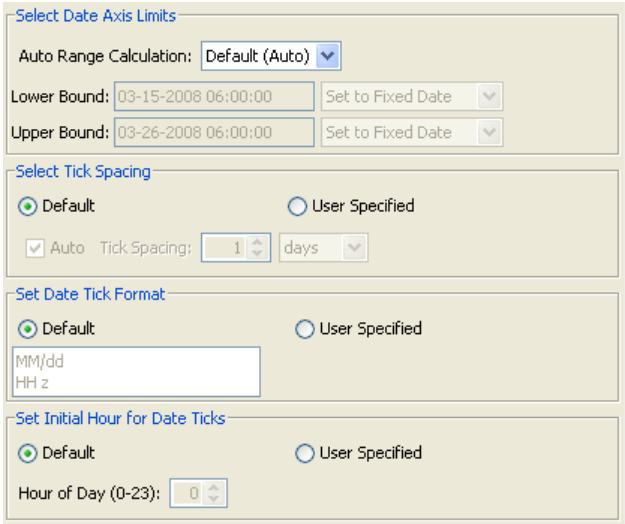
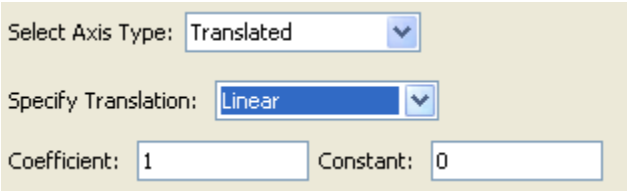


Figure 12-6: Editing components for time-axis specific axis modifier parameters.

12.2.5.3 Translated Axis Parameters

If the axis type is set to "Translated", then a panel will be displayed below the **Select Axis Type Choice Box** that can be used to specify the translation:



By default, the translation will be "Linear", with the coefficient and constant of the linear transformation being specified in the **Coefficient Field** and **Constant Field**. The other two choices, "StageToDischarge" or "DischargeToStage", apply a rating curve to the opposite axis to compute the tickmarks of the translated axis. In either case, a location id is required:

If the **Use Default Location Check Box** is checked, then the location corresponding to predefined argument "defaultLocationId" (see the *Graphics Generator Getting Started Manual*) will be used. If unchecked, the location id can be entered in the **Override Location Id Text Field** which is an **Argument Inserting Text Field** (Section 2.2, pg. 10).

12.2.6 Plot Title Appearance Modifier

The Plot Title appearance modifier component, shown in Figure 12-7, is used to specify the following:

- Plot Title Text: Specifies multiple lines of text to display in plot title.
- Plot Title Font: Specifies font and color of text.
- Plot Title Border Line Widths: Specifies line width of each side of rectangular border drawn around title.
- Plot Title Border Color: Specifies the color to use to draw the border.
- Plot Title Text Insets: Specifies spacing in pixels around text within the border.
- Plot Title Horizontal Alignment: Specifies the alignment (CENTER, LEFT, RIGHT) of the title and border within the chart.
- Plot Title Text Alignment: Specifies the alignment (CENTER, LEFT, RIGHT) of the text within the border rectangle.

The text and font are specified using standard text and font components. The border line widths of the border are specified via the **Top Line Width Field**, **Left Line Width Field**, **Bottom Line Width Field**, and **Right Line Width Field**. Each field must be a number. The border color is specified by clicking on the **Border Line Color Button** which opens a **Choose Color Dialog** (Section 2.3, pg. 13) to be used to select a color. The text insets are specified via field similar to the border line widths. The horizontal and text alignments are specified via the **Select Horizontal Alignment** and **Select Text Alignment Choice Boxes**, each of which provides CENTER, LEFT, and RIGHT as options, with CENTER being the default.

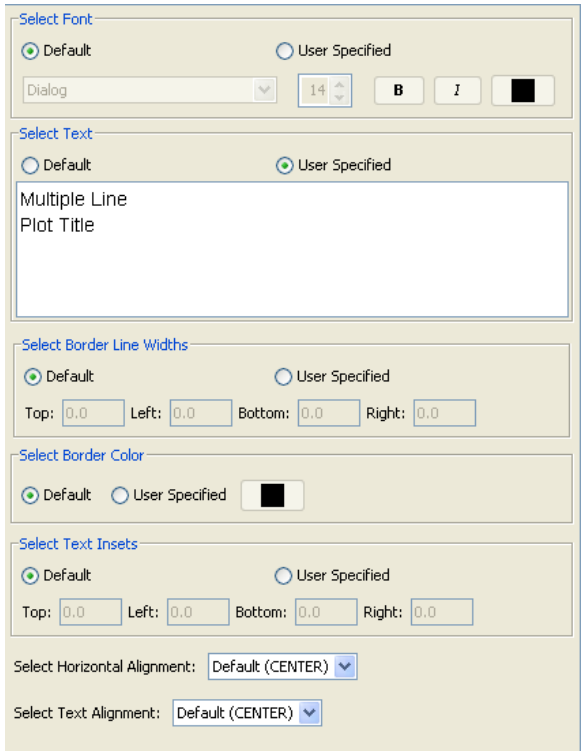


Figure 12-7: Plot title appearance modified editing component.

12.2.7 Legend Appearance Modifier

The Legend appearance modifier, shown in Figure 12-8, is used to specify the following:

- Legend Visibility: Specifies if the legend should be displayed.
- Legend Position: Specifies where to place the legend: on the “Top”, “Right”, “Left” or “Bottom” of the chart.
- Legend Title Font: Specifies the font to use for the title of the legend, if there is one.
- Legend Title Text: Specifies the title of the legend.
- Border Line Width: Specifies the width of the border line to be drawn around the legend. A width of 0 implies no border.
- Border Line Color: Specifies the color of the border line.
- Legend Entry Font: Specifies the font to use for entries in the legend.

The legend visibility and legend position are both specified using **Default/User Specified Choice Boxes**, whereas **Default/User Specified Radio Buttons** are used for the remaining components. The legend title and font are specified via standard text and font modifier components, which the legend entry font is specified using a standard font modifier component.

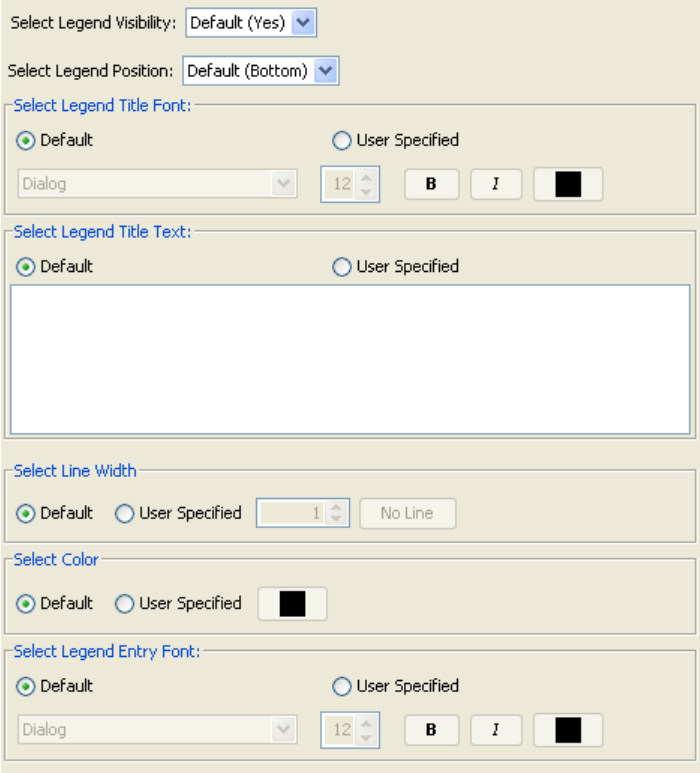


Figure 12-8: Legend appearance modifier editing component.

The border line width, if not default, is set within the **Border Line Width Spinner**. The **No Line Button** can be clicked to set the line width to 0. The border line color is specified by clicking on

the **Border Line Color Button** which opens a **Choose Color Dialog** (Section 2.3, pg. 13) to be used to select a color.

12.2.8 Thresholds Appearance Modifier

The Threshold appearance modifier, shown in Figure 12-9, specifies marks and zones that must displayed on the plot highlighting key values or regions along the domain and range axis. Each mark or zone is specified via threshold parameters, so that the Threshold appearance modifier specifies a list of threshold parameters. Threshold parameters include the following:

- Identifier: A unique identifier for the threshold. Arguments can be used for the identifier, and should be used if a template is being created. An *evaluated identifier* is the identifier after its arguments have been replaced by their argument values.
- Visible Flag: Indicates if the threshold should be drawn on the chart.
- Include in Axis Limits: Indicates if the threshold should be included when calculating default axis limits (i.e., if the default range should include that threshold).
- Font: Font applied to the mark or zone label.
- Text: The label text.
- Label Anchor: The position of the label relative to the mark or zone.
- Color: The color of the mark or zone.
- Line Width: The width of a mark line.
- Subplot Index: The index of the subplot on which the mark or zone is to be drawn.
- Axis Id: The identifier of the axis the zone should be drawn against: “domain”, “left” (default), or “right”.
- Zone Flag: Indicates if a zone or mark is used.
- Axis Value Start: The value used for a numerical mark or the starting value of a zone. It can include arguments, including using the thresholdValue argument function, but after replacing arguments the value must be a number or “unbounded”. If unbounded, then the threshold must be a zone and the end value cannot be unbounded.
- Axis Value End: The end value of a zone. It can include arguments, but after replacing arguments the value must be a number or “unbounded”. If unbounded, then the start value cannot be unbounded.
- Date Axis Value Start: The date used for a time mark or the starting date of a zone. If unbounded, then the threshold must be a zone and the end date cannot be unbounded.
- Date Axis Value End: The end date of a zone. If unbounded, then the start date cannot be unbounded.

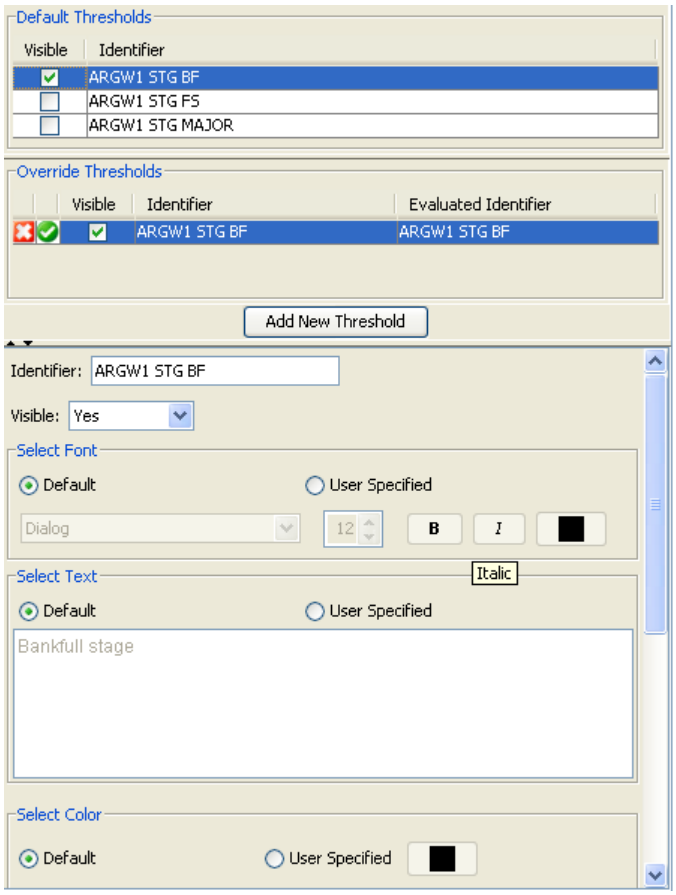
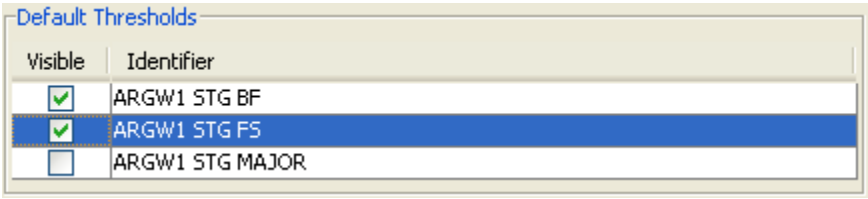


Figure 12-9: Thresholds appearance modifier editing component.

12.2.8.1 Managing Thresholds

Default thresholds are loaded based on the flag in the **Include Thresholds Checkbox** in the **Input Series Panel**. They are listed in the **Default Thresholds Table**, which also includes a checkbox that can be clicked to change the visibility of the thresholds:

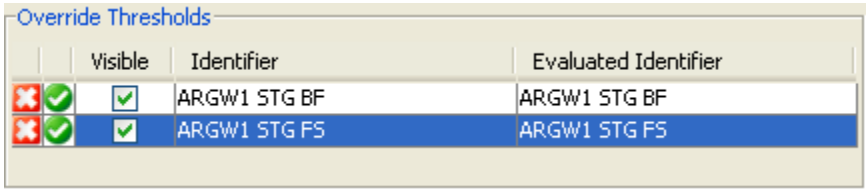


The default threshold identifier will always be set to

```
<location id> <parameter id> <threshold id>
```

where location id and parameter id identify the time series data type, and threshold id identifies a threshold for that time series.

A user may choose to override a default threshold or define a new threshold. Such thresholds are listed in the **Override Thresholds Table**:



The table includes five columns:

1. A delete column.
2. A column that displays a status icon: if the threshold parameters are valid, meaning they either override a default threshold that can be found or are fully specified with no corresponding default; or if the threshold parameters are supposed to override a default set of parameters, but the default cannot be found. The latter will occur if, for example, a default threshold is made visible and then a change is made to the input series in the **Input Series Panel** such that the identifiers of the default thresholds change. When override threshold parameters are invalid, the chart will be drawn without that threshold and a warning message will be sent to the log window.
3. A "Visible" column, which displays the visibility of the threshold as a checkbox (if visible, it will be checked).
4. An "Identifier" column, displaying the identifier for the threshold which can include arguments (see the *Graphics Generator Getting Started Manual*).
5. An "Evaluated Identifier" column, displaying the value of the identifier after any arguments have been replaced.

To override a default threshold, the evaluated identifier for the override threshold must be identical to the identifier of the default threshold. When a selection is made from the **Default Thresholds Table**, the corresponding override threshold, if one exists, is selected in the **Override Thresholds Table**, and vice-versa.

To add a new threshold, click on the **Add New Threshold Button** and specify an identifier. If the evaluated identifier corresponds to a default threshold identifier, it is assumed to override that default.

12.2.8.2 Threshold Parameters Panel

When a threshold is selected in either table, a **Threshold Parameters Panel**, shown in Figure 12-10, will be displayed below the two tables.

When modifying a default threshold, once a change is made in the panel, an override threshold will be created and added to the **Override Thresholds Table**. To revert back to the default parameters, delete the override threshold from the table.

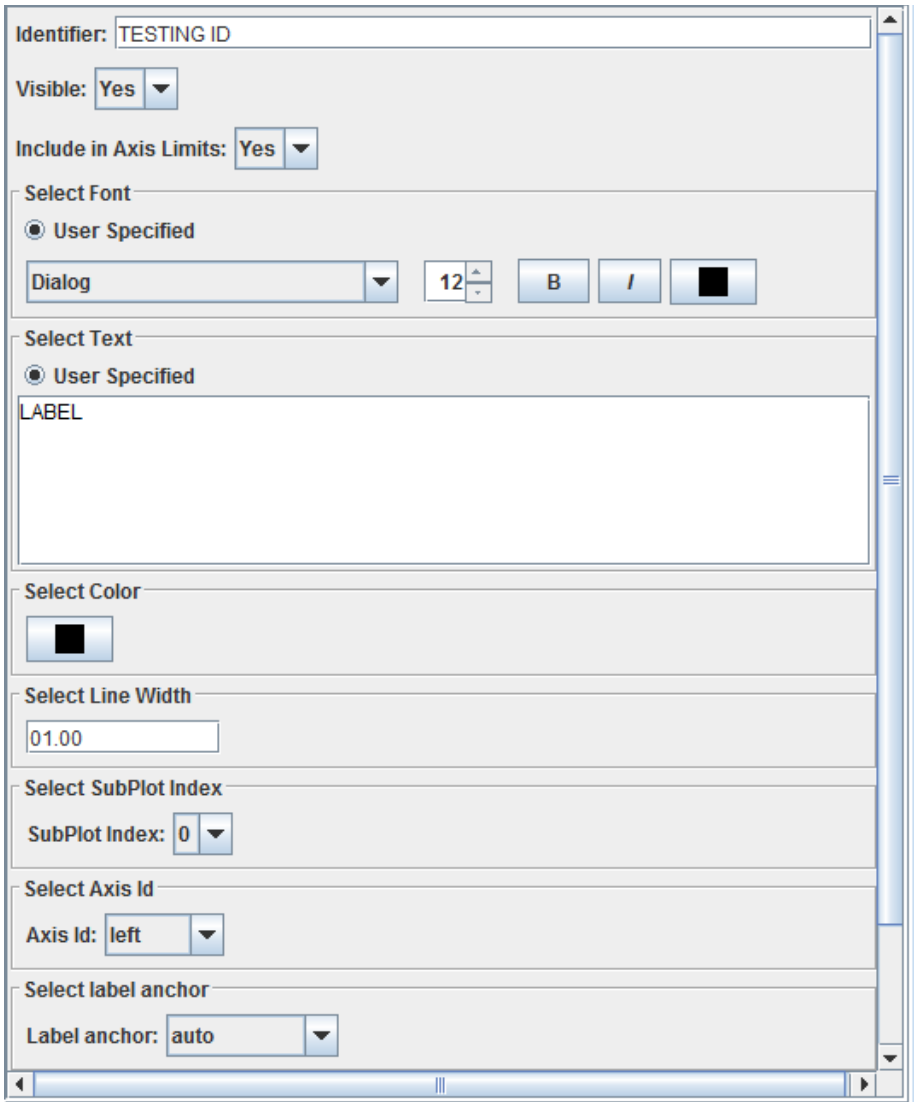
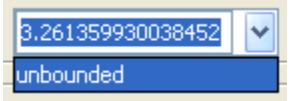


Figure 12-10: Threshold Parameters Panel (portion).

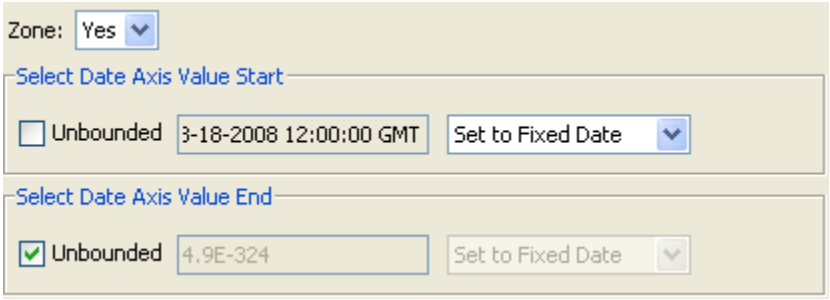
Each parameter displayed in the **Threshold Parameters Panel** can be either user specified or default, if a corresponding default threshold exists. This choice is made either by using **Default/User Specified Radio Buttons** or **Default/User Specified Choice Boxes**. If no default threshold exists whose identifier equals the evaluated identifier of the threshold being modified, then all parameters must be set, and no default radio buttons or choice boxes will be made available in the panel.

The values or times for a threshold marker or zone are modified at the bottom of the **Threshold Parameters Panel**. Which component is displayed depends on what type of axis the threshold is plotted against. If the axis is numerical, then a **Select Axis Value Start Panel** will be displayed, and, if it is a zone, a **Select Axis Value End Panel** will be displayed, as shown in Figure 12-10. The start and end values are specified in **Axis Value Start Choice Box** and **Axis Value End Choice Box**, respectively. Each can be edited manually or set to "unbounded" by selecting it from the choice box:



Note that an unbounded value is only allowed if the threshold is a zone.

If the axis is time-based (typical of the domain axis), the two components are the **Select Axis Date Start** and **Select Axis Date End Panels**:



For times, the value can be edited via a **Date Chooser Panel** (see Section 2.1, pg 8) or can be set to be unbounded if it is a zone by clicking on the **Unbounded Checkbox**. If unbounded, then the **Data Chooser Panel** will be disabled; to set a date, the **Unbounded Checkbox** must be unchecked first.

12.2.9 Subtitles Appearance Modifier

The Subtitles appearance modifier, shown in Figure 12-11, specifies subtitles that are displayed on the chart on any side of its subplots. Each subtitle is specified via subtitle parameters, so that the Subtitles appearance modifier specifies a list of subtitle parameters. Subtitle parameters are identical to the Plot Title parameters specified in Section 12.2.6, pg 79. In addition, subtitle parameters include the parameter Subtitle Position, which specifies the position of the subtitle relative to the subplots (TOP, LEFT, BOTTOM, RIGHT).

If a subtitle position is TOP, it will be displayed between the plot title and the subplots. If a position is identical to that of the legend, it will be displayed between the legend and the subplots.

Subtitles specified in referenced templates (see the *Graphics Generator Getting Started Manual*) are always drawn on the plot. It is impossible for those subtitles to be made invisible or replaced by the subtitles defined in the **Appearance Panel**. For this reason, it should be carefully considered before adding a subtitle to a template.

12.2.9.1 Managing Subtitles

The subtitles defined for the template are listed in the **List of Subtitles Table**. The table includes two columns:

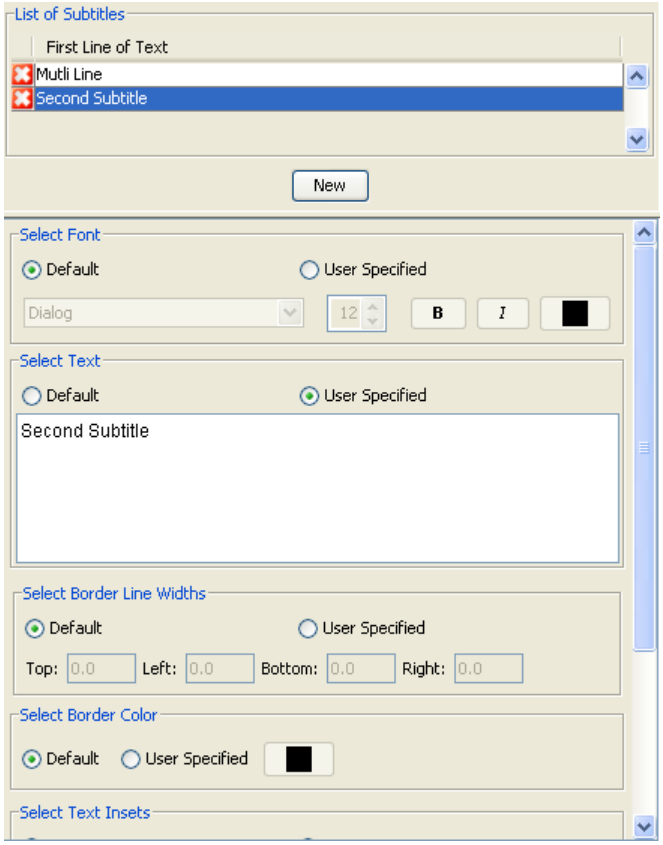


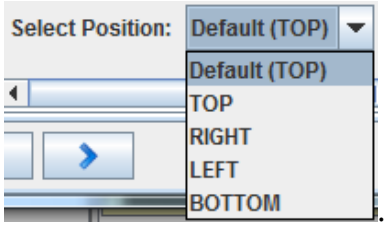
Figure 12-11: Subtitle Parameters Panel.

1. A delete column.
2. A column that displays the first line of text of the subtitle.

The **New Button** below the table is clicked, a new subtitle is added with no text and is selected.

12.2.9.2 Subtitle Parameters Panel

The **Subtitle Parameters Panel** is displayed below the **List of Subtitles Table** and **New Button**. It is updated whenever a row of the **List of Subtitles Table** is selected and displays components used to modify the parameters of the selected subtitle. It is identical to the editing component for the plot title appearance modifier (Section 12.2.6, pg. 79) except that it includes a **Select Position Choice Box** for selecting the position (TOP is default):


Select Position:
Default (TOP)
Default (TOP)
TOP
RIGHT
LEFT
BOTTOM

13 Editor: Output Panel

The **Output Panel**, shown in Figure 13-1, is used to specify output generator plug-ins that will be applied when the product is generated via a workflow to generate output files. The parameters specified in this panel are only saved when a product template is saved, not when a referenced template is saved, as they only apply to product templates.

The **Current Status Display Panel** displays a preview of the output generated from the plug-in, and is updated whenever the **Preview Output Button**.

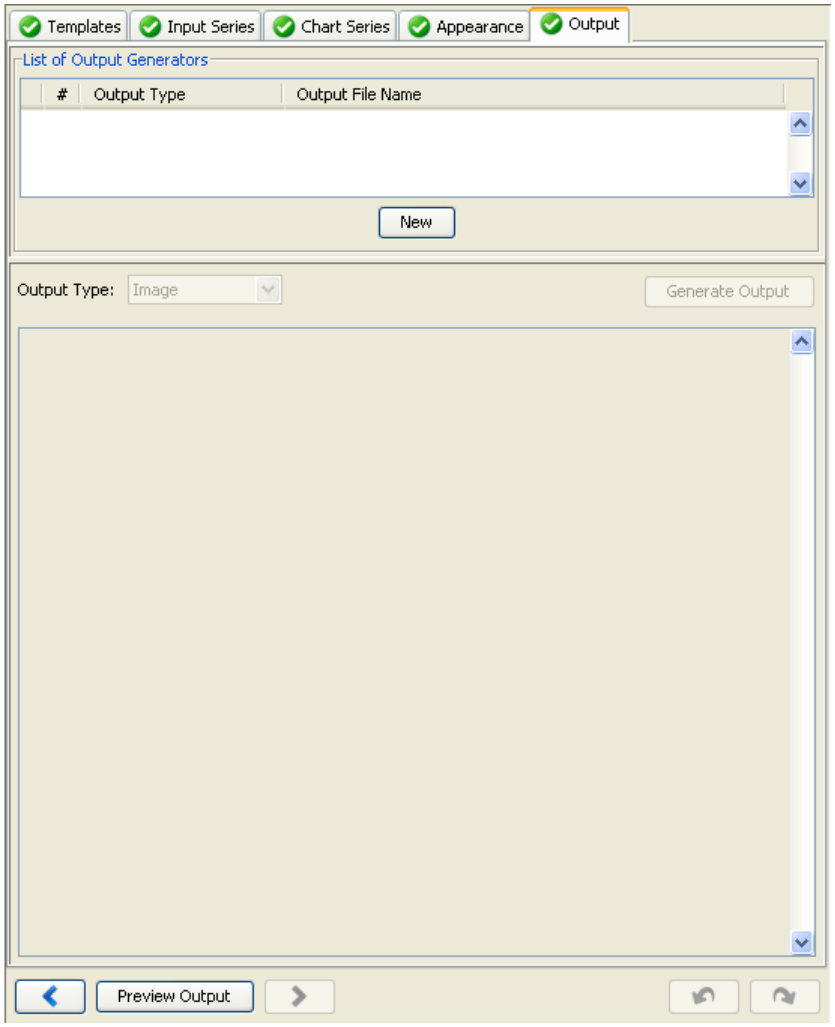


Figure 13-1: Output Panel.

13.1 *Components*

The following describes the **Output Panel** components:

- **List of Output Generators Table**: A list of the output generator plug-ins currently included in the product template. The plug-ins are listed by output type (i.e. plug-in name) and output file name. The first column is a delete column.
- **New Button**: Click to create a new output generator plug-in, which by default will have the output type image and an empty output file name.
- **Output Type Choice Box**: A selectable list of output types.
- **Generate Output Button**: Creates the output file specified by the output plug-in.
- **Output Parameters Panel**: Displayed below the choice box, the **Output Parameters Panel** displays a panel for editing the parameters of the output plug-in. It is updated whenever the output type is changed.
- **Preview Output Button**: Updates the **Current Status Display Panel** to display the output generated via the plug-in. For example, if the output type is "Image", then the **Current Status Display Panel** will display the image created in the file.

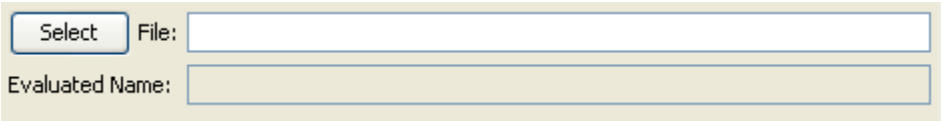
13.2 *Usage*

13.2.1 Specifying an Output Generator Plug-In

To add an output generator plug-in to the product template, click on the **New Button**. Then, select the desired output type from the **Output Type Choice Box** and specify the parameters in the **Output Parameters Panel**, which will include the file name. To verify the settings, click on the **Generate Output Button** and check that the file was created.

13.3 *Plug-Ins*

An output generator plug-in takes information from the charting engine within the Graphics Generator and generates an output file. There are four output generator plug-ins delivered with the Graphics Generator, each corresponding to an output type. All of them share a common parameter: the output file name. It is specified via the following panel:



The components of the panel are:

- **Select Button**: Click to open a file browser and select the output file.
- **File Field**: Displays the name of the output file. This field is an **Argument Inserting Text Field** (see Section 2.2, pg 10), meaning that the output file name can accept an embedded argument, allowing it to be set generically. This allows for the user to create a new template by opening a previous template, changing its arguments, and saving the

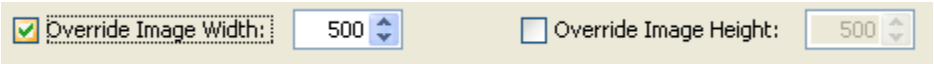
new template. The output file name, if it uses arguments, will not need to be updated each time.

- **Evaluated Name Field**: Displays the file name after replacing any arguments.

The plug-ins are described below.

13.3.1 Image Plug-in

The Image output generator plug-in generates a chart image file. The type of image is determined by the file name, and can be a .jpg, .png, or .gif. The width and height of the image are dictated by parameters edited via the following panel:



The default dimensions are 500 x 500 pixels. To override either the width or height, click on the appropriate override check box and set the value by typing it into the field or using the up/down arrows, .

13.3.2 ParametersXML Plug-in

The ParametersXML output generator plug-in generates an XML file specifying the parameters of the template. This file can then be imported via the **Product and Template Manager Dialog** (see 3.1.1, pg. 20) if desired.

Here is an example of part of a parameters XML file:

```
<?xml version="1.0" encoding="UTF-8" standalone="no"?>
<productTemplateParameters>
    <referencedTemplate productId="ref_ensemble_spread">
        <argument id="defaultEnsembleId">HMOS</argument>
    </referencedTemplate>
    <referencedTemplate productId="ref_temp">
        <argument id="defaultLocationId">FOLC1UP</argument>
    </referencedTemplate>
    <referencedTemplate productId="ref_precip">
        <argument id="defaultLocationId">NFDC1UP</argument>
    </referencedTemplate>
    <inputSeriesProviderParameters convertToDisplayUnits="false"
includeThresholds="false" name="PiTimeSeries">
        <parameter
id="timeSeriesXMLFile">testdata/chartEngine/inputs.default.xml</parameter>
    </inputSeriesProviderParameters>
    <chartSeriesParameters>
…
```

13.3.3 PiTimeSeriesXML Plug-in

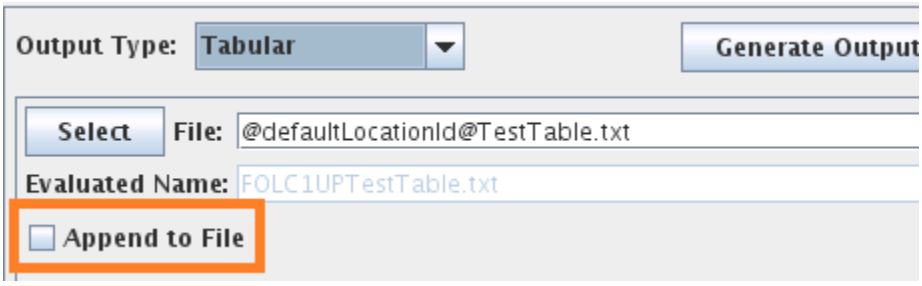
The PiTimeSeriesXML output generator plug-in generates a pi-timeseries schema compliant XML file that contains the time series output by the calculator plug-ins, if the plug-ins generated time series. If any calculated chart series is not a time series, an error will occur.

Here is an example of part of a pi-timeseries XML file:

```
<?xml version="1.0" encoding="UTF-8"?>
<TimeSeries xmlns="http://www.wldelft.nl/fews/PI" xmlns:xsi="http://www.w3.org/2001/XMLSchema-
instance" xsi:schemaLocation="http://www.wldelft.nl/fews/PI
http://fews.wldelft.nl/schemas/version1.0/pi-schemas/pi_timeseries.xsd" version="1.2">
    <timeZone>0.0</timeZone>
    <series>
        <header>
            <type>instantaneous</type>
            <locationId>DILM5</locationId>
            <parameterId>QIN</parameterId>
            <timeStep unit="second" multiplier="3600"/>
            <startDate date="2008-03-15" time="18:00:00"/>
            <endDate date="2008-03-20" time="18:00:00"/>
            <missVal>NaN</missVal>
            <stationName>Dillworth</stationName>
            <units>m3/s</units>
            <fileDescription>testdata\piTimeSeriesProvider\inputs.default.xml</fileDescription>
        </header>
        <event date="2008-03-15" time="18:00:00" value="3.5890002" flag="0"/>
        <event date="2008-03-15" time="19:00:00" value="3.5890002" flag="0"/>
…
```

13.3.4 Tabular Plug-in

The Tabular output generator plug-in generates an ASCII text file specifying all of the plotted chart series in a tabular format, including information contained in the header of the time series (such as location id, data type, etc.). This output generator plug-in allows for output to be appended to the target file, if that file exists. That option is controlled via the **Append to File Checkbox**:



If the checkbox is checked, then, if the target file already exists, the generated output will be appended to it. Otherwise, any existing file will be overwritten.

Here is an example of part of a tabular ASCII text file without the **Append to File Checkbox** being checked:

```
==============================
DATA SOURCE #1
==============================
Input Time Series:
  Location #1:
    Location id: DILM5
    Location name: Dillworth
    Location description: null
    Parameter id: QINE
    Ensemble id: HMOS

Aggregations Performed In Order:
  Aggregator #1:
    Type: Mean
    Period start time: 2008-03-21 00 GMT
    Period end time: 2008-03-25 18 GMT
    Time step: 1 day

Calculations Performed:
  Name: Quantiles    Calculator-specific parameters:
      probability: MIN
      probability: 0.25
      probability: 0.50
      probability: 0.75
      probability: MAX
      distribution: Empirical
```

```
Computed (Range) Data Description: Discharge [CMSD]
Domain Data Description: Time

DATA:
                  Series: MIN                     ...
          Time              Discharge [CMSD]      ...
+----------------------++----------------------+--...
   2008-03-22 00 GMT             2.6454           ...
   2008-03-23 00 GMT             2.107            ...
   2008-03-24 00 GMT             1.8585           ...
   2008-03-25 00 GMT             1.1289           ...
+----------------------++----------------------+--...
...
```

This is an example of part of a tabular ASCII text file with the **Append to File Checkbox** being checked:

```
==============================
DATA SOURCE #1
==============================
Input Time Series:
  Location #1:
    Location id: FOLC1UP
    Location name: TEST TEST TEST
    Location description: null
    Parameter id: MAT
    Ensemble id: NOT AN ENSEMBLE

Aggregations Performed In Order:

Calculations Performed:
  Name: TimeSeries
Computed (Range) Data Description: Temperature [degc]
Domain Data Description: Time

DATA:
                  Series: MAT
          Time             Temperature [degc]
+----------------------++----------------------+
   2008-03-20 00 GMT              4.04
   2008-03-20 06 GMT              6.61
…
+----------------------++----------------------+

==============================
DATA SOURCE #2
==============================
Input Time Series:
  Location #1:
    Location id: FOLC1UP
    Location name: TEST TEST TEST
    Location description: null
    Parameter id: FMAT
```

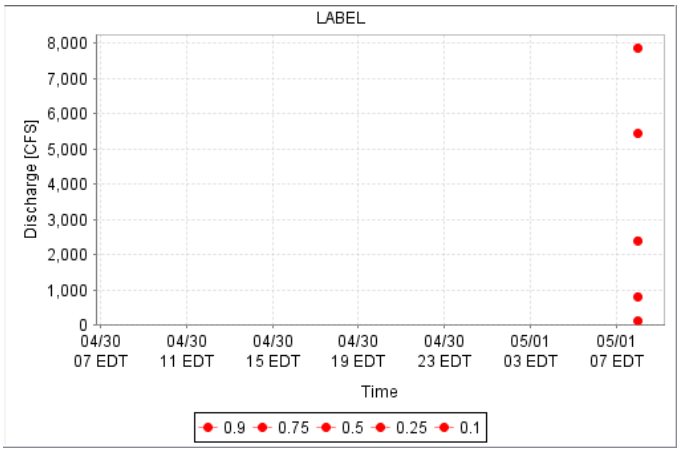
```
    Ensemble id: NOT AN ENSEMBLE

Aggregations Performed In Order:
Calculations Performed:
  Name: TimeSeries
Computed (Range) Data Description: Temperature [degc]
Domain Data Description: Time

DATA:
                  Series: FMAT
          Time             Temperature [degc]
+----------------------++----------------------+
   2008-03-21 00 GMT              6.61
   2008-03-21 06 GMT              1.91
…
```

13.3.5 ESPADPQuantiles Plug-in

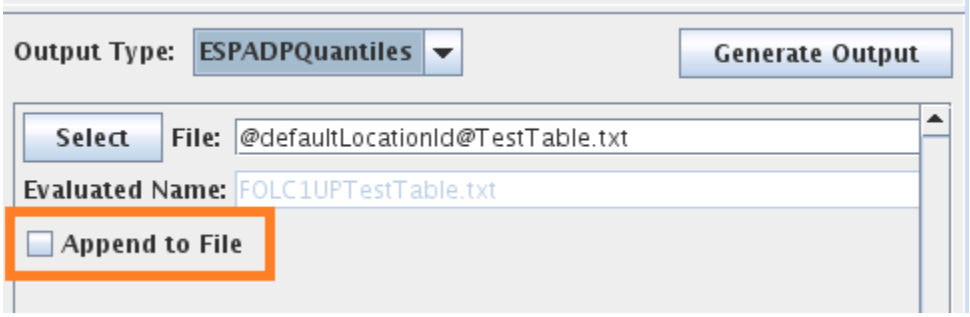
The ESPADPQuantiles output generator plug-in creates an ASCII text file with output that matches as closely as possible that of the legacy ESPADP quantiles product; see the example below. To create this output, the parameters of the generator must satisfy several requirements:

- All chart series specified in the **Calculators Panel** must use a "Quantiles" calculator plug-in. Calculators that do not yield any data (e.g., correspond to an ensemble that cannot be found) are skipped.
- The units of the data output by the "Quantiles" calculators after unit conversion (see Section 11.1) must be identical for all chart series that yield data.
- All calculations must be for exceedance probabilities (not non-exceedance); i.e., check the **Exceedance Check-box** for all chart series calculator plug-ins (see Section 11.5.1).
- All calculators must use the same distribution; i.e., verify the **Distribution Choice Box** selection for each chart series calculator (see Section 11.5.1).
- The list of probabilities specified for the "Quantiles" calculators must be identical for all calculators (see Section 11.5.5).
- All chart series must use aggregations that are of the same type (i.e., mean, min, max, etc) and yield only ONE value in each output time series. For example, an aggregation using a period computation time step is acceptable.
- All aggregated time series computed for any of the chart series must have the single required value (see previous bullet) recorded at the same time. In other words, if one chart series yields data at time 1/1/2014 12Z and the rest yield data at time 1/1/2014 18Z, the output generator will fail.

If all of the requirements are met, then, when viewing the Graphics Generator product template that includes the ESPADPQuantiles output generator, the **Full Chart Display Panel** should display points that correspond to the probabilities used in the "Quantiles" calculators (one set of points per calculator, but all points will be red unless the series drawing parameters are modified; see Section 11.2):



As with the **Tabular** output generator plug-in, this plug-in allows for output to be appended to the target file, if that file exists. That option is controlled via the **Append to File Checkbox**:



If the checkbox is checked, then, if the target file already exists, the generated output will be appended to it. Otherwise, any existing file will be overwritten.

- The release package includes an example of using this output generator for AHPS products; see the *Graphics Generator AHPS Products Installation Guide*. The product therein accounts for all of the requirements above.

- To create a new product to employ the ESPADPQuantiles, use this AHPS example product as a starting point. That will ensure that the requirements above are satisfied. Simply change the input series providers and modify the probabilities employed in the quantiles calculator as need.

- To add a new ensemble to the ESPADPQuantiles output (e.g., add 'HS' computations to a 'CS' or 'ESP' product), first copy an existing chart series definition (click on the **Create Copy Button** described in Section 8.1). Next, within the **Selected Time Series Panel**, modify the time series selection identified in the **Time Series Selections Table** to use the appropriate ensembleId in the 'Ens' column. Lastly, if necessary, modify the time series selection identified for the original chart series definition so that it uses the appropriate ensembleId in the 'Ens' column for the original chart series. Without this last change, the original chart series will be calculated with <u>all</u> input time series possibly causing an error.

Here is an example of part of an ESPADPQuantiles generated ASCII text file without the **Append to File Checkbox** being checked:

```
# ENSEMBLE HEADER INFORMATION
# Segment: CBNK1
# Trace File Name: NOT APPLICABLE
# Output Variable: Maximum
# Data Type: RIVER DISCHARGE
# Units: CFS
# Analysis Period: 02/01/2012 12 - 05/01/2012 12 GMT
# Interval: 02/01/2012 12 - 05/01/2012 12 GMT
```

```
#
# Statistics based on all years.
#
# EXCEEDANCE PROBABILITY ESTIMATES
#
# Distribution: Empirical
#       CS: Mean: 3424.63, StdDev: 3184.61
# Exceedance    Conditional
# Probabilities  Simulation
# -----------------------------------------
  0.900          117.547
  0.750          808.854
  0.500          2396.504
  0.250          5435.645
  0.100          7870.037

# EMPIRICAL SAMPLE POINTS
#            Cond.
#Trace    Year      Data Exceed.
# year  Weight      Point  Prob.
# ---------------------------------
  1951  0.017   2913.866  0.459
  1952  0.017   2129.360  0.525
  1953  0.017   1510.144  0.639
...
```

14 GraphGen Viewer Panel

The **GraphGen Viewer Panel**, shown in Figure 14-1, displays chart constructed by the Graphics Generator. It is opened by clicking on the **GraphGen Viewer Button**, , in the CHPS interface tool bar. When clicked, the viewer will be opened to display the chart constructed from the currently selected product template in the **GraphGen Thumbnail Panel**, or, if none is selected, the current selected template in the **GraphGen Tree Panel**.

Figure 14-1: GraphGen Viewer Panel.

14.1 *Components*

The following components are displayed in the toolbar of the **GraphGen Viewer Panel**:

- **Lock/Unlock Viewer Button**: Indicates that the viewer is locked, so that the image will never change, even if the corresponding product template is modified.
- **Lock/Unlock Viewer Button**: Indicates that the viewer is unlocked, so that any change in the selection within the **GraphGen Thumbnails Panel** or **GraphGen Editor Panel** (whichever is the source) will be reflected in the **GraphGen Viewer Panel**.
- **Send Product to Open Editor Button**: When clicked, the **GraphGen Tree Panel** will be updated to select the product template corresponding to the viewed product. That will result in the **GraphGen Editor Panel**, if opened, switching to the viewed product.
- **Source Label**: Indicates whether the viewer determined which product chart to display via **GraphGen Tree Panel** selection or **GraphGen Thumbnaisl Panel** selection.

15 GraphGen Model Adapter

The GraphGen Model Adapter is designed to generate product output files via a workflow. The model adapter requires as input only the segment id and template id of each product template to process. Each product template must be constructed beforehand using the **GraphGen Editor Panel**, with the output files to produce specified via output generator plug-ins. The adapter is configured as any other module of CHPS within a module configuration file.

15.1 *Execute Activity*

The class name that must be used within the `executeActivity` section of a module configuration file for the GraphGen Model Adapter is:

ohd.hseb.graphgen.adapter.GraphGenModelAdapter

It expects a single argument specifying the location of the run information file. The following is an example of an `executeActivity`:

```
<executeActivity>
    <command>
        <className>ohd.hseb.graphgen.adapter.GraphGenModelAdapter</className>
    </command>
    <arguments>
        <argument>%ROOT_DIR%/run_info.xml</argument>
    </arguments>
    <timeOut>300000</timeOut>
</executeActivity>
```

15.2 *Properties*

The GraphGen Model Adapter uses the following properties, input via the `exportRunFileActivity` section of the module configuration file: ohdGraphgenCentralDir, baseOutputDir, product.<segment id>, productXMLFile.<segment id>, piServiceBackendRFCIdentifier, piServiceHostName, and piServicePortNumber. Each is described below.

15.2.1 Property ohdGraphgenCentralDir

The ohdGraphgenCentralDir property is <u>required</u> and directs the GraphGen Model Adapter to the templates and settings to use during execution. The property value is a directory path and should be set to the templates and settings central area, as specified by the global property ohdGraphgenCentralDir, or to a CHPS stand-alone local area; see the *Graphics Generator Getting Started* guide for information on both. Usually, the central area should be used, especially if the adapter is run non-interactively, for example via a scheduled workflow. To use the central area, specify the property as follows:

```
<string key="ohdGraphgenCentralDir" value="$ohdGraphgenCentralDir$"/>
```

A local area should only be used while testing the adapter configuration to make sure expected products are generated. For the local area corresponding to the CHPS stand-alone used to run the GraphGen Model Adapter, specify the property as follows:

```
<string key="ohdGraphgenCentralDir" value="%REGION_HOME%/Models/graphgen"/>
```

However, the value can be any directory containing the required OHD_GRAPHGEN_PRODUCTS_AND_SETTINGS.xml file.

15.2.2 Property baseOutputDir

The baseOutputDir property is required and specifies a base output directory for all generated products defined such that the output file name is a relative path (i.e., a path not starting in '/' or '.'). For such products, the generated file will be placed relative to this value of the baseOutputDir. A typical setting for the property is as follows:

```
<string key="baseOutputDir" value="%ROOT_DIR%/products"/>
```

15.2.3 Property products.<segment id>

The products.<segment id> property is required to be set at least once and defines products to generate for a segment based on a list of product templates (see the *NOTE* below). The product templates are defined in a semicolon delimited list as the property value. When processing each of these product templates, the predefined argument overrideActiveSegmentId (see the *Graphics Generator Getting Started Manual*) is set to the value of "`<segment id>`" specified as part of the property name after "`products.`" An example of a line within an exportRunFileActivity section of the configuration file is as follows:

```
<string key="products.ARGW1" value="AHPSFlowHistogram; AHPSStageHistogram;
AHPSVolumnHistogram"/>
```

In this example, the segment id is "ARGW1" and the three specified product templates are processed.

The list of product templates defines a list of patterns used to match template ids. Standard Java pattern matching is used; for a description, see

http://download.oracle.com/javase/1.4.2/docs/api/java/util/regex/Pattern.html.

For example, the following line will match all product templates for segment ARGW1 such that the product id begins with "AHPS" and does not include any numbers or white-space ("[a-zA-Z]" only pattern matches letters):

```
<string key="products.ARGW1" value="AHPS[a-zA-Z]*"/>.
```

This example is similar, but allows for use of numbers and white-space (the '.' matches any character), and uses two patterns to specify the AHPS flow and stage product templates independently, while excluding the volume product templates:

```
<string key="products.ARGW1" value="AHPSFlow.* ; AHPSStage.*"/>
```

The value of the property can have one of two special values, as well:

- "all": all product templates available for that segment will be processed, including those define for "all segments" and included product groups.
- "all only": all product templates defined for the group "all segments" will be processed for the specified segment.

For example:

```
<string key="products.ARGW1" value="all only"/>.
```

Each 'key' must only appear once in a set of run file properties. Hence, all products to be generated for a segment must be specified within a single property. Otherwise, the value of a latter property with a given key will overwrite the previous property value.

15.2.4 Properties piServiceBackendRFCIdentifier, piServiceHostName, piServicePortNumber

The properties piServiceBackendRFCIdentifier, piServiceHostName, piServicePortNumber together identify the URL of the FEWS PI-service to which the Graphics Generator will connect when generating products. The PI-service is accessed for time series data and location information (latitude, longitude, etc.). The url is as follows:

```
http://<piServiceHostName>:<piServicePortNumber>/<piServiceBackendRFCIdentifier>/FewsPiService
```

For example (ABRFC):

```
https://localHost:2008/abrfc_pi/FewsPiService
```

By default, the value of piServiceHostName is localHost, the value of piServicePortNumber is 8100, and the value of piServiceBackendRFCIdentifier is unspecified (not used; this is equivalent to setting the property to be empty, ""). Altogether, if none of the properties are specified, then the PI-service for the first open CHPS session on the local machine is accessed.

The standard method of handling these properties is to define properties within the applicable global properties file:

```
piServiceBackendRFCIdentifier=??rfc_pi
piServiceHostName=localHost
piServicePortNumber=<service_number>
```

Then, refer to those properties within the adapter configuration file:

```
<string key="piServiceBackendRFCIdentifier" value="$piServiceBackendRFCIdentifier$"/>
<string key="piServiceHostName" value="$piServiceHostName$"/>
<string key="piServicePortNumber" value="$piServicePortNumber$"/>
```

More explicit instructions are provided within the *Graphics Generator Installation Guide*.

15.3 *Examples*

Example files were installed as part of the Install Notes in the directory:

<*configuration dir*>/exampleAdapterConfigFiles

It includes two module configuration files, a workflow file, a module instance descriptor file, and a workflow descriptor file.

15.3.1 Example 1

This first example process the product template with template id “TestCase1” for product group “TestProcedure”. In this case, “TestProcedure” is not a valid segment id, so that the product template TestCase1 does not make use of the active segment id when built.

```
<?xml version="1.0" encoding="UTF-8"?>
<generalAdapterRun xmlns="http://www.wldelft.nl/fews"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://www.wldelft.nl/fews http://chps1/schemas/generalAdapterRun.xsd">
    <general>
        <description>GraphGen Test 1 Product</description>
        <rootDir>%REGION_HOME%/Models/graphgen</rootDir>
        <workDir>%ROOT_DIR%/work</workDir>
        <exportDir>%ROOT_DIR%/input</exportDir>
        <exportDataSetDir>%ROOT_DIR%</exportDataSetDir>
        <exportIdMap>IdExportSACSMA</exportIdMap>
        <importDir>%ROOT_DIR%/output</importDir>
        <importIdMap>IdImportSACSMA</importIdMap>
        <dumpFileDir>$GA_DUMPFILEDIR$</dumpFileDir>
        <dumpDir>%ROOT_DIR%</dumpDir>
        <diagnosticFile>%ROOT_DIR%/output/diag.xml</diagnosticFile>
        <timeZone>
            <timeZoneOffset>-08:00</timeZoneOffset>
        </timeZone>
    </general>
    <activities>
        <startUpActivities>
            <makeDir>
                <dir>%ROOT_DIR%/output</dir>
            </makeDir>
        </startUpActivities>
        <exportActivities>
            <exportRunFileActivity>
                <exportFile>%ROOT_DIR%/run_info.xml</exportFile>
                <properties>
                    <int key="printDebugInfo" value="0"/>
                    <string key="piServiceBackendRFCIdentifier"
value="$piServiceBackendRFCIdentifier$"/>
                    <string key="piServiceHostName" value="$piServiceHostName$"/>
                    <string key="piServicePortNumber" value="$piServicePortNumber$"/>
                    <string key="ohdGraphgenCentralDir" value="$ohdGraphgenCentralDir$"/>
                    <string key="baseOutputDir" value="%EXPORT_DIR%/products"/>

                    <string key="products.TestProcedure" value="TestCase1"/>
                </properties>
            </exportRunFileActivity>
        </exportActivities>
        <executeActivities>
            <executeActivity>
                <command>
                    <className>ohd.hseb.graphgen.adapter.GraphGenModelAdapter</className>
                </command>
                <arguments>
                    <argument>%ROOT_DIR%/run_info.xml</argument>
                </arguments>
                <timeOut>300000</timeOut>
            </executeActivity>
        </executeActivities>
    </activities>
</generalAdapterRun>
```

15.3.2 Example 2

The second example generates all AHPS products delivered with the installation for the segments BLKO2 and CBNK1.

```
<?xml version="1.0" encoding="UTF-8"?>
<generalAdapterRun xmlns="http://www.wldelft.nl/fews"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://www.wldelft.nl/fews http://chps1/schemas/generalAdapterRun.xsd">
    <general>
        <description>GraphGen Test 1 Product</description>
        <rootDir>%TEMP_DIR%</rootDir>
        <workDir>%ROOT_DIR%/work</workDir>
        <exportDir>%ROOT_DIR%/input</exportDir>
        <exportDataSetDir>%ROOT_DIR%</exportDataSetDir>
        <importDir>%ROOT_DIR%/output</importDir>
        <dumpFileDir>$GA_DUMPFILEDIR$</dumpFileDir>
        <dumpDir>%ROOT_DIR%</dumpDir>
        <diagnosticFile>%ROOT_DIR%/output/diag.xml</diagnosticFile>
    </general>
    <activities>
        <startUpActivities>
            <makeDir>
                <dir>%ROOT_DIR%/output</dir>
            </makeDir>
            <makeDir>
                <dir>%ROOT_DIR%/work</dir>
            </makeDir>
            <makeDir>
                <dir>$EXPORT_DIR$/products</dir>
            </makeDir>
        </startUpActivities>
        <exportActivities>
            <exportRunFileActivity>
                <exportFile>%ROOT_DIR%/run_info.xml</exportFile>
                <properties>
                    <string key="piServiceHostName" value="$piServiceHostName$"/>
                    <string key="piServicePortNumber" value="$piServicePortNumber$"/>
                    <string key="piServiceBackendRFCIdentifier"
value="$piServiceBackendRFCIdentifier$"/>
                    <string key="baseOutputDir" value="$HEFS_PRODUCTS_DIR$"/>
                    <string key="ohdGraphgenCentralDir" value="$ohdGraphgenCentralDir$"/>
                    <string key="products.BLKO2" value="AHPS.*"/>
                    <string key="products.CBNK1" value="AHPS.*"/>
                </properties>
            </exportRunFileActivity>
        </exportActivities>
        <executeActivities>
            <executeActivity>
                <command>
                    <className>ohd.hseb.graphgen.adapter.GraphGenModelAdapter</className>
                </command>
                <arguments>
                    <argument>%ROOT_DIR%/run_info.xml</argument>
                </arguments>
                <timeOut>300000</timeOut>
            </executeActivity>
        </executeActivities>
    </activities>
</generalAdapterRun>
```

Appendix A: The Mathematics Underlying the Graphics Generator

This appendix presents important mathematical concepts employed by the Graphics Generator.

A.1 Time Series Aggregation

An aggregation is defined by the following:

- *start date* (overall period of aggregation): The start date for computing the computation times. The first value in the aggregated time series is one *computation time step* (see below) <u>after</u> this date.
- *end date* (overall period of aggregation): The end date for computing the computation times. The last value in the aggregated time series will have a computation time no later than this time.
- *computation time step*: The time step at which aggregated time series values are computed. The first computation time is always one *computation time step* after the *start date*. Additional values are computed for each *computation time step* thereafter, with the last value being assigned the last computation time before or on the *end date*.
- *aggregation period*: For each computation time, the width of the period over which the aggregated value will be computed.
- *period anchor*: Whether the aggregation periods are centered on the computation times or end at the computation times.

Though each aggregator plug-in (see Section 10.3) has its own specific rules for aggregation, the general aggregation algorithm works as follows:

1. For every value of the provided input time series, determine its *affected window*. For an instantaneous data type, such as STG or QIN, a value's *affected window* is centered at the value's valid time (i.e., for any time within the affected window, the best estimate of the data value for instantaneous data is usually the time series value at the window's center, because it is the closest in time). For an accumulative data type, such as MAP, a value's *affected window* ends at the value's valid time (i.e., for any time within the affected window, the event occurring at that time contributes to the accumulated value at the end of the *affected window*).
2. Determine the computation times based on the *start date*, *end date*, and *computation time step*, as described earlier.
3. For each computation time…
    a. Determine that computation time's *aggregation period*.
    b. Find all input time series values whose *affected windows* overlap or touch on the *aggregation period*.
    c. Pass that information to the aggregator plug-in, which then returns a value to record. For example, the mean aggregator will compute the weighted average of the provided values, with the weights based on the proportion of the *affected*

windows included in the *aggregation period*. A maximum aggregator, on the other hand, simply returns the largest of the provided values.

d. Record the value in the aggregated time series at the computation time.

4. Populate the aggregated time series meta-information appropriately. For example, if the *period anchor* is "centered", then the data type is set to instantaneous so that the next aggregator, if one exists, will recognize the computation time as having been at the middle of its *aggregation period*. Otherwise, the data type will be accumulative.

If a missing value is present within an *aggregation period*, it is up to the aggregator plug-in to determine how to behave; typically, the aggregated value will be set to missing. Multiple aggregations can be performed, with the results of the first aggregation being used as input to the second aggregation, second as input to the third, and so on.

Here are some examples of settings for typical aggregations:

description of aggregation	type	start date	end date	computation time step	aggregation period	period anchor
Daily mean starting from T0 for one year (used as part of a volume computation when input is CFS or CMS)	mean*	T0	T0 + 365 days	24 hours*	as computation time step*	ending*
Total volume over the months of Apr – Jun from a T0 before Apr 1	volume (requires CFSD or CMSD input)	04-01-0001 12:00:00	07-01-0001 12:00:00	period	as computation time step*	ending*
Total volume for Apr – Jun when T0 is after Apr 1 (observed flows must be appended to the time series before T0 via a merge)	volume	tsStartTime (because T0 may be after 4/1, input series provider <u>must</u> provide time series starting at 4/1 12Z!)	07-01-0001 12:00:00	period	as computation time step*	ending*
Total volume for Apr – Jun when T0 is before Apr 1, or *residual volume* when T0 is within the Apr – Jun period; see item (A) below	volume	tsEndTime – 4 firstDayOfMonth	tsEndTime	period	As computation time step*	ending*
Monthly volumes starting from the beginning of the first full month after T0 through Jun	volume	T0 + 1 firstDayOfMonth	07-01-0001 12:00:00	1 month	as computation time step*	ending*
Accumulated monthly volumes (as above, but accumulate the volume as time moves forward)	volume	T0 + 1 firstDayOfMonth	07-01-0001 12:00:00	1 months	accumulative	ending*
10 day moving average computed every day starting at T0 for 90 days	mean*	T0	T0 + 90 days	1 day	10 days	centered

* The value is the default for that aggregation parameter.
(A) The definition of the aggregation requires that the input time series provider provide data that ends at the end of June (i.e., the end date is specified as 07-01-0001 12:00:00 assuming a 12Z-12Z computation day). Furthermore, for the residual volume to be computed, the **Ignore Missing Values Checkbox** must be checked.

A.2 Computing Empirical Distributions

An empirical distribution is calculated for a particular time step as follows:

1. Collect values from all time series at that time step. This creates a set of size N.
2. Sort the values from smallest to largest.
3. To the ith value in the sorted set ($i = 1, 2, \ldots, N$) assign the probability $i/(N + 1)$.

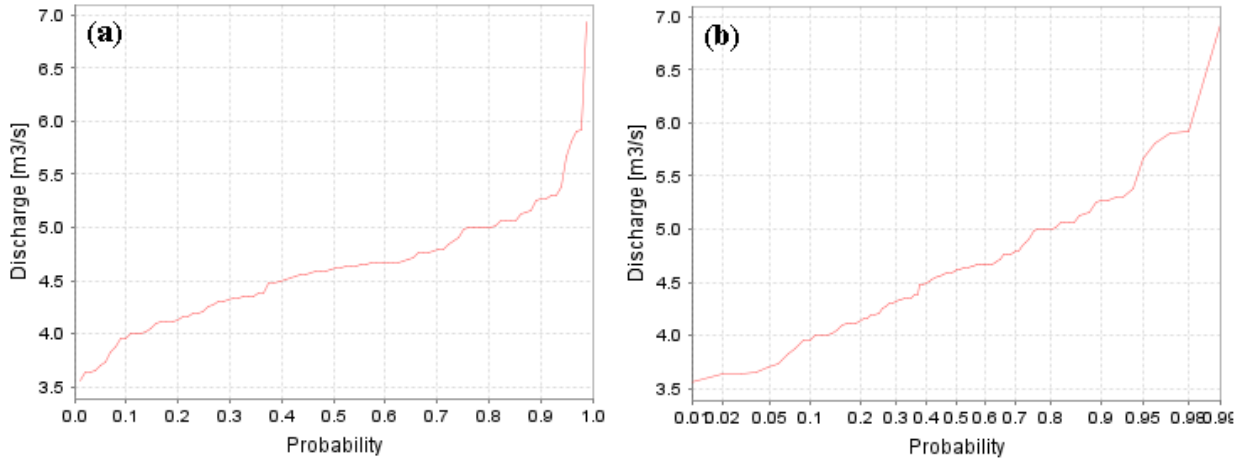
When the process above is completed, each value in the set in Step 1 will be assigned a probability.

A.3 Plotting Data Against a Normalized Probability Axis

A normalized probability axis is used to display the probabilities of a distribution such that, if the distribution were normal, the probability points would appear as a line. Given a set of distribution plotting points, $\{(x_i, p_i)$: x_i is a value, p_i is a probability, and $i = 1,\ldots,N\}$, determining the value at which to plot the point along a normalized probability axis follows this process:

1. Calculate the standard normal distribution value for each probability: $z_i = Q^{-1}(p_i)$, where Q is the cumulative distribution function of a standard normal variate.
2. Plot the points $\{(x_i, z_i)\}$.
3. Tick marks along the normalized probability axis are fixed to the values $\{Q^{-1}(0.01)$, $Q^{-1}(0.02)$, $Q^{-1}(0.05)$, $Q^{-1}(0.1)$, $Q^{-1}(0.2)$, $Q^{-1}(0.3)$, $Q^{-1}(0.4)$, $Q^{-1}(0.5)$, $Q^{-1}(0.6)$, $Q^{-1}(0.7)$, $Q^{-1}(0.8)$, $Q^{-1}(0.9)$, $Q^{-1}(0.95)$, $Q^{-1}(0.98)$, $Q^{-1}(0.99)\}$.
4. Label the tick marks according to the probability used.

Below is an example showing a non-exceedance function plotted against a standard linear probability axis in plot (a) and a normalized probability axis in plot (b):


(a)
Discharge [m3/s]
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Probability
(b)
Discharge [m3/s]
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
0.01 0.02 0.05 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 0.95 0.98 0.99
Probability

Appendix B: Instructions for Adding a Plug-In