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# 1. INTRODUCTION

The Interactive Calibration Program (ICP) is a graphical user interface (GUI) that facilitates calibration of NWSRFS models run with the Manual Calibration Program (MCP3). With ICP, a user can run the MCP3 program, view hydrograph output and other time series displays, modify parameters, and see the results of those changes.

This User Manual document provides a reference for using the ICP software. It is intended for scientists and engineers who use ICP to calibrate NWSRFS models. This documentation also describes how to install and troubleshoot ICP, to aid those who support the operational system. It is expected that users have a basic understanding of the NWSRFS environment and have a user environment that is configured with appropriate App Defaults information.

## 1.1 How to Use This Document

This User Manual provides an overview of the ICP GUI and functionality and provides separate sections for each model (NWSRFS operation) that can be calibrated in ICP.

The Getting Started section describes how to start and stop ICP and provides general information about the main ICP features.

Subsequent sections describe ICP features related to calibrating specific models, in particular for the NWSRFS operations that are represented in ICP. Other operations can be calibrated in ICP by using the text editor feature to edit the operation parameters in the MCP3 input deck. This document focuses on the ICP features for editing SNOW-17, SAC-SMA, and UNIT-HG operations, which include graphical editors for parameters.

The Troubleshooting section provides information about troubleshooting software behavior (NOT troubleshooting bad calibrations!). It may be appropriate in the future to add calibration guidance information to this document.

Appendix A describes how to install and configure ICP in the operational system.

# 2. GETTING STARTED

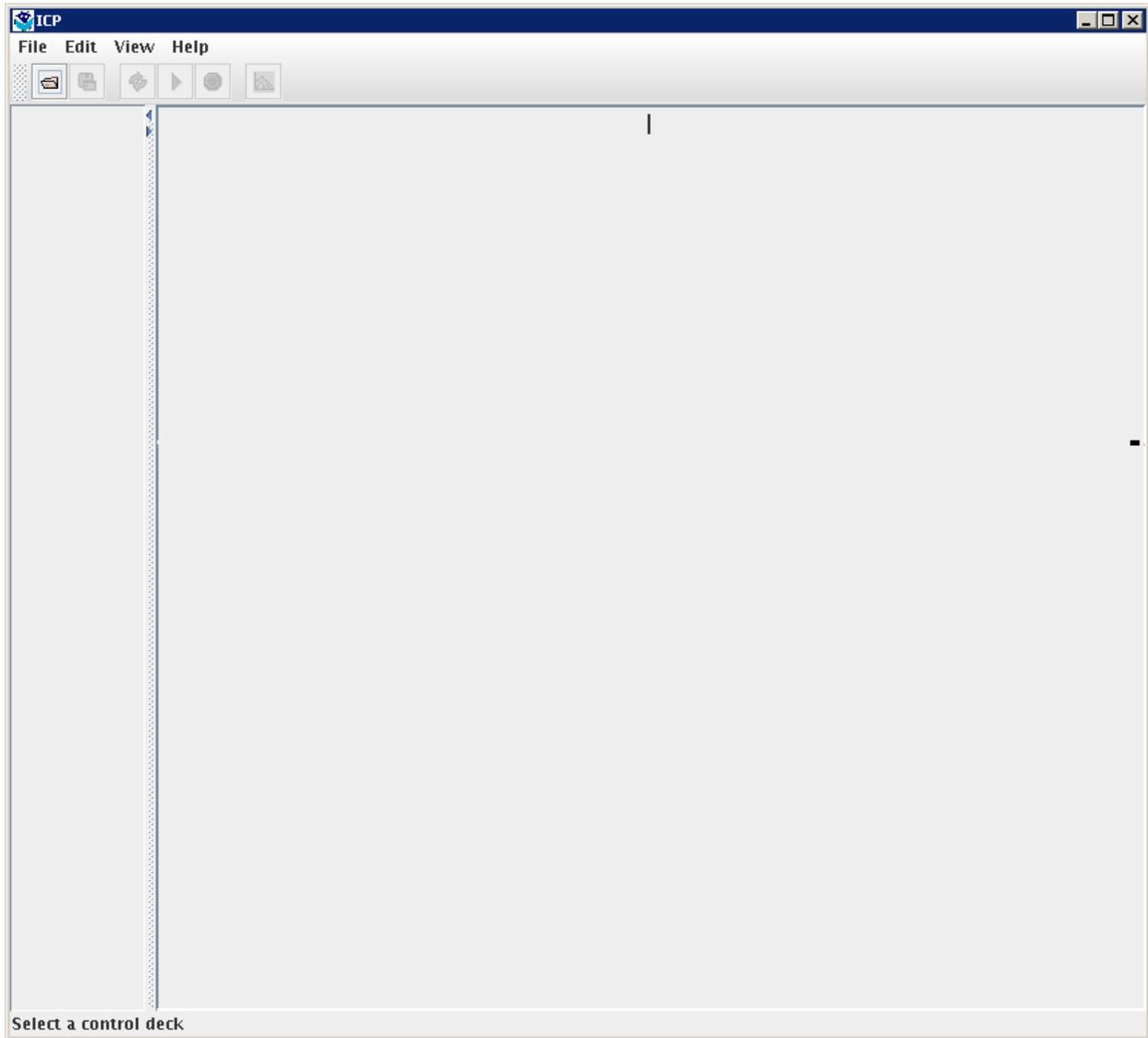
This section of the documentation provides an overview of ICP, describing how to start the software and summarizing features. Other sections describe in more detail how to use features for specific NWSRFS operations.

## 2.1 Starting ICP

The new ICP is a replacement for a previous version of the ICP software (subsequently referred to as the “legacy ICP”). In order to minimize transition issues and allow the old and new ICP to be run at the same time, the new ICP is started with a script called “icpnew”. This script utilizes NWSRFS App Defaults settings consistent with the original ICP. To start ICP, run the following in a terminal window:

```
icpnew
```

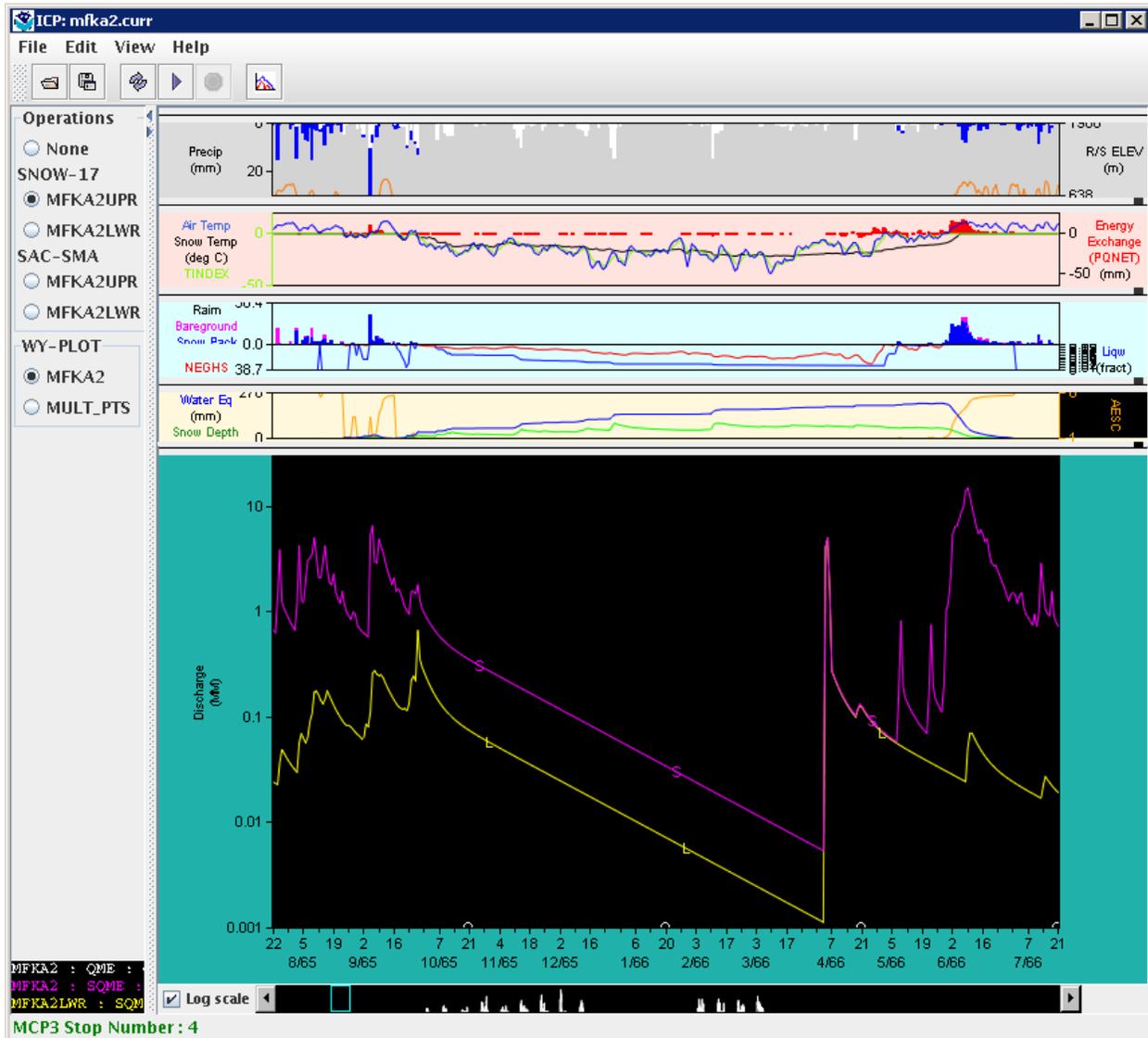
The following screen should appear. If not, see the Troubleshooting section. The following sections provide an overview of ICP features.



MainWindow\_Startup

### ICP Main Window at Startup

After opening an MCP3 control deck, running MCP3, and displaying WY-PLOT output (all described below), the main ICP window will appear similar to the following:



MainWindow\_AfterRun

## Main ICP Window After Running MCP3 and Displaying Results

### 2.1.1 Running Multiple ICP Sessions

ICP runs the MCP3 software to perform simulations. When run with ICP, MCP3 creates output in a directory specified by the `mcp3_icp_iface` App Defaults token. Typically this is set to `/tmp/$USER/mcp3_ntrfc`, and files are written and cleared as appropriate by MCP3 and ICP. Some output files created by MCP3 have the same name regardless of the deck being run. Consequently, when two sessions are run, the files interfere with each other. The legacy ICP did allow multiple sessions to be run; however, this limited other functionality.

To allow running multiple sessions in the new ICP, the `mcp3_icp_iface` App Defaults token must be set to a value different from the default in the terminal window for the second session. For example, do the following:

```
mkdir /tmp/$USER/mcp3_ntrfc2
export mcp3_icp_iface=/tmp/$USER/mcp3_ntrfc2
```

### 2.1.2 Sharing Files with the Legacy ICP

The legacy ICP strictly enforces file extensions *.curr*, *.best*, and *.prev*. Additionally, the base name of the deck must agree with the parent folder. For example, for a segment, the name of the folder would be *SEGMENT* and the deck name must be *SEGMENT/SEGMENT.curr*.

However, the new ICP allows any file names and extensions (within the MCP3 limitations – see the next section). The new flexibility allows users to manage various calibration scenarios more effectively. The legacy ICP will not accept filenames unless they have the extensions mentioned above. Therefore, to run files in the legacy ICP, make sure to name (or rename) decks appropriately. It is recommended that users utilize the features of the new ICP and only rename decks when there is a need to utilize the legacy ICP.

### 2.1.3 MCP3 Filename Limitations

When run from within ICP, MCP3 has the following file naming conventions. These conventions are enforced by ICP when decks are saved. Creating files with invalid names outside of ICP may result in unexpected software behavior.

- Overall file path length cannot exceed 100 characters. This is usually not an issue in operational systems but may be an issue in development environments. The workaround is to perform work using a shorter path or use symbolic links in the file system to shorten paths.
- The file extension (characters after the first “.”) cannot exceed four characters. For example, “.ver1” is allowed, but “.ver12” is not. Using longer extensions results in MCP3 output files with truncated names that do not match the input deck name and may cause errors in ICP. Although MCP3 may run, the output cannot be shared with ICP.

## 2.2 Typical ICP Session

A typical ICP session during calibration consists of the follow steps:

1. Select an MCP3 deck (and optionally indicate that MCP3 should run automatically when parameter edits are made). MCP3 will always run automatically after a deck is selected, in order to refresh output displays.
2. Review the results in the WY-PLOT and PLOT-TS displays and MCP3 output viewer.
3. As appropriate, edit operation input parameters using tabular, curve, input deck editors, and/or external editor.
4. Rerun MCP3 (repeat steps 2-4 as needed).
5. Periodically save a copy of the deck, either to archive a milestone in calibration, or simply as a backup of work. Repeat as appropriate.

ICP allows the input editors and output viewers to remain open throughout the ICP session. Windows can be arranged across multiple monitors (if available), allowing users to quickly switch between input and results windows.

ICP allows the deck to be saved with a new name, using the new name in the active session. This is the “save forward” approach where users must choose a new name for the current MCP3 input file. ICP also allows a copy of the MCP3 input file to be saved, allowing an archive to be preserved, for example as a “best” version. This is the “save back” approach where users can name copies of the input file as appropriate. Users should evaluate the approach that works best. These features are different from the

legacy software, which limited MCP3 input files to previous (.prev), current (.curr), and best (.best) versions. ICP allows the legacy naming conventions to be used, without making it a requirement.

## 2.3 Overview of Interface

The main ICP window contains controlling menus and toolbars and is also used for WY-PLOT displays. A secondary PLOT-TS window is also available if the MCP3 deck includes a PLOT-TS operation. Both windows have similar features, although the main (WY-PLOT) window functions as the starting point for opening decks and exiting ICP.

The main ICP window provides the following features:

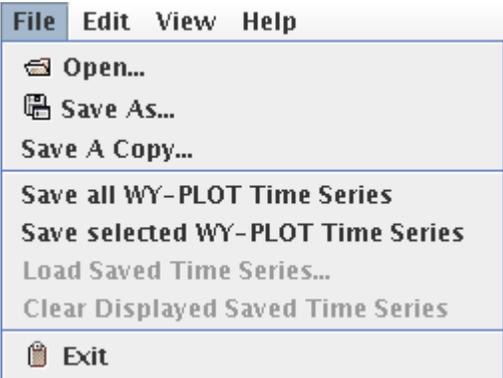
- Title bar – indicates the deck that is open.
- Menus – perform high-level actions
- Tools (top, below menus) – icon buttons to perform common actions
- Navigation area (left) – allows relevant options to be selected for displays
- Plot area (most of window) – display area for plots
- Status area (bottom) – provide important feedback, including the MCP3 run status

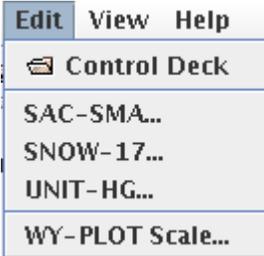
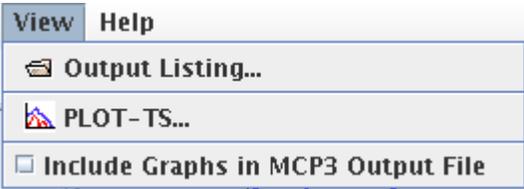
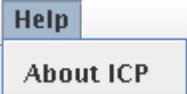
Additional information about specific features is provided below.

### 2.3.1 Menus

Menus are provided for important actions relevant for the window. The following summary highlights important functionality. The WY-PLOT and PLOT-TS display functionality is discussed in more detail in following sections.

#### ICP Main Window Menus

Menu	Illustration	Summary
File	 <p style="text-align: right;">Menu_File</p>	<p>Open – open an MCP3 input deck using a navigable file chooser dialog</p> <p>Save As... – save the current MCP3 input deck with a new name, and use in the active session</p> <p>Save A Copy... – save a copy of the current MCP3 input deck to a new name, but continue using the current deck in the active session</p> <p>Save all WY-PLOT Time Series – save time series from the last MCP3 run, from all WY-PLOT operations, for display in the WY-PLOT via the Load Saved Time Series menu item (a similar menu item is available in the PLOT-TS window)</p> <p>Save selected WY-PLOT Time Series – save time series from the last MCP3 run, from the selected WY-PLOT operations, for display in the WY-PLOT via the Load Saved Time Series menu item (a similar menu item is</p>

Menu	Illustration	Summary
		<p>available in the PLOT-TS window)</p> <p>Load Saved Time Series – load time series that were previously saved, to display on the WY-PLOT discharge plot (a similar menu item is available in the PLOT-TS window)</p> <p>Clear Displayed Saved Time Series – clear from the WY-PLOT the time series that was loaded with Load Saved Time Series (a similar menu item is available in the PLOT-TS window)</p> <p>Exit – exit ICP (unsaved edits to parameters or input decks are not detected)</p>
Edit	 <p style="text-align: right;">Menu_Edit</p>	<p>Control Deck – display the MCP3 control deck in an editable text window (or external editor – see the Installation and Configuration appendix)</p> <p>SAC-SMA... – display the SAC-SMA operation parameter editor</p> <p>SNOW-17... – display the SNOW-17 operation parameter editor</p> <p>UNIT-HG... – display the UNIT-HG operation parameter editor</p> <p>WY-PLOT Scale... – change the WY-PLOT scale (X and Y axis limits)</p>
View	 <p style="text-align: right;">Menu_View</p>	<p>Output Listing... – display the MCP3 output in a non-editable display window (or external editor – see the Installation and Configuration appendix)</p> <p>PLOT-TS... – display the PLOT-TS window, which has similar features as the main WY-PLOT window (enabled if the MCP3 deck includes a PLOT-TS operation)</p> <p>Include Graphs in MCP3 Output File – if checked, the output listing will include the text representation of WY-PLOT and PLOT-TS output (the default is not checked since ICP provides graphical output displays)</p>
Help	 <p style="text-align: right;">Menu_Help</p>	<p>About ICP – display the ICP version (use when contacting support)</p>

## 2.3.2 Tools

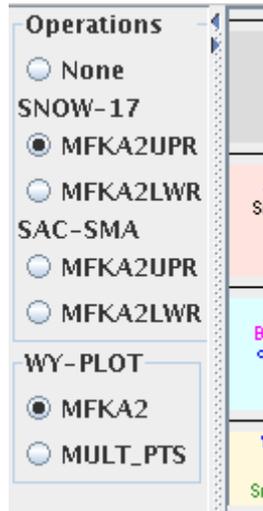
Tools provide quick access to important functionality and in some cases may duplicate menus. The following tools are available on the main ICP window:

### ICP Main Window Tools

Tool Graphic	Tool Name	Summary
	Open Deck	Open an MCP3 input deck using a navigable file chooser dialog (same functionality as the File...Open menu item).
	Save As	Save the current MCP3 input deck with a new name, and use in the active session (same functionality as the File...Save As... menu item).
	Reload	Reload the MCP3 input deck from the file system, update parameter editors if open, and run MCP3 if "Run MCP3 automatically" is checked in the open or editor dialogs. This is useful when an external editor is being used to edit the deck, for example when calibrating operations that do not have parameter editors provided by ICP.
	Run MCP3	Run MCP3 using the current deck. Recent parameter edits must have been previously saved in an editor window. This tool is also available in the PLOT-TS window.
	Stop MCP3	This tool is only enabled while MCP3 is running. Stop the MCP3 run and keep displays as they were before the run started. This tool is useful if MCP3 is hung up for some reason or more frequently if the user realizes that they introduced an input error and do not want to wait until the run finishes before correcting the input error.
	PLOT-TS	Display the PLOT-TS window. This tool is available when the MCP3 control deck includes PLOT-TS operations.

### 2.3.3 Navigation Area

The main ICP window and the PLOT-TS window both include a navigation area:



Main\_Navigation

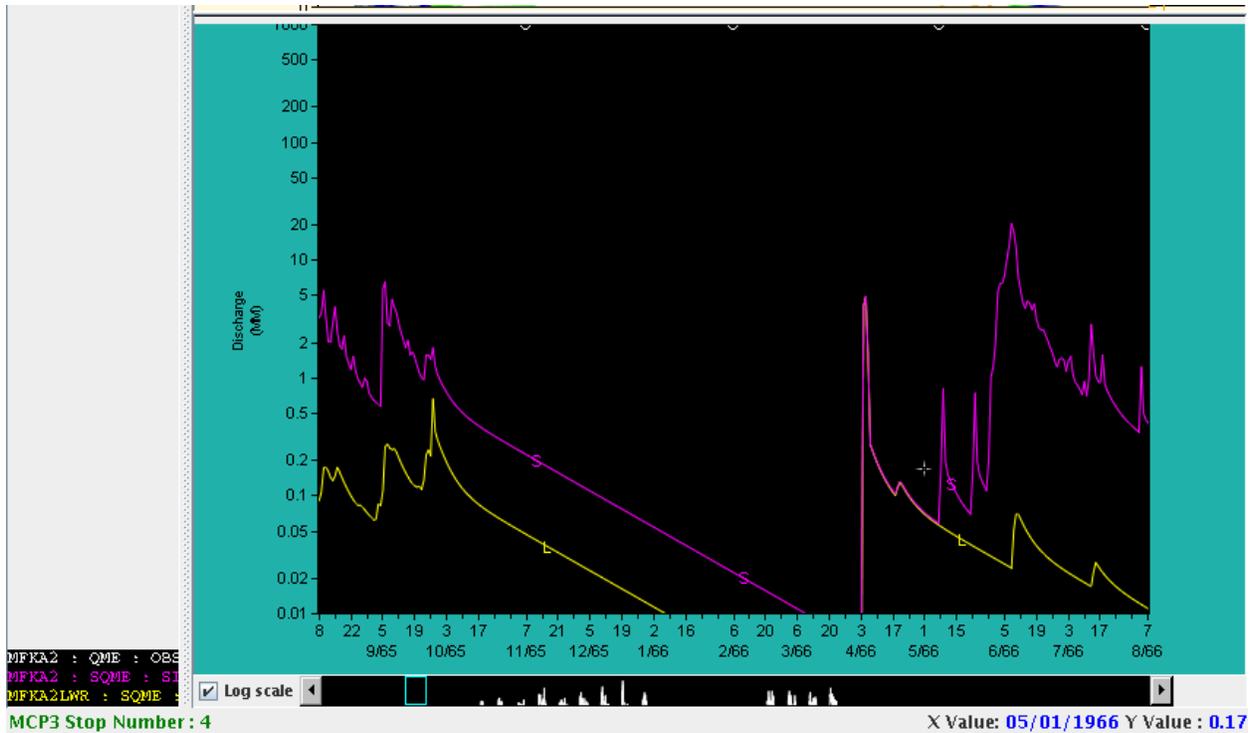
#### Main Window Navigation Area

The purpose of the navigation area is to allow a user to quickly select operations from the deck and display corresponding graphical output in the plot area. For the WY-PLOT display, operations are listed in logical order (SNOW-17, then SAC-SMA, followed by WY-PLOT). For each operation type, the specific operations are listed in the order that they appear in the MCP3 control deck. The selections in the navigator remain between MCP3 runs. The SNOW-17 and SAC-SMA operations can also be turned off in the WY-PLOT display by selecting the None choice.

The divider on the right side of the navigator allows the navigator and plot panels to be resized relative to each other.

### 2.3.4 Plot Area

Most of the main ICP window is devoted to WY-PLOT output, consisting of SAC-SMA or SNOW-17 time series above a discharge plot. Similarly, most of the PLOT-TS window is devoted to PLOT-TS output. Specific features of each plot are discussed in following sections. General features are as follows.

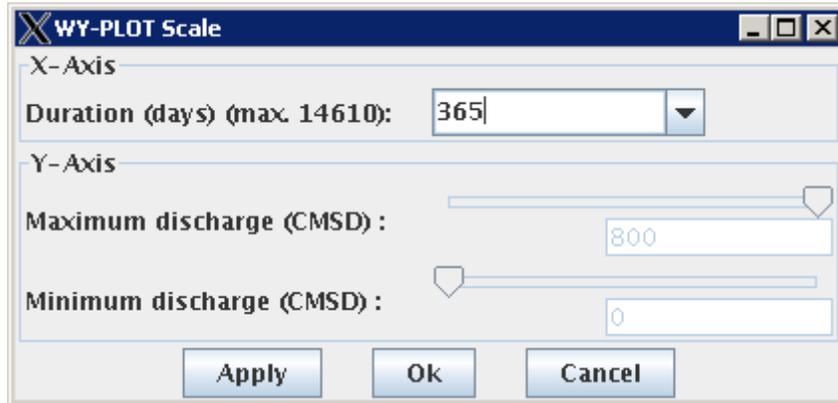


Plot\_Main

Main Window Discharge Plot Area

### 2.3.4.1 Setting the Scale of the Plot

The plots display time series as per the WY-PLOT (and PLOT-TS) operations in the MCP3 control deck. Y-axis limits are determined from data limits, in some cases are hard-coded, or are specified in the deck. The Y-axis scale and X-axis duration (visible period) are set using the main window Edit...WY-PLOT Scale... menu item. The PLOT-TS window scale is configured using the Edit...PLOT-TS Scale... menu item. For example, the WY-PLOT scale editor is shown below:



WY-PLOT\_Scale

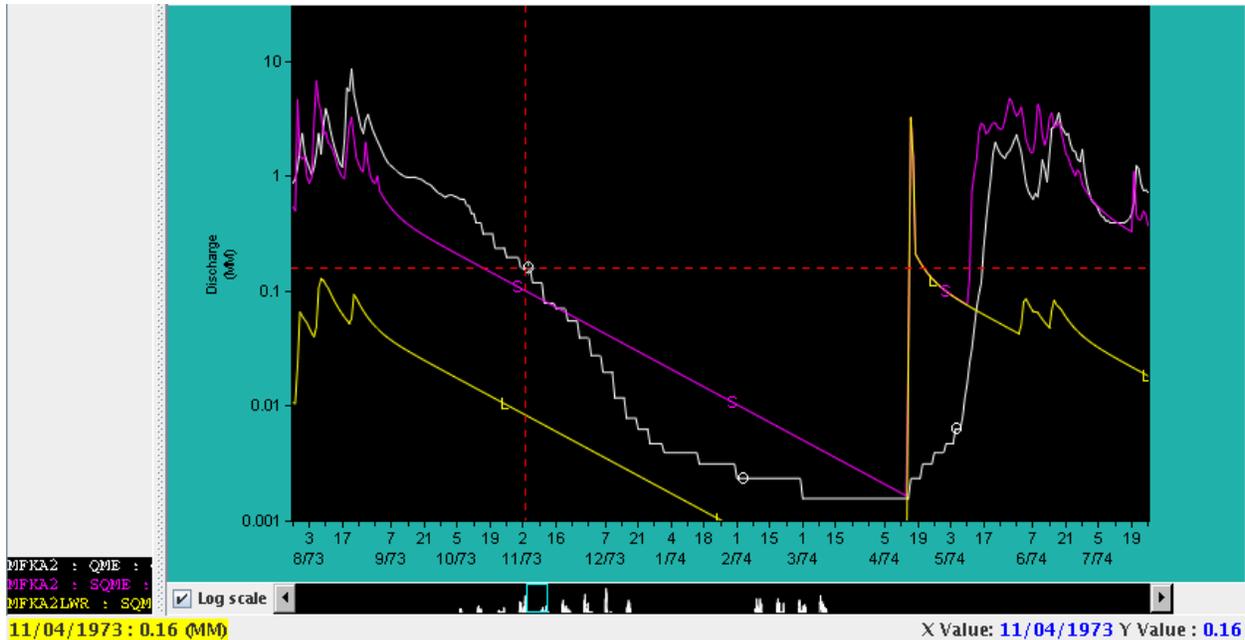
#### WY-PLOT Scale Dialog

The Y-axis range cannot be edited when log scale is selected because the purpose of using a log axis is to show all available data. Using log scale with WY-PLOT results in the discharge plot having units of millimeters. The maximum and minimum values to display can be selected by using the sliders or typing values into the fields. Values outside of the displayed range can be entered, which will result in the sliders rescaling.

### 2.3.4.2 Displaying the Coordinates Corresponding to a Point on the Graph

The date and data value corresponding to the mouse location are shown in the lower right corner of the plot window and are updated as the mouse is moved. The data coordinates that are shown are interpolated from the pixel coordinates of the mouse and therefore values may not exactly match time series data values. This feature is enabled for the WY-PLOT discharge plot and all PLOT-TS plots.

To display the exact data value corresponding to time series, right-click on the WY-PLOT discharge plot or a PLOT-TS plot. This will display the date/time and corresponding data value in the status bar in the lower left of the window and will display a red dashed cross hair in the plot window, as shown in the following figure:



Plot\_CrossHair

### Example Time Series Plot Data Value Display

The data coordinate information will continue to be displayed until another status message is shown. The crosshair will be removed when the mouse leaves the plot area or the plot is scrolled. If the time series has only missing data at the selected plot position, then only the vertical line will be displayed. The following behavior is specific to the plot operations:

WY-PLOT – the first time series listed in the deck for the WY-PLOT operation is used to find the data value (as per the legacy ICP)

PLOT-TS – the nearest time series vertically is chosen to determine the data coordinates

The plot scale should be changed if it is difficult to select a data point.

#### 2.3.4.3 Plot Legend

A legend for the graph is shown in the bottom of the navigator area (to the left of the plot). The full legend can be shown by widening the navigator area. Tool tips showing the legend information can also be shown by positioning the cursor over an item in the legend.

#### 2.3.4.4 Scrolling a Plot

A panner window is shown below the graph and displays the full period with a cyan box indicating the portion of the entire plot that is currently visible in the plot window. The graph can be scrolled by any of the following methods:

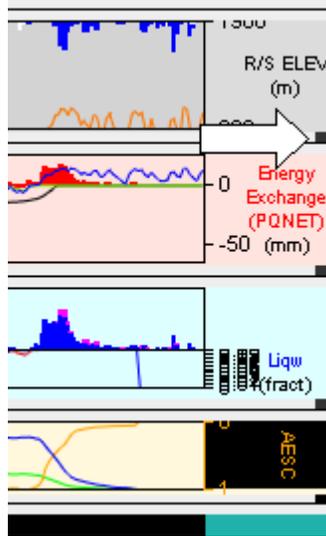
1. Click on (or hold) the scrollbar arrows on the ends of the panner window. Each click shifts the graph by one day. Holding the mouse down will scroll continuously. This can be used to make slight adjustments to the visible period but is generally too slow to scroll through the entire period.
2. Click on the cyan box in the panner and drag it to the desired position.

3. Click to either side of the cyan box in the panner to scroll to the side that was clicked. The plot will scroll by one screen. Hold the left mouse down on either side to cause scrolling to jump through multiple screens.
4. Click with the middle mouse button to reposition the plot at the requested position.
5. Grab the plot (e.g., the discharge plot) and drag the mouse in either direction. This is equivalent to dragging the cyan box in the panner.

If the plot is scrolled to the edge of the period and the duration is changed to extend beyond the period, the visible extent of the graph may be adjusted to accommodate the new duration.

### 2.3.4.5 Resizing Plots

The WY-PLOT and PLOT-TS plots are separated by horizontal dividers, as shown below:



Plot\_Handles

#### Plot Handles for Resizing Subplots

There are two types of dividers, with similar behavior:

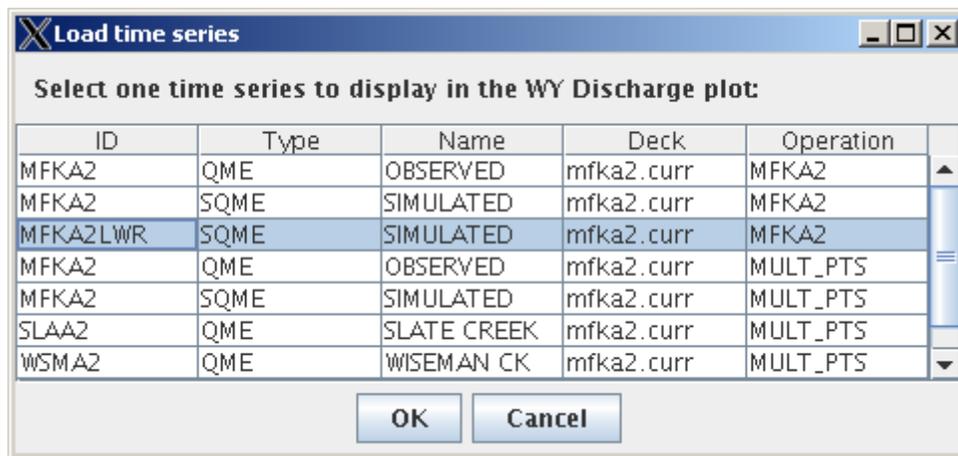
1. Main dividers split the WY-PLOT discharge plot (lower part of main window) from the SAC-SMA and SNOW-17 output (upper part of main window). To resize the plot area on either side of the divider, position the cursor on the divider and then drag the divider while holding the left mouse button down. The plots above and below the divider will resize proportionally as the divider is pulled. A black square handle is provided to facilitate seeing the width of the divider.
2. Sub-plot dividers separate sub-plots, for example within the SAC-SMA plot area. These dividers are also represented as a gray line across the plot window but are also highlighted with a small black box (see the horizontal arrow in the above figure). To resize the plot area on either side of the divider, position the cursor on the divider and then drag the divider while holding the left mouse button down. The sub-plots above and below the divider will resize as the divider is pulled.

Attempts have been made to set intelligent defaults on plot sizes and for the behavior of plots during resizing. Running ICP remotely (for example using Cygwin or Hummingbird Exceed) may result in cursors that are different than when run when sitting at a Linux console. For example, the cursor should change to double vertical arrows when positioned over a divider but may remain a simple arrow when running remotely.

### 2.3.4.6 Displaying Saved Time Series

Time series from a previous simulation can be displayed on the WY-PLOT discharge plot and PLOT-TS sub-plots. Similar to the legacy ICP, the new ICP allows only a single time series from a previous simulation to be displayed on the plot. However, all output time series can be saved and any of them can be displayed (one at a time). The procedure to display saved data is similar for WY-PLOT and PLOT-TS and is summarized below:

1. Run MCP3 to generate output.
2. Use the File...Save Time Series menu item on the main or PLOT-TS plot window to save output time series for viewing in later plots. The time series are saved in files that use a unique name. The time series will be available for plots until the user quits ICP (and the temporary files are cleaned) or a new set of time series files is saved.
3. Make appropriate changes to the input deck and rerun MCP3.
4. Use the File...Load Saved Time Series menu item on the appropriate plot window to load saved time series. For example, the following figure illustrates selecting a time series to display on a WY-PLOT:



WY-PLOT\_LoadTS

#### Selecting Saved Time Series for Display on the WY-PLOT Discharge Plot

After loading, the time series will be displayed as an orange dashed line on the plot and will be listed in the plot legend.

5. If necessary, clear the time series from the plot using the File...Clear Displayed Saved Time Series menu item from the appropriate plot window. The plot will be redrawn without the saved time series.

### 2.3.4.7 Missing Data in Plots

Missing data values in plots are handled similar to the legacy ICP. In order to not clutter the plot and to improve plot performance, a limited number symbols per line are shown and therefore symbols are not guaranteed to be drawn at single data points. Handling of missing data varies by plot type, as described below.

For WY-PLOT, missing data result in a break in the line. Therefore, if non-missing values are available only intermittently, values will not be visible on the plot unless a symbol happens to align with the single value. It is recommended that PLOT-TS be used in cases where extensive missing data will be encountered.

For PLOT-TS, missing data represented as -999 values in the original data are allowed to draw on the plot but are ignored for the scale. This results in vertical lines down to -999 and serves as a visual cue

that data are missing. Setting the scale to have a minimum value below -999 will show the missing values but normally users would rely on the default scaling.

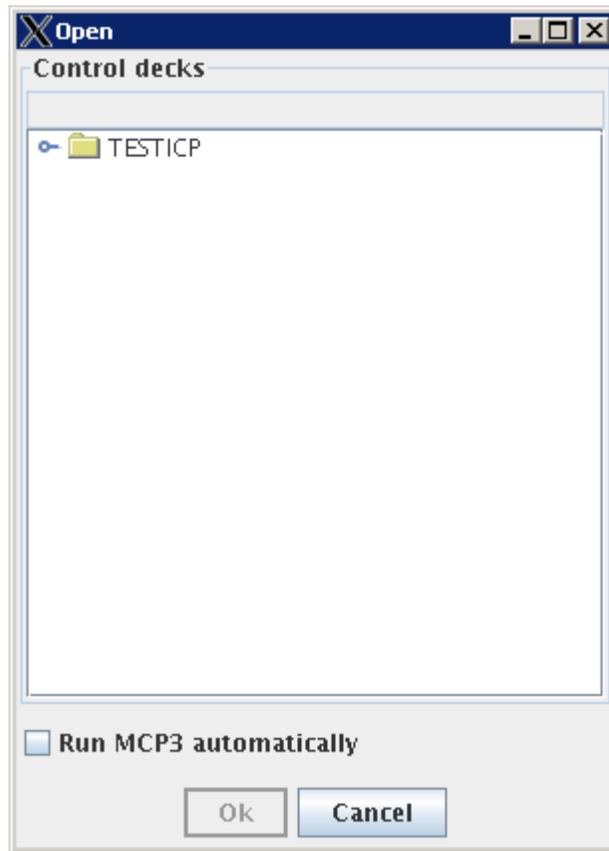
For log scale, the minimum value for plot purposes is typically set to .001 since values  $\leq 0$  are not allowed.

### 2.3.5 Status Area

The status area at the bottom of the main and PLOT-TS windows indicates the status of important actions. In particular, after MCP3 is run, the status area will indicate the MCP3 stop code. A stop code less than or equal to 4 will result in a status area message. A stop code greater than 4 will additionally result in an error dialog and the user can indicate if plots should be attempted. Errors are typically the result of incorrect formatting in the input deck. All errors and warnings should be corrected if possible. ICP will generally detect when there is an input error because MCP3 will report an error; however, there are limited cases where MCP3 does not cleanly handle errors and MCP3 may need to be stopped using the Stop MCP3 tool. The MCP3 output listing can be reviewed to evaluate errors.

## 2.4 Selecting an MCP3 Deck

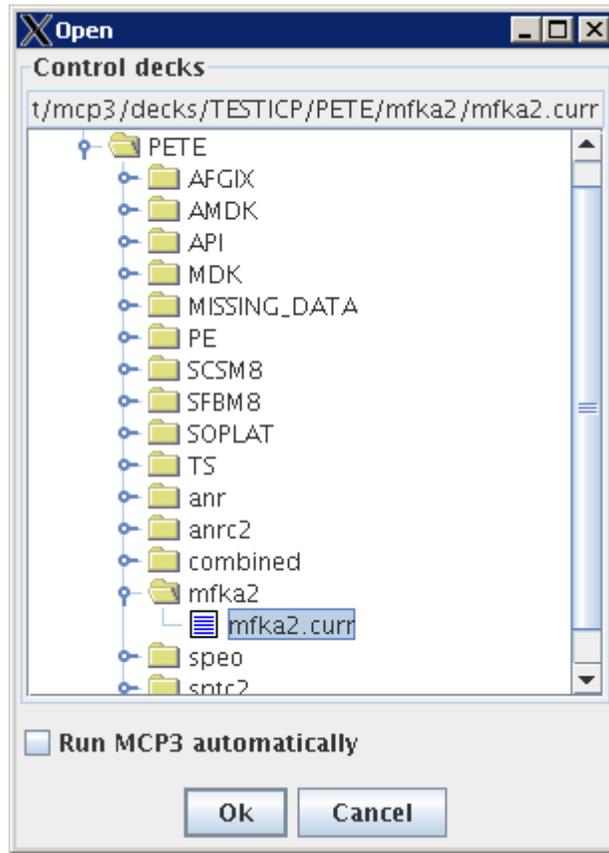
An MCP3 deck is selected by using the File...Open menu item or the Open tool. The following dialog will be displayed, opening to the directory specified by the `mcp_decks` App Defaults token.



Menu\_File\_Open

**Selecting an MCP3 Deck – Initial View**

To navigate to a deck, expand/contract the directory tree by double-clicking on the directory name next to the folder symbol, or single-click on the left-most symbol. For example, after expanding several layers, the open dialog may appear as follows:



Menu\_File\_Open\_Selected

### Selecting an MCP3 Deck – After Expanding Directories

The following are features of the open dialog:

1. The name of the most recent selected file is displayed at the top of the dialog.
2. The dialog refreshes each time that it is displayed. This is necessary to display the list of new decks that may have been created with File...Save As..., File...Save a Copy..., and due to user actions external to ICP.
3. By default MCP3 will always run after a deck is initially opened, to allow ICP to display the results associated with the selected deck. Selecting the “Run MCP3 automatically” checkbox will turn on automatic MCP3 runs for the session. A similar checkbox is displayed in many of the editor windows to streamline calibration. The initial MCP3 run will occur regardless of the checkbox setting. The setting is remembered during the ICP session but not between sessions.

After selecting a deck to be edited, press OK. Or, press Cancel to continue with the previously selected deck.

After a deck is selected, it will be the active deck used in calibration. The deck editor and open parameter editors will update with information from the selected deck. If the selected deck does not have operations for open parameter editors, the editors will close. The output displays will clear until MCP3 results are available for display.

Unlike the legacy ICP, there is no need to reselect a name to save before running MCP3. All edits to data occur on the currently selected deck. Different deck names can be saved using File...Save As... and File...Save a Copy... menu items.

## 2.5 Running MCP3

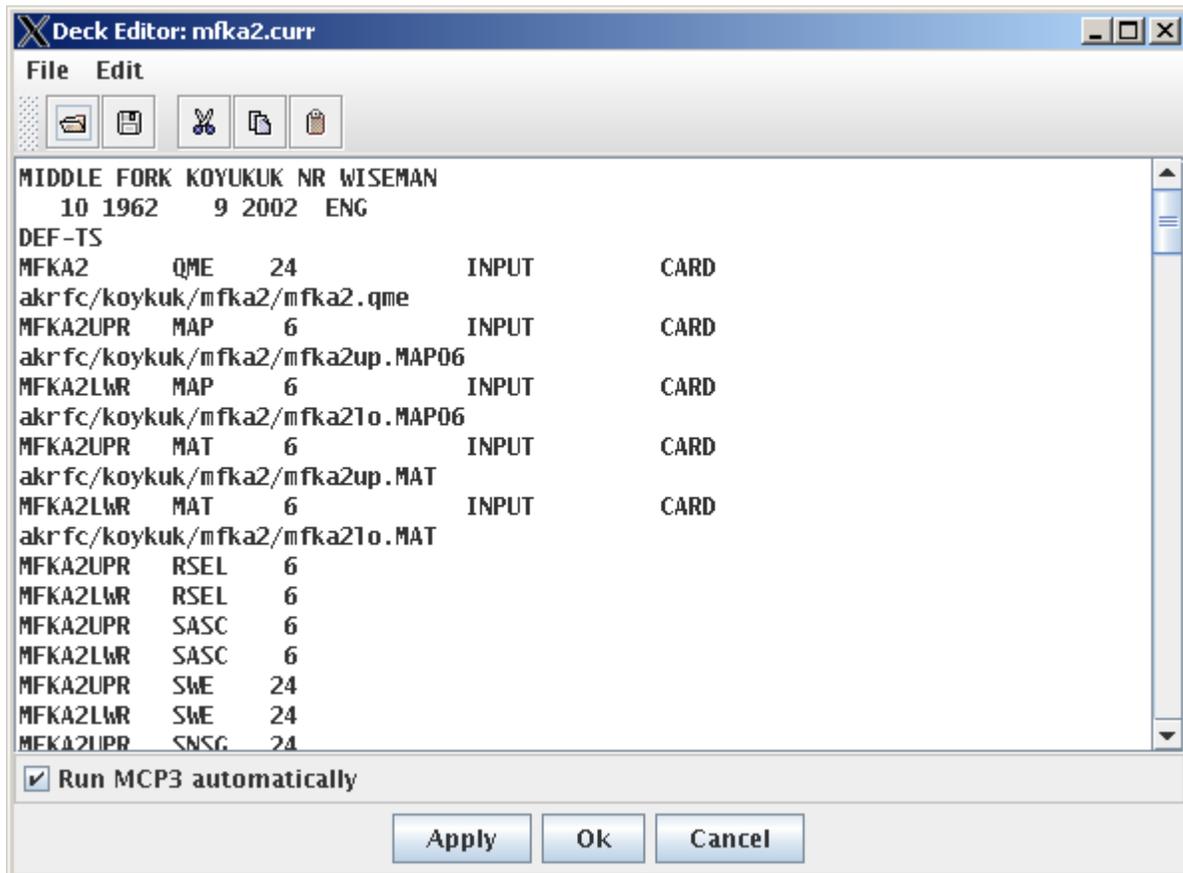
At an time after an MCP3 control deck has been selected, MCP3 can be run using either the Reload or Run buttons on the main ICP window. MCP3 will also run if the “Run MCP3 automatically” checkbox has been selected in any dialog throughout ICP and Apply or Ok buttons are used in parameter editors. If open, the output displays, including the MCP3 output listing, WY-PLOT, and PLOT-TS windows will be automatically updated to display MCP3 output.

## 2.6 Editing MCP3 Input

The MCP3 control deck can be edited in several ways, each of which is discussed in more detail in the following sections.

### 2.6.1 Editing the MCP3 Control Deck

The Edit...Control Deck menu item in the main ICP window displays an editor window for the MCP3 control deck.



Menu\_Edit\_ControlDeck

### Control Deck Editor

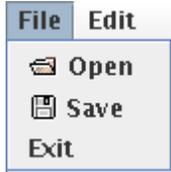
An internal editor is used by default. A user-specified editor can be configured using the `icp_editor` App Defaults token (see the Installation and Configuration appendix). The Reload tool available on the

main ICP window is useful if an external editor is used. If a line is selected in the internal editor, then the line will be reselected after the next MCP3 run, keeping the editor at the same position.

### 2.6.1.1 Editor Menus

The following menus are available in the editor:

#### ICP Editor Menus

Menu	Illustration	Summary
File	 <p>Editor_Menu_File</p>	<p>Open – open an MCP3 input deck using a navigable file chooser dialog. The deck editor and open parameter editors will update with information from the selected deck. If the selected deck does not have operations for open parameter editors, the editors will close. The output displays will clear until MCP3 output is available for display. This is equivalent to the File...Open menu on the main window.</p> <p>Save – save the changes made to the deck and update other parameter editors that are open. If “Run MCP3 automatically” is checked, run MCP3 and update output displays.</p> <p>Exit – close the editor. This hides the window but does not perform actions associated with the Ok or Cancel buttons. Immediately reopening the editor after Exit is selected will show the previous editor contents.</p>
Edit	 <p>Editor_Menu_Edit</p>	<p>Cut – cut selected text, removing it from the file and saving in the clipboard.</p> <p>Copy – copy selected text, saving it to the clipboard.</p> <p>Paste – paste the clipboard contents at the caret position in the editor.</p> <p>Select All – select the content of the entire file.</p>

### 2.6.1.2 Editor Tools

The tools available at the top of the editor window are as follows:

**ICP Editor Tools**

Tool Graphic	Tool Name	Summary
	Open Deck	Open an MCP3 input deck using a navigable file chooser dialog. See the description for the File...Open menu item.
	Save	Save the changes made to the deck and update other parameter editors that are open. If "Run MCP3 automatically" is checked, run MCP3 and update output displays. This is equivalent to the Apply button.
	Cut	Cut selected text, removing it from the file and saving in the clipboard.
	Copy	Copy selected text, saving it to the clipboard.
	Paste	Paste the clipboard contents at the caret position in the editor.

### 2.6.1.3 Editor Buttons

The buttons available at the bottom of the editor window are as follows:

**ICP Editor Buttons**

Button	Description
Apply	Save the deck and update other parameter editors that are open. If "Run MCP3 automatically" is checked, run MCP3 and update output displays. Do not close the editor window.
OK	Save the deck and update other parameter editors that are open. If "Run MCP3 automatically" is checked, run MCP3 and update output displays. Close the editor window.
Cancel	Close the editor window and dismiss any edits that may have been made.

### 2.6.1.4 Editor Behavior

The internal editor has the behavior listed below. “Caret” refers to the cursor position.

#### ICP Editor Behavior

Editor Action	Key Combination
Caret backward	Left arrow
Caret beginning of line	Home
Caret beginning of file	Ctrl+Home
Caret down.	Down arrow
Caret end of line	End
Caret end of file	Ctrl+End
Caret forward	Right arrow
Caret next word	Ctrl+Right arrow
Caret previous word	Ctrl+Left arrow
Caret up	Up arrow
Copy to clipboard	Copy OR Ctrl+c
Cut to clipboard	Cut OR Ctrl+x
Delete next	Delete
Delete previous	Backspace OR Ctrl+h
Insert break	Enter
Insert tab	Tab
Page down	Page Down
Page up	Page Up
Paste from clipboard	Paste OR Ctrl+v
Select all	Ctrl+a
Selection backward	Shift+Left Arrow
Selection begin line	Shift+Home
Selection begin file	Ctrl+Shift+Home
Selection down	Shift+Down arrow
Selection end line	Shift+End
Selection end file	Ctrl+Shift+End
Selection forward	Shift+Right arrow
Selection next word	Ctrl+Shift+Right arrow
Selection page down	Shift+Page Down
Selection page left	Ctrl+Shift+Page Up
Selection page right	Ctrl+Shift+Page Down
Selection page up	Shift+Page Up
Selection previous word	Ctrl+Shift+Left arrow
Selection up	Shift+Up arrow
Unselect	Ctrl+backslash

## 2.6.2 Editing Operation Parameters in Table and Curve Editors

Operation parameters are edited using menus such as Edit...SAC-SMA.... Parameters are listed in a table, as illustrated in the following figure.

	MFKAZUPR	MFKAZLWR
UZTWM	10.	10.
UZFWM	25.	5.
UZK	30.0	0.30
PCTIM	0.0	0.0
ADIMP	0.35	0.0
RIVA	0.0	0.0
ZPERC	150.	150.
REXP	1.20	2.0
LZTWM	50.	50.
LZFSM	30.0	10.0
LZFPM	60.	40.
LZSK	0.180	0.180
LZPK	0.0250	0.0250
PFFREE	0.80	0.80
SIDE	0.0	0.0
ET_DEMAND	Curve	Curve
PERCOLATION_DEMAND	Perc	Perc

Preserve ratio/diff

Run MCP3 automatically

Apply Ok Cancel

ParameterTable

### Typical ICP Parameter Editing Table Illustrated by SAC-SMA Parameter Table

The tabular parameter display will vary slightly depending on the operation; however, the general behavior is similar:

1. One table is displayed for an operation type, with columns for each instance of the operation type in the deck.
2. Parameter values are formatted using a precision appropriate for each parameter.
3. Secondary editors/tools are available where appropriate. These are made available as buttons in the parameter table (see sections below for more information).
4. A “Run MCP3 automatically” checkbox is provided. If selected, then saving parameter edits with Apply or OK will cause MCP3 to run and output displays to be automatically updated.
5. Some editors include a “Preserve ratio/diff” checkbox that when selected applies an edit made in one column to all columns, in order to streamline editing.
6. The parameter editors can remain open during a session. However, opening a new MCP3 control deck may result in some windows closing, or warnings being shown that previous results must first be saved.

### 2.6.2.1 Parameter Table Editing Behavior

Parameter table editors respond to mouse actions as follows:

1. **Single click** to select cell for editing. The cursor will be at the position that was clicked.
2. **Double click** to select the cell for editing. The entire value is selected and can be typed over.

Parameter table editors validate input as follows:

1. When exiting a cell, the cell value is validated, checking for out of range and improper data type/formatting issues. If the value contains improper characters or is outside the valid range, a yellow warning displaying the valid range will be displayed for a short time. When a value is invalid, the focus will remain in the cell. The user can either provide a correct value or can press ESC, which will restore the cell to its previous value (assumed to be valid). If a cell contains an invalid value and the Apply or Ok buttons are pressed, the cell contents will revert to the previous value, as if ESC had been pressed.
2. If focus is transferred out of the cell via Enter, Tab, or mouse click, a modified cell value will be accepted, provided it is valid.
3. If the user clicks Apply, or Ok, valid cell edits will be accepted and invalid cell edits will be restored to their previous value (which is assumed to have been valid). The yellow window will be displayed for invalid cell values.

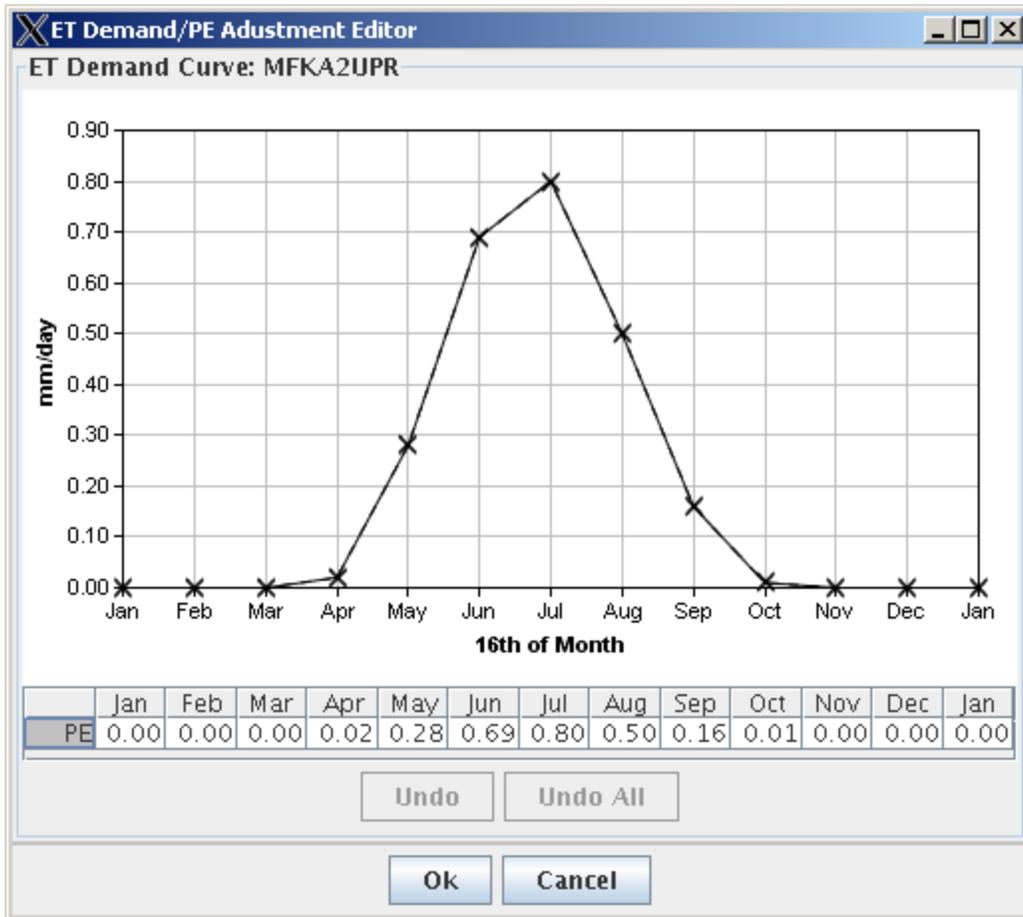
Specific key combinations for various editing actions are listed in the following table:

**Parameter Table Editor Behavior**

<b>Editor Action</b>	<b>Key Combination</b>
Move to next cell	Tab OR Right arrow
Move to previous cell	Shift+Tab OR Left arrow
Wrap to next row	Tab OR Right arrow
Wrap to previous row	Shift+Tab or Left arrow
Block move vertical	Page Up, Page Down
Block move left	Ctrl+Page Up
Block move right	Ctrl+Page Down
Block extend vertical	Shift+Page Up/Page Down
Block extend left	Ctrl+Shift+Page Up
Block extend right	Ctrl+Shift+Page Down
Move to first cell in row	Home
Move to last cell in row	End
Move to first cell in table	Ctrl+Home
Move to last cell in table	Ctrl+End
Select all cells	Ctrl+A
Deselect current selection	Up/Down Arrow OR Page Up/Page Down OR Home/End
Extend selection one row	Shift+Up/Down arrow
Extend selection one column	Shift+Left/Right arrow
Extend selection to beginning/end of row	Shift+Home/End
Edit cell without overriding current contents	F2
Reset cell content prior to editing	Esc

### 2.6.2.2 Editing Operation Parameters in Curve Editors

Curve editors are accessible from parameter table editors and provide a graphical way to modify parameter values. The results can be accepted or cancelled. All curve editors are similar in behavior.



Curve\_SAC-SMA

#### Typical ICP Curve Editor

For dialogs with combined curve and table, either the table cells can be edited or the curve points may be dragged, in any sequence. The curve will update when the cell value is accepted, whereas dragging a point will update the corresponding cell value in the table. To drag a point, it is only necessary to hold the mouse down with the cursor anywhere in the region associated with a point. For example, in the above figure, the point for Jun can be selected by clicking anywhere in the half-month before or after Jun. After a point is dragged, the original curve is shown as a solid line and the new curve is shown in a dashed line. This allows the user to verify their actions undo the change if necessary.

Each edit action will create an undo entry in a list. Dragging a point creates an entry each time the mouse is released. The Undo button will restore the cell values for each action in reverse order of editing (the last edit will be the first restored). The Undo All button will restore all cells to the original values when the curve editor was opened.

Additional information about various curve editors is provided in sections below.

## 2.7 Viewing MCP3 Output

MCP3 output is available after MCP3 has been run and can be displayed using the View...Output Listing menu item in the main ICP window. An internal editor is used by default. A user-specified editor can be configured using the `icp_editor` App Defaults token (see the Installation and Configuration appendix).

```

OutputViewer: mfka2.curr
File Edit
1NWSRFS CALIBRATION SYSTEM - PROGRAM MCP3 (VERSION: ob7.2 - 05/19/06) DATE=Mar 28, 2007 - 02:10:06
0
*****
*****
*****
***** MIDDLE FORK KOYUKUK NR WISEMAN *****
*****
*****
***** PERIOD USED FOR THIS RUN -- OCT/1962 TO SEP/2002 *****
*****
*****
*****
OTIME SERIES USED BY SEGMENT:
0 TIME DATA DATA TIME SERIES FILE ESP ESP
SERIES ID TYPE INTERVAL TYPE TYPE TYPE TS EXTERNAL INFORMATION
-----
1 MFKA2 QME 24 HOURS INPUT CARD
CARD: ID=15564875 DESCRP= MF KOYUKUK R NR WIS POR=08/1970-09/1987
PATHNAME=/home/sam/icpnew_beta_0.5.12/calb/data/area_ts/akr/c/koyukuk/mfka2/mfka2.qme
2 MFKA2UPR MAP 6 HOURS INPUT CARD
CARD: ID=MFKA2UPR DESCRP=MF WISEMAN - UPPER POR=10/1962-09/2002

```

View\_OutputListing

### MCP3 Output Listing Viewer

The behavior of the internal editor is the same as for the input deck editor; however, the output is not editable and therefore only the copy features are available.

MCP3 output should be reviewed when an MCP3 runtime error occurs or MCP3 is stopped because it is not responding. Typical errors are bad parameter formatting and bad time series file locations.

### 3. EDITING (SNOW-17) MODEL PARAMETERS

SNOW-17 operation parameters are edited using the Edit...SNOW-17... menu item. A parameter table will be displayed as follows:

	MFKAZUPR	MFKAZLWR
SCF	0.95	0.95
MFMAX	0.80	80.0
MFMIN	0.10	0.10
NMF	0.20	0.20
UADJ	0.15	0.10
SI	999.0	999.0
DAYGM	0.0	0.0
MBASE	0.0	0.0
PXTEMP	1.0	1.0
PLWHC	0.10	0.10
TIPM	0.10	0.10
AREAL_DEPLETION	Curve	Curve

Preserve ratio/diff

Run MCP3 automatically

Apply Ok Cancel

Parameters\_SNOW-17

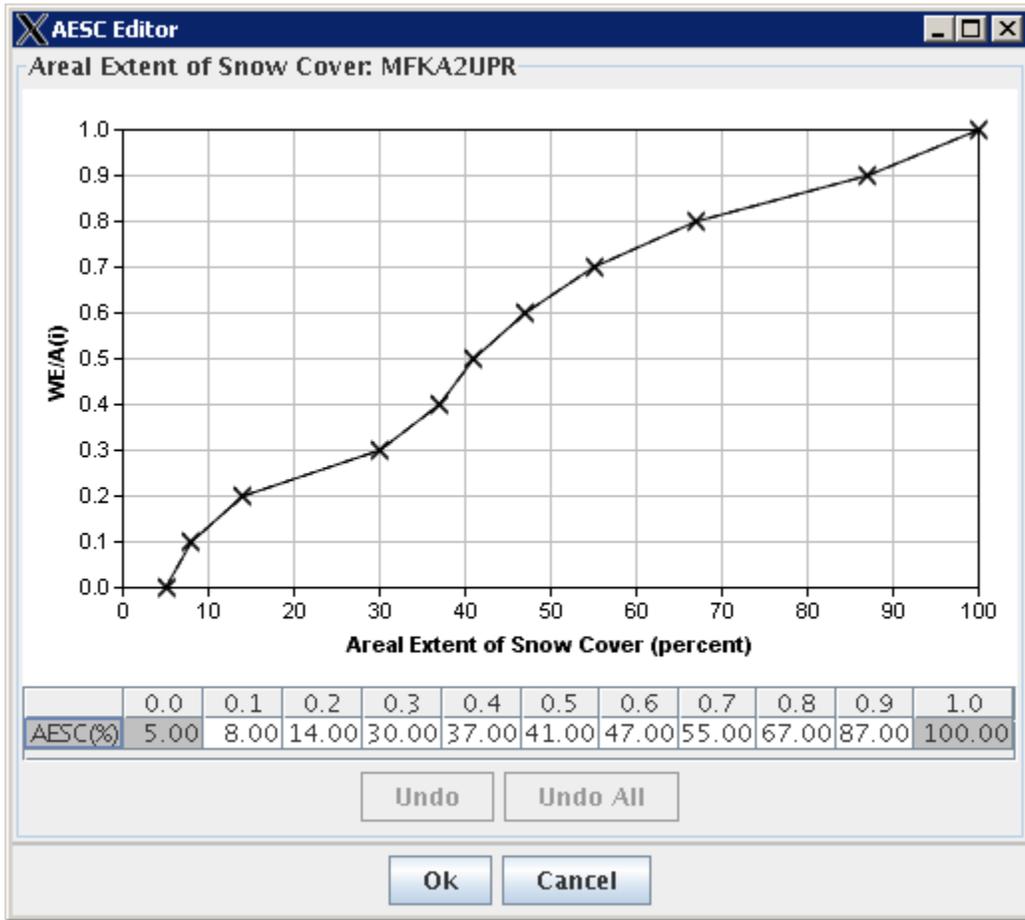
#### SNOW-17 Parameter Editor

The general editor features were described in Section 2.6.2. The “Preserve ratio/diff” checkbox indicates whether an edit in one column should result in associated edits in other columns, where either a ratio or difference is maintained. The units, validation constraints, and ratio/diff behavior for parameters in ICP are listed in the following table:

#### SNOW-17 Parameter Constraints

Parameter	Units	Minimum Value	Maximum Value	Ratio/Diff
SCF		$0 < \text{SCF}$		Ratio
MFMAX		$0 < \text{MFMAX}$		Ratio
MFMIN		$0 < \text{MFMIN}$		Ratio
NMF		$0 \leq \text{NMF}$	$\text{NMF} < 999.9$	Ratio
UADJ		$0 \leq \text{UADJ}$	$\text{UADJ} < 999.9$	Ratio
SI		$0 \leq \text{SI}$	$\text{SI} < 999.9$	Ratio
DAYGM		$0 \leq \text{DAYGM}$	$\text{DAYGM} < 999.9$	Ratio
MBASE		$-273 \leq \text{MBASE}$	$\text{MBASE} < 999.9$	Diff
PXTEMP		$-273 \leq \text{PXTEMP}$	$\text{PXTEMP} < 999.9$	Diff
PLWHC		$0 \leq \text{PLWHC}$	$\text{PLWHC} \leq 1.0$	Ratio
TIPM		$0.1 \leq \text{TIPM}$	$\text{TIPM} \leq 1.0$	Ratio

The areal extent of snow cover curve for a SNOW-17 operation can be viewed by pressing the Curve button for the AREAL\_DEPLETION parameter. A curve editor similar to the following is displayed:



Curve\_SNOW-17

### SNOW-17 Areal Extent of Snow Cover Curve Editor

The curve coordinates can be dragged horizontally and AESC values can be edited by typing in the table cells under the curve. After making changes, press Ok to save the changes. It is necessary to press Apply or Ok in the main parameter editor window to save the changes to the input deck.

## 4. EDITING SACRAMENTO SOIL MOISTURE ACCOUNTING (SAC-SMA) MODEL PARAMETERS

SAC-SMA operation parameters are edited using the Edit...SAC-SMA... menu item. Parameters are listed in a table similar to the following:

	MFKAZUPR	MFKAZLWR
UZTWM	10.	10.
UZFWM	25.	5.
UZK	30.0	0.30
PCTIM	0.0	0.0
ADIMP	0.350	0.0
RIVA	0.0	0.0
ZPERC	150.	150.
REXP	2.0	2.0
LZTWM	50.	50.
LZFSM	30.0	10.0
LZFBM	60.	40.
LZSK	0.180	0.180
LZPK	0.0250	0.0250
PFRFE	0.80	0.80
SIDE	0.0	0.0
ET_DEMAND	Curve	Curve
PERCOLATION_DEMAND	Perc	Perc

Preserve ratio/ diff

Run MCP3 automatically

Apply Ok Cancel

ParameterTable

### SAC-SMA Parameter Editor

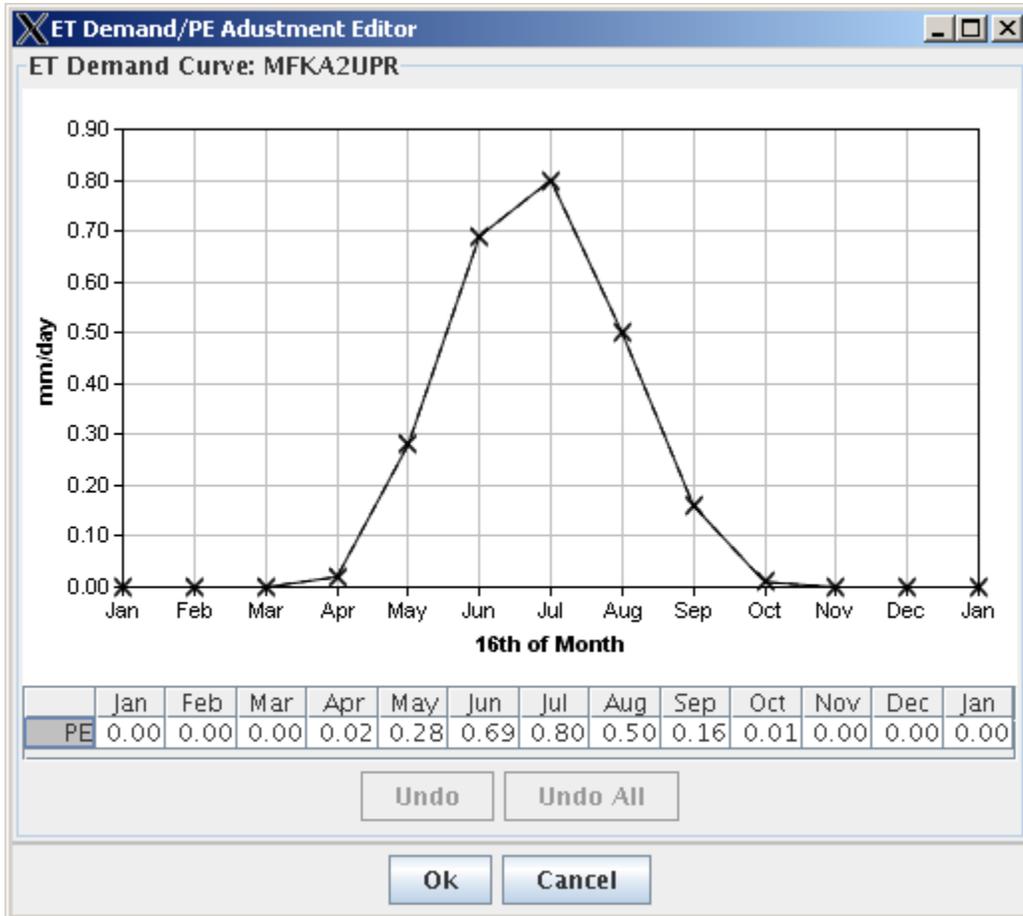
The general editor features were described in Section 2.6.2. The “Preserve ratio/diff” checkbox indicates whether an edit in one column should result in associated edits in other columns, where either a ratio or difference is maintained (this does not apply to the curves). The units, validation constraints, and ratio/diff behavior for parameters in ICP are listed in the following table:

### SAC-SMA Parameter Constraints

Parameter	Units	Minimum Value	Maximum Value	Ratio/Diff
UZTWM		0.1 <= UZTWM		Diff
UZFWM		0.1 <= UZFWM		Diff
UZK		0 <= UZK	UZK <= 1.0	Ratio
PCTIM		0 <= PCTIM	PCTIM <= 1.0	Ratio
ADIMP		0 <= ADIMP	ADIMP < 1.0 - PCTIM	Ratio
RIVA		0 <= RIVA	RIVA <= 1.0	Ratio
ZPERC		0 <= ZPERC		Ratio
REXP		0 < REXP		Ratio
LZTWM		0.1 <= LZTWM		Diff

Parameter	Units	Minimum Value	Maximum Value	Ratio/Diff
LZFSM		0.1 <= LZFSM		Ratio
LZFPM		0.1 <= LZFPM		Ratio
LZSK		0 <= LZSK	LZSK <= 1.0	Ratio
LZPK		0 <= LZPK	LZPK <= 1.0	Ratio
PFREE		0 <= PFREE	PFREE <= 1.0	Ratio
SIDE		0 <= SIDE		Ratio

The ET demand curve for a SAC-SMA operation can be viewed by pressing the Curve button for the ET\_DEMAND parameter. A curve editor similar to the following is displayed:

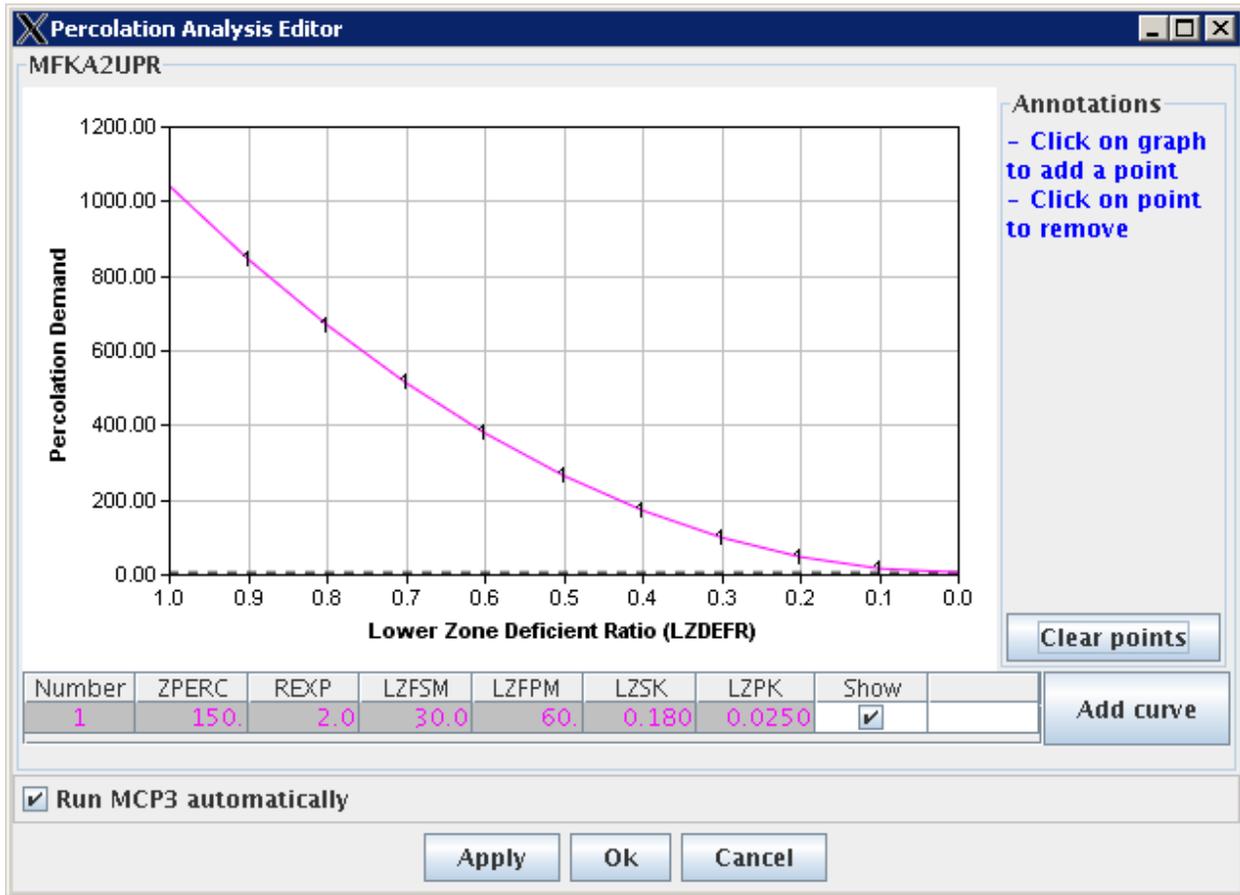


Curve\_SAC-SMA\_ETDemand

### SAC-SMA ET Demand Curve Editor

The curve coordinates can be dragged vertically and PE values can be edited by typing into the table cells under the curve. After making changes, press OK to save the changes. It is necessary to press Apply or Ok in the main parameter editor window to save the changes to the input deck.

The percolation curve for a SAC-SMA operation can be viewed by pressing the Curve button for the PERCOLATION\_DEMAND parameter. A curve editor similar to the following is displayed:



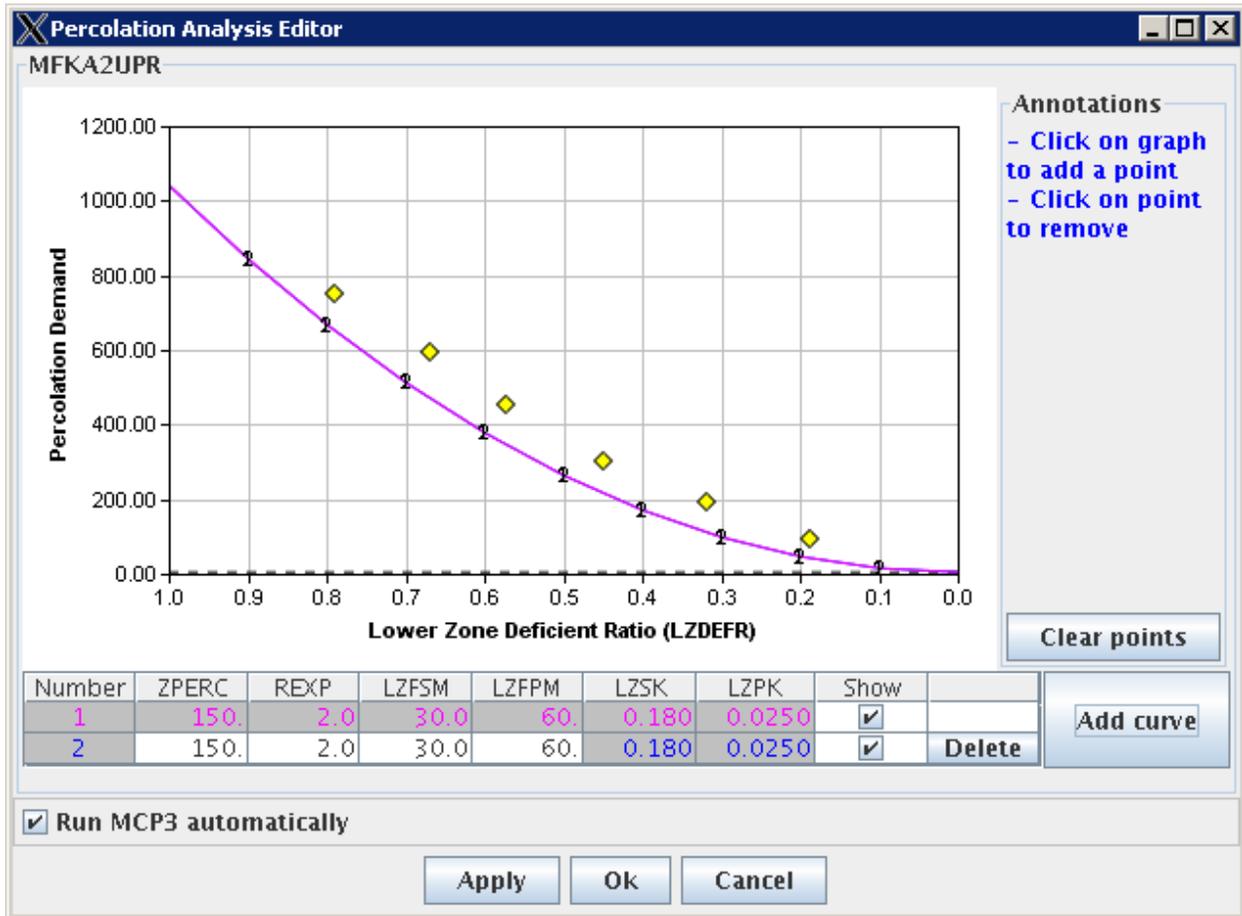
Curve\_SAC-SMA\_PERC

### SAC-SMA Percolation Curve Analysis Editor After Initial Display

The initial display shows the curve corresponding to the values from the control deck (the curve that was last applied). This curve can only be edited by modifying the cell values in the table. The curve is not editable by clicking and dragging.

As indicated in the upper right of the window, points can be added to the curve as a target (see figure below for example). The Clear points button can be used to clear all points.

To add an additional curve for analysis, press the Add Curve button, which will result in a display similar to the following:

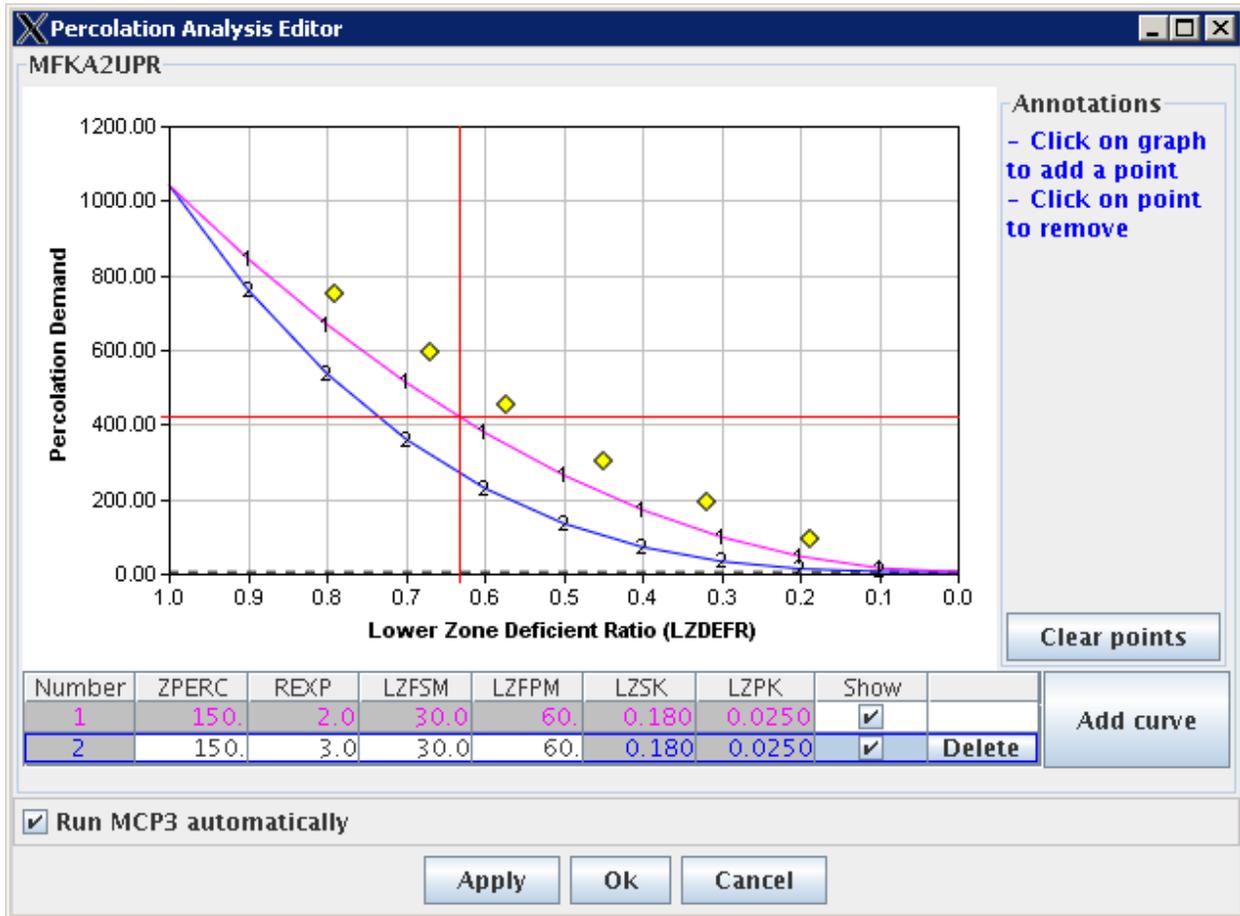


Curve\_SAC-SMA\_PERC2

### SAC-SMA Percolation Curve Analysis Editor After Adding a Curve

The coordinates of the curve can be edited by first selecting a row in the table and then editing cell values (press Enter or Tab to cause the value to be recognized). A new curve will be displayed for the new values. The edited results can be applied and MCP3 run. Only a single curve can be selected and saved. There is no need to apply edits in the main SAC-SMA parameter window, unless other parameters were edited.

If the percolation curve editor is displayed and the user clicks on the WY-PLOT discharge plot (using the left or right mouse button), the corresponding location on the percolation curve is indicated as shown in the following figure:



Curve\_SAC-SMA\_PERC2

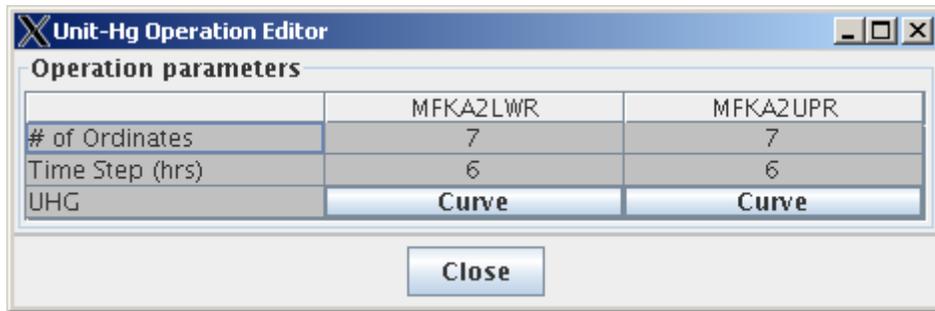
### SAC-SMA Percolation Curve Analysis Editor After Editing Parameters and Clicking on WY-PLOT Discharge Plot

This allows modelers to evaluate the curve for wet and dry periods in a simulation and adjust the curve as appropriate. Once a curve is edited and saved, new points from WY-PLOT will appear on the latest saved curve.

The curves in the percolation analysis editor can be selected for display visibility and deletion. The first curve cannot be deleted. These features are mainly used to manage the curve display.

## 5. EDITING UNIT-HG OPERATION PARAMETERS

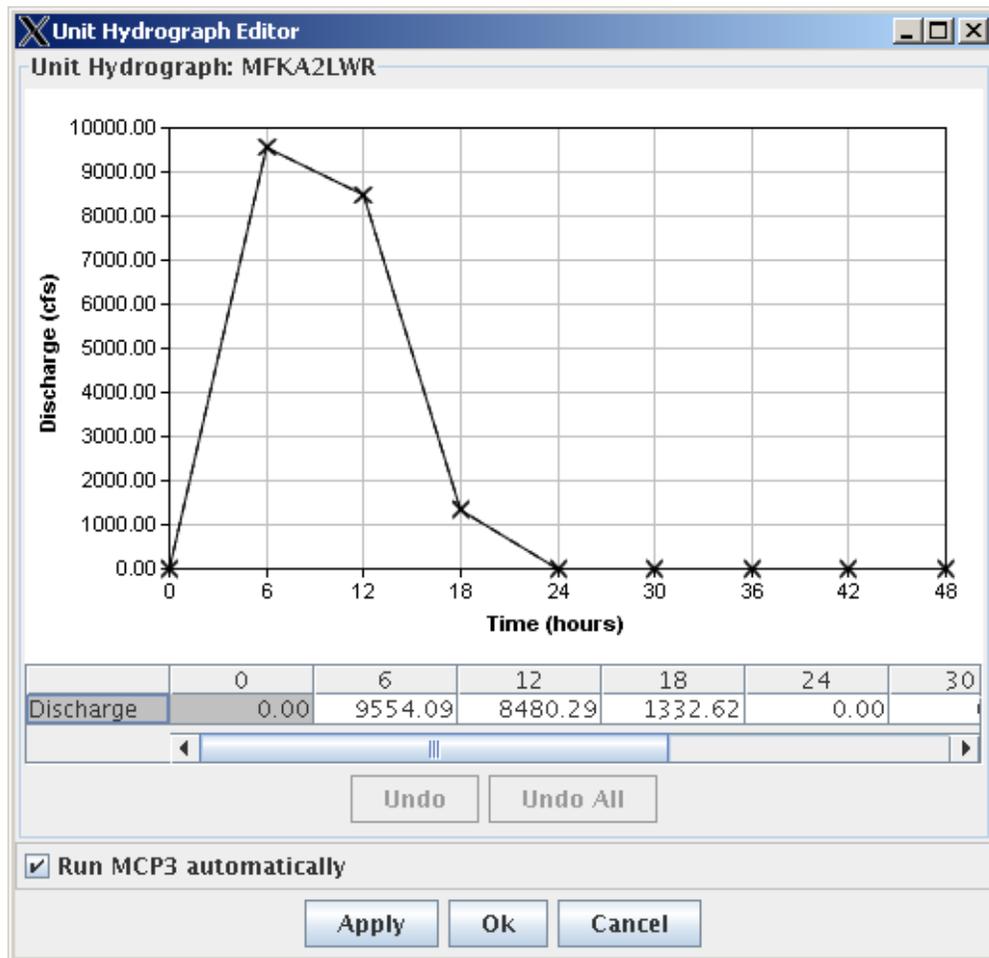
UNIT-HG operation parameters are edited using the Edit...UNIT-HG... menu item. A parameter table will be displayed as follows:



Parameters\_UNIT-HG

### UNIT-HG Parameter Editor

The values in the table shown above are not editable, and the user must press the Curve button for the UHG parameter. The following figure illustrates the curve editor:



Curve\_UNIT-HG

### UNIT-HG Curve Editor

Unit hydrograph ordinates in the table can be edited, or points on the curve can be dragged vertically. When a single ordinate on the curve is changed, all unit hydrograph ordinates are modified to preserve the volume under the graph as follows:

1. Dragging a single point will result in all points being scaled to preserve the sum of the curve values (even the dragged point is adjusted).
2. If a second point (to the right of the first point) is dragged, the curve between the two most recently edited points is made a straight line, and the points are adjusted to maintain the original sum.

The edits made in the UNIT-HG curve editor can be immediately applied and MCP3 optionally run. When the window is closed using OK or Cancel, the main UNIT-HG editor can simply be closed.

## **6. DISPLAYING SIMULATION RESULTS USING THE WATER YEAR PLOT (WY-PLOT)**

General WY-PLOT display features were described in Section 2.3.4. Additional functionality specific to the WY-PLOT display includes:

1. The navigator can be used to switch between SNOW-17, SAC-SMA, and WY-PLOT operations.
2. If no WY-PLOT operation is included, a note will be shown in the navigator. SAC-SMA and SNOW-17 output can still be selected for plotting.
3. The RAIM time series graph will only be shown if the input deck specifies that the time series should be displayed.

## **7. DISPLAYING SIMULATION RESULTS USING THE TIME SERIES PLOTS (PLOT-TS)**

General PLOT-TS display features were described in Section 2.3.4. Additional functionality specific to the PLOT-TS display includes:

1. The navigator can be used to switch between PLOT-TS operations.
2. Saved time series can be displayed in each sub-plot.
3. The File menu includes an item to close the window (but not exit ICP).

## 8. TROUBLESHOOTING

The following table summarizes common ICP run-time errors and possible solutions.

**ICP Errors and Possible Solutions**

#	Error Condition	Possible Solution(s)
1	<p>At startup running icpnew, the following error message is displayed:</p> <pre>Exception in thread "main" java.lang.UnsupportedClassVersionError: ohd/hseb/icp/ICP (Unsupported major.minor version 49.0) at .... at.... etc.</pre>	<p>ICP requires version 5+ Java Runtime Environment (JRE) software. This error is indicative of an earlier version of the JRE being used (e.g., due to an older OB release being installed on the system). The JRE is located in a directory pointed to by the App Defaults variable <code>sys_java_dir</code> followed by <code>/bin/java</code>. Check the version by running:</p> <pre>\$(gad sys_java_dir)/bin/java -version</pre> <p>The version should be 1.5 or greater as indicated in the following output:</p> <pre>java version "1.5.0_04" Java(TM) 2 Runtime Environment, Standard Edition (build 1.5.0_04-b05) Java HotSpot(TM) Server VM (build 1.5.0_04-b05, mixed mode)</pre>
2	<p>After running MCP3, an exception message is displayed indicating an "out of memory" error.</p>	<p>The <i>icpnew</i> script calls the Java Runtime Environment with the <code>-mx###m</code> parameter that indicates the maximum memory to use during a session. This value may need to be increased if new MCP3 decks are used that exceed limits seen by software developers. The script can be changed on the local system but developers should be contacted so that the source script can be changed for the next software release.</p>
3	<p>A warning dialog is shown indicating that MCP3 had a stop code greater than 4.</p>	<p>This is indicative of an error in the MCP3 input. Use the View...Output Listing menu to review MCP3 output and correct the input error.</p>
4	<p>MCP3 does not complete running.</p>	<p>There are cases where an input error causes MCP3 to crash without providing ICP with an exit status. In such cases, the Stop button in the main ICP window should be used to stop the MCP3 process. Use the View...Output Listing menu to review output and troubleshoot the error.</p>

## APPENDIX A – INSTALLATION AND CONFIGURATION

This appendix describes how to install ICP in the operational NWSRFS.

### A.1 Installing ICP

ICP is distributed as part of NWSRFS. The following files comprise the ICP installation in the operational NWSRFS. The installed location uses the get\_apps\_defaults program (or “gad” alias).

#### ICP Software Files

#	ICP File	Installed Location	Comments
1	icpnew	gad icp_scripts  For example: /awips/hydroapps/ lx/rfc/nwsrfs/icp/scripts	This script starts the ICP software. The script is called “icpnew” to allow the replacement ICP to be installed parallel to the legacy ICP software.
2	icp.jar	gad icp_rls	This Java jar file contains the compiled Java code that is run by the Java Runtime Environment (JRE).
3	User Manual		See <a href="http://hsp.nws.noaa.gov/oh/hrl/general/indexdoc.htm">http://hsp.nws.noaa.gov/oh/hrl/general/indexdoc.htm</a>

See the next section for system dependencies. ICP may not run if the NWSRFS software installation is incomplete.

## A.2 System Dependencies

ICP depends on NWSRFS files and configuration described in the following table. The “icpnew” script checks for needed App Defaults tokens and verifies the existence of directories and files before starting the ICP software.

**ICP NWSRFS Software Dependencies**

#	ICP Dependency	Installed Location	Comments
1	mcp3	gad calb_rls	ICP relies on MCP3 software to perform simulations. The installation of MCP3 is not described in this documentation but must be correct for MCP3 to run.
2	run_mcp3	gad icp_scripts	This script is used to run MCP3 from ICP.
3	MCP3 to ICP transfer directory	gad mcp3_icp_iface  For example: /tmp/\${LOGNAME}/mcp3_ntfrc	This user-specific directory is where temporary files are written to transfer information between MCP3 and ICP.  See Section 2.1.1. for information about running multiple ICP sessions at the same time.
4	Java Runtime Environment	gad sys_java_dir  For example: /usr/local/java	the Java Runtime Environment (JRE) runs the ICP software. It must be available and be version 1.5 (now also referred to as Java 5).
5	ChartDirector.jar	gad util_rls  For example: /usr/local/java/lib	This Java package provides the charting features used by ICP.
6	User’s calibration MCP3 input deck location	gad mcp_decks  For example: /awips/hydroapps/lx/rfc/nwsrfs/calb/input/\${LOGNAME}/mcp3  or, in relation to the RFC’s files:  ./rfc/nwsrfs/calb/input/\${LOGNAME}/mcp3	The location of MCP3 input decks used in calibration.
7	User’s calibration station time series file location	gad calb_sta_ts_dir  For example: ./rfc/nwsrfs/calb/data/sta_ts	The location of historical station time series (e.g. flow) in CARD format.

8	User's calibration area time series file location.	gad calb_area_ts_dir  For example: ./rfc/nwsrfs/calb/data/area_ts	The location of historical area time series (e.g., MAP and MAT) in CARD format.
9	User's calibration peak flow time series file location.	gad peakflow_data_dir  For example: ./rfc/nwsrfs/calb/data/area_ts	The location of historical peak flow time series in CARD format.
10	User's calibration output file location.	gad calb_output  For example: ./rfc/nwsrfs/calb/output	The location of MCP3 output, in particular for the main output file. A location to transfer information from MCP3 to ICP via binary files is defined by the mcp3_icp_iface App Defaults token (see item 3 above).