
**NATIONAL WEATHER SERVICE
OFFICE of HYDROLOGIC DEVELOPMENT**

TEST PLAN and PROCEDURES

Interactive Calibration Program (ICP) Replacement

**Version 4.8
Updated for ICP Version 1.00.00**

Revision History

Date	Version	Description	Author
02/04/2006	4.1	Test Plan and Procedures document provided with development and testing environment background.	Steve Malers (RTi)
12/18/2006	4.2	Based on feedback from OHD and after analyzing the needs of the project, split the previous document into an ICP Developer Manual (with information for developers) and a more traditional HOSIP Test Plan (based on SRA Software Enhancements). ICP developers who have an understanding of the software development environment can use the former, and the latter has a GUI test section that can be used by beta testers with no need to understand the developer environment (other than perhaps needing to login to NHDR machines for testing).	Steve Malers (RTi)
01/11/2007	4.3	Update the test plan content for the ICP 0.4 release. Clean up and submit to OHD for formal review. The content of the test plan will continue to grow as software development occurs.	Steve Malers (RTi)
02/19/2007	4.4 ICP Version 0.5	Change the name of the document file and document version to include the ICP version, to hopefully help avoid confusion. Update the test plan content for the ICP 0.5 release. The content of the test plan will continue to grow as software is finalized for operational release. This version does not contain ICP feedback – has not been received from OHD.	Steve Malers (RTi)
3/28/2007	4.5 ICP Version 0.6	Update the test plan content for the ICP 0.6 release, which now includes all functionality. Future updates to this document will mainly be cleanup and finalizing the cross-reference between tests and requirements.	Steve Malers (RTi)
6/20/2007	4.6 ICP Version 0.7	Update the test plan content for the ICP 0.7 release.	Steve Malers (RTi)
9/6/2007	4.7 ICP Version 1.00.00	Update the test plan content for the ICP 1.00.00 release and complete some tests that were previously incomplete.	Steve Malers (RTi)
9/6/2007	4.8 ICP Version 1.00.00	Update the test plan content for the ICP 1.00.00 release to reference the current OHD development machines.	Ai Vo (OHD)

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1. Introduction

ICP is an interactive graphical user interface (GUI) that edits parameters for the Manual Calibration Program (MCP3), runs MCP3, and displays text and graphical results. The existing ICP software (written in C and using the Motif/X-Windows graphical toolkit) is difficult to maintain and enhance and is therefore being replaced. The replacement ICP, written in Java, provides the same functionality as the original ICP, while addressing usability issues. The replacement ICP does not make any changes to the existing MCP3 program or the file formats used by MCP3.

1.1 Identification

Interactive Calibration Program (ICP) Replacement

Project ID: NID-05-019-SON-05-002

1.2 Document Overview

This testing plan details the work to be accomplished during testing and details the responsibilities of each participant. Executing the test plan will confirm that the ICP software functionality performs as expected.

ICP is an interactive program and therefore testers are assumed to have a good working knowledge of the GUI functionality. Testing GUI applications is challenging because the sequence of user actions can vary greatly, and GUIs are also impacted by system configuration including window managers, running remotely, and other “look and feel” issues. Consequently, ICP testing must rely on users exercising the GUI.

Low-level and automated tests are also important, in order to quickly verify core capabilities and test system interactions. These tests require some software developer skills and the access to NWS test computers.

The body of this document summarizes the approach used in testing. Appendix B provides the details of the test plan, which can be used to verify functionality and be used for final acceptance testing. This appendix will be updated during development and will be finalized for the final software delivery. Test results will be provided corresponding to the final test plan.

Testers who receive a stand-alone beta test installer can follow the steps in Appendix B for operational testing. The plan can be followed as a part of acceptance testing or a subset can be followed. The ICP User Manual provides additional information about running the software, for free-form testing. The User Manual may be a more suitable reference for beta testers at RFCs.

2. Testing Approach

The replacement ICP is being developed using an agile approach, with approximately monthly releases. Interim software releases will be provided to beta testers. Release notes will be provided giving instructions on the review approach for each release. It is recommended that acceptance testing not occur for all features in all releases, but wait until near the final delivery. Components that are indicated to be complete before the final delivery can undergo acceptance testing, whereas incomplete functionality should be reviewed for usability and overall functionality. For example, cosmetic features may not be finalized in the first interim release in which the features appear, and will be finalized in the subsequent release. However, it is likely that changes related to cosmetics and usability will occur throughout development and therefore full acceptance testing should occur at the end of the development effort.

Development and testing are occurring in a configuration for OB8.1, OB8.2 and OB8.3, including testing on the lx8 NHDR machine. The software can be migrated to OB8.3 by changing the user's account configuration files (e.g., change the DS_BUILD developer environment variable). ICP development utilizes the MCP3 and NWSRFS software and configuration files supplied with the standard NWSRFS development (/fs) and operational (/awips) environments. Development tools are assumed to be consistent with AWIPS OB release 8.3, although newer versions of Java, etc., in later OB releases should be backward compatible. It is assumed that a version 1.5 Java Runtime Environment (JRE) is available and will be provided within the installed OB system (see the sys_java_dir App default token). Because Java 1.5 is available within the OB7.2 AWIPS configuration, the ICP software developed for OB8.3 can be provided to testers running on OB7.2 systems. If testers do not have an OB7.2 or later system, then arrangements can be made for these users to login to the NHDR computers.

ICP testing will occur at the following levels:

1. **Unit Testing** – The ICP replacement is being developed in Java and Eclipse is being used to manage the developer sandbox. JUnit will be used to unit test low-level code in batch mode. Unit tests will be run via Eclipse and can also be run from command line Ant targets. Unit tests will verify the software functionality at a low level and protect against unforeseen impacts of new development. Primary functionality will be tested, in particular related to input/output and utility code and the framework will allow additional tests to be added as additional ICP enhancements are implemented. Unit testing will occur repeatedly as software developers write code. Software developers will also run unit tests before delivering code to OHD. OHD developers will be able to check out ICP from the repository and run unit tests.
2. **Regression Testing** – Note that this type of testing was not originally scoped but some work was done to investigate regression testing, in order to automate testing. However, project resources have not been sufficient to fully implement this approach. The following documentation is provided to allow for possible implementation in future enhancements to ICP. ICP regression testing will compare the primary output products from ICP:
 - a. MCP3 input decks
 - b. Images from ICP plots

Regression testing will utilize the Abbot software (<http://abbot.sourceforge.net/doc/overview.shtml>). Expected results will be generated by running the existing ICP, replacement ICP, or through manual edits of MCP3 decks. Corresponding user interactions will be recorded in the new ICP using the Costello software and will be replayed in automated fashion using the Abbot software. The resulting output will be compared with the expected results. This approach can be automated using JUnit with Abbot. The Abbot software tools can included in the ICP development environment sandbox as jar files.

The focus of regression testing will be to compare MCP3 input decks (thereby demonstrating the overall ICP deck editor functionality). Core editing functionality will be scripted to verify that user actions via the GUI do result in expected file edits.

The test framework for images is somewhat fragile in that images will not exactly match if windows have been resized, colors have changed, or any of the contents rendered in the image have changed (e.g., labels, data, sizing of plots, window manager effects). Therefore, although it is desirable to implement image comparisons, such tests may be difficult to implement in practice. RTi will attempt to put the framework in place so that additional development can take advantage of the approach; however, the final result may be more of a

demonstration, which can be further evaluated and implemented at OHD in later development.

Regression testing will initially be implemented in the ICP developer sandbox, to allow developers to verify software during development. Test data, expected results, GUI action scripts, and controlling test software will also be packaged into an installer that can be installed in the standard test location (e.g., /awips/hydroapps /testData/icp for OB8.3) and can be pointed to by scripts that use ICP and system software. Working test scripts will be provided to run in this configuration. RTi will work with OHD to demonstrate the scripts on the NHDR 1x8 test machine and work with OHD to modify if necessary based on OHD's integration/acceptance testing.

Operational Testing – Operational testing will utilize full data sets and exercise ICP functionality from a user perspective. Operational testing consists of repeating a list of steps in order to verify expected behavior and results. A useful and recommended exercise is to run the existing and replacement ICP in parallel to compare functionality. The core functionality of the replacement ICP matches the original ICP; however, some enhancements have been implemented to address usability issues. When running the existing and replacement ICP in parallel, different actions will be necessary to recreate the same result. Therefore it is recommended that the replacement ICP is run according to the Appendix B instructions and that the existing ICP is run in parallel (using whatever actions are required to achieve the same result – these steps are NOT documented in this test plan because it is expected that ICP testers are familiar with the existing ICP). Subsequent testing sessions can skip the comparison of the replacement and existing ICP and focus on running the test cases for the replacement ICP.

Operational testing will occur by providing selected OHD and RFC users with an ICP beta installer, which includes the replacement ICP software, test data, and run scripts that configure the ICP and MCP3 environment. RTi also performs significant calibration work for the NWS and calibrators will utilize ICP for production calibration work as soon as features are available. Operational testing is expected to occur after each software release, at a level appropriate for the software features in place at the time. Usability and performance evaluation will occur and feedback will be considered in later releases.

3. Certification of Requirements from CONOPS

The complete functionality of the existing ICP was documented in the requirements section in the HOSIP Stage 4 CONOPS document. The requirements and the corresponding test cases are documented in Appendix B and will be completed as development occurs. In the final release it is expected that automated tests will be carried out by OHD developers to gain a certain level of acceptance and the GUI will be tested according to the test plan and free form testing to fully validate the software.

4. Roles & Responsibilities

Personnel	Roles	Responsibilities
Steve Malers	RTi Task Manager	The task manager will coordinate the task's completion.

Personnel	Roles	Responsibilities
Steve Malers	RTi Software Quality Assurance Manager	Ensure that ICP developer and release versions conform to the NWSRFS environment and that development/testing guidelines are followed.
Michael Kane, Shaun Carney, Michael Thiemann	RTi Project Engineers	Provide test data and serve as initial testers, before release to the NWS.
Ai Vo Dieu	OHD Project Manager	Coordinate with RTi Task Manager to provide information about the NWSRFS development and test environment. Coordinate distribution of ICP test software to the field. Perform acceptance testing (or identify others to do so).
Mike Smith, Eric Anderson, RFC ICP uses	Research Scientists, Hydrologists	Run ICP as per the test plan and, as appropriate, perform free form testing, provide feedback on the new design, usability, and performance.

5. Risk Assessment & Management

The principal risks identified for testing are as follows:

#	Risk	Management
1	The development and test environment for developers will not match that of OHD integrators.	RTi has devoted resources to matching the NWS NHDR machines for development and is adhering to the specifications for OB 8.1 release for operational testing. Final testing also occurs on the lx8 NHDR machine.
2	Insufficient unit tests are implemented allowing runtime errors to manifest.	Test-driven development with unit tests is being used for development. In particular, data I/O code utilizes services that are unit tested before being utilized by other code.
3	Insufficient regression tests are implemented, allowing runtime errors to occur.	Key functionality will be tested with automated regression tests, in particular to compare MCP3 decks as edited with ICP. The framework will also allow extension and additional tests will be added based on the final software. Errors discovered during development and testing will indicate that additional regression or unit tests should be implemented. Developers will coordinate the implementation of such tests.

#	Risk	Management
4	Insufficient operational test cases are defined, allowing functionality to go without testing.	<p>Major classes of functionality will be defined with test cases.</p> <p>Errors discovered during development and testing will indicate that additional regression, unit, or operational tests should be implemented. Developers will coordinate the implementation of such tests.</p> <p>Several ICP users at RTi will be utilized to test ICP in production mode, while performing calibration work.</p>
5	The testing process for users will be difficult to execute, resulting in incomplete testing.	Interim software releases, and coordination between RTi and OHD developers will identify impediments to testing and delivery before the final delivery, and implement appropriate solutions.
6	Because ICP is a graphical program, it is difficult and cost-prohibitive to keep the test plan up to date and execute all steps of the plan with each release.	<p>Use of automated unit and regression tests will over time minimize the need to rely on human testers.</p> <p>The ICP replacement design is relatively stable and therefore features will not be undergoing significant change over time.</p> <p>The new ICP features are more streamlined, facilitating testing and use.</p> <p>Several ICP users at RTi will be utilized to test ICP in production mode, while performing calibration work.</p>
7	Feedback from testers is not received in time to incorporate in software.	By delivering software in multiple releases, feedback on specific releases can be planned for and considered in the following release.

APPENDIX A – TABLE OF ACRONYMS

AHPS	Advanced Hydrologic Prediction Service
AWIPS	Advanced Weather Interactive Processing System
GUI	Graphical User Interface
ICP	Interactive Calibration Program
MCP3	Manual Calibration Program
NWS	National Weather Service
NWSRFS	National Weather Service River Forecast System
OHD	Office of Hydrologic Development
RES-J	Joint Reservoir Regulation operation
RFCs	River Forecast Centers
RTi	Riverside Technology, inc.

APPENDIX B – TEST PLAN DETAILS

This appendix defines the test plan for each software release iteration. This appendix in particular is intended to help the NWS with ICP acceptance testing (verifying that ICP provides required functionality and generates results as intended).

The test plan excludes tests for MCP3 – it is assumed that MCP3 has passed tests defined by its developers.

B.1. Operational Tests

This section contains information about the operational test cases.

Based on the data requirements determined for ICP testing, the following data sets were selected for testing and are provided for testing. Additional data sets may be added as development occurs and special cases are identified.

Table B. 1. Data Sets Used With Operational Testing

#	INPUT DECK	KEY OPERATIONS	PERIOD	COMMENTS
1	AFGIX/AFGIX.curr AFGIX.err1 Others are variations.	SAC-SMA (2), SNOW-17 (2), UNIT-HG, WY-PLOT (2) SAC-PLOT, CHANGE-T RSNWELEV, WEIGH-TS	1990 - 1999	This deck contains the SAC-SMA model with the frozen ground component enabled. It will result in an additional plot at the top of the WY-PLOT. This new plot is labeled: FROST INDEX. Deck AFGIX.err1 includes a time list that will generate an error – use to detect MCP3 errors.
2	AMDK/AMDK.curr	SAC-SMA (2), SNOW-17 (2), UNIT-HG, WY-PLOT (2)	1990 - 1999	This deck contains a standard set-up of the SNOW-17 and SAC-SMA models.
3	anr/Antero_ResJ.main	RES-J, PLOT-TS	1978 - 2005	This data set was used to diagnose a problem with setting min/max values for PLOT-TS and provides another PLOT-TS example.
4	anrc2/anrc2.best	SAC-SMA (2), SNOW-17 (2), UNIT-HG, WY-PLOT	1977 - 2004	This data set was used to diagnose a problem with the WY-PLOT navigator.
5	API/API.curr	SAC-SMA (2), SNOW-17 (2), UNIT-HG, WY-PLOT (2), API-CONT	1990 - 1999	This deck was included to exercise the API model parameter change option in ICP. However, including an API model in the MCP3 deck does not “un-gray-out” the API-CONT option under the “Edit- Selected Parameters” menu.
6	combined/simple.resj	RES-J, PLOT-TS (2)	1981 - 2004	This is a complicated RES-J deck with complicated PLOT-TS.

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#	INPUT DECK	KEY OPERATIONS	PERIOD	COMMENTS
7	MDK/MDK.curr	SAC-SMA (2), SNOW-17 (2), UNIT-HG	1950 - 1999	This deck contains SNOW-17 and SAC-SMA models, but it has a SAC-PLOT and <u>no</u> WY-PLOT. This was included to see if the SAC and SNOW states would still display under the WY-PLOT menu. They do, there is no hydrograph.
8	mfka/mfka2.curr	SAC-SMA (2), SNOW-17 (2), PLOT-TS, WY-PLOT	1962 – 2002	This data set was used to diagnose a problem – it had spaces in headers that had to be handled.
9	MISSING_DATA/ NSNOW.best	SAC-SMA (2), UNIT-HG (2), WY-PLOT	1961 - 1987	This deck has no SNOW-17 operations.
10	PE/AFGIX.curr	SAC-SMA (2), SNOW-17 (2), UNIT-HG, WY-PLOT (2)	1990 - 1999	This deck has frozen ground in the SAC-SMA model and also reads an input time series of PE values. So, the PE values in the SAC-SMA model are <u>not</u> PE-demand but are PE-adjustments. The old-ICP plot under “Edit-Selected Parameters-SAC-SMA- ET-demand Curve” still lists the values as demand – though they are used in the SAC-SMA model as adjustments .
11	SCSM8/SCSM8.curr SCSM8.RAIM SCSM8.sml	SAC-SMA (2), SNOW-17 (2), WY-PLOT	1982 - 2004	The SCSM8.RAIM deck has 1 WY-PLOT with RAIM and 2 WY-PLOT with no RAIM. The data have a large range.
12	SFBM8/SFBM8.curr SFBM8/SFBM8.err1	SAC-SMA (2), UNIT-HG (3)	1948 - 2004	Deck with longer period. Also has PEAKFLOW time series. SFBM8.err1 will hang MCP3 and ICP – use for testing extreme conditions.
13	SOPLAT/sacs2.best	SAC-SMA (4), SNOW-17 (4), UNIT-HG (4), WY-PLOT (3)	1975 - 2004	This is an example of a deck with many operations.
14	speo/speo.curr	SAC-SMA, UNIT-HG, WY-PLOT	1955 - 1962	Another test variation that was used to diagnose an initial problem.
15	sptc2/sptc2.curr	SAC-SMA (5), SNOW-17 (5), UNIT-HG (7), WY-PLOT (4), PLOT-TS (1)	1948 - 2004	Time series names had spaces and it is a complicated deck.
16	TS/TS.curr	RES-J, PLOT-TS	1995 – 1999	The purpose in including it is to see what ICP does when no WY-PLOT is in the deck.
17	watc2div/watc2div.best	UNIT-HG (2), PLOT-TS (1)	1978 - 2004	Another example that was used for initial troubleshooting.

B.1.1. Operational Test and Results

The following table is a restatement of the functional requirements listed in Appendix D of the ICP CONOPS 4.4 document and when development is complete test cases will exist for all requirements. The shading in the table organizes requirements according to functional areas.

Table B. 2. Requirements and Corresponding Operational Tests

ID	Title	Use Case Satisfied	Description	Operational Test Case(s)
ICP FR-1.0C	Application Environment	ICP UC-1C	The ICP operating environment shall be set using the operating system environment or configuration files. This shall include directory locations and the path to the MCP3 executable program.	1.A - startup
ICP FR-2.0C	Execution Path	ICP UC-1C	The ICP execution path shall be set through the user's environment.	1.A - startup
ICP FR-3.0C	GUI Start	ICP UC-2C	The Graphical User Interface shall start when the user invokes a command from the OS.	1.A
ICP FR-4.0C	MCP3 Deck Selection	ICP UC-3C	The ICP shall select an initial MCP3 deck through GUI menu and window components.	2.C
ICP FR-4.1C	Directory Creation and Deletion	ICP UC-4C/ ICP UC-5C/ ICP UC-6C/ ICP UC-12C	ICP shall create or delete directories through GUI components during deck selection. The application environment shall indicate the base directory locations.	Omitted based on kickoff and user feedback. See 7A-7B for save/copy features.
ICP FR-4.2C	Copies Chosen Deck to Local Directory	ICP UC-13C	ICP shall work with a copy of the chosen MCP3 deck in the user's defined work directory. The work directory shall be defined in the application environment.	2.A – startup 7A – 7D
ICP FR-4.3C	Re-naming Chosen MCP3 Deck	ICP UC-7C	ICP shall be able to re-name the chosen MCP3 deck in the work directory. The user through GUI components shall choose the new name.	7A – 7B

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ID	Title	Use Case Satisfied	Description	Operational Test Case(s)
ICP FR-5.0C	Executes MCP3	ICP UC-8C	ICP shall execute MCP3 using the specified deck in the work directory. The user through GUI components shall invoke MCP3.	2.N - 2.R
ICP FR-5.1C	MCP3 Output	ICP UC-13C	The ICP shall place MCP3 output in a user specified directory.	5A – 5D
ICP FR-5.2C	MCP3 Notification	ICP UC-9C	The ICP shall use GUI components to open a notification window of the completion and status of MCP3.	2Q – 2R
ICP FR-5.3C	Viewing MCP3 Output	ICP UC-11C	The ICP shall use GUI components to open a window for viewing the text MCP3 output. These components shall have resizing and scrolling capabilities.	5.A - 5.D
ICP FR-6.0C	Editing the Chosen MCP3 Input Deck	ICP UC-10C	The user shall be able to edit the chosen MCP3 input deck by using standard GUI components.	3.A - 3.H
ICP FR-6.1C	Making and Saving SAC-SMA Parameter Changes	ICP UC-14C	The ICP shall use GUI components to edit SAC-SMA parameters in the chosen MCP3 deck. These parameters include UZK, PCTIM, ADIMP, RIVA, ZPERC, REXP, LZFP, LZFSM, LZSK, LZPK, PFREE, and SIDE. The user can preserve the ratio/difference for specified parameters in any SAC model in a basin listed in the input deck.	4A – 4C, 4F
ICP FR-6.1.1C	Editing ET-Demand Curves or PE Adjustment Factors	ICP UC-15C	The ICP shall use GUI or plotting components to add or edit the monthly ET-Demand curve or the monthly PE adjustment factors.	4D – 4E

ID	Title	Use Case Satisfied	Description	Operational Test Case(s)
ICP FR-6.2C	Making and Saving SNOW-17 Parameter Changes	ICP UC-16C	The ICP shall use GUI components to edit SNOW-17 parameters in the chosen MCP3 deck. These parameters include SCF, MFMAX, MFMIN, NMF, UADJ, SI, DAYGM, MBASE, PXTEMP, PLWHC, and TIPM. The user can preserve the ratio/difference for selected parameters across multiple models in an input file for a basin.	10.A – 10.D
ICP FR-6.2.1C	Editing AESC Curve	ICP UC-17C	The ICP shall use GUI or plotting components to edit the nine monthly AESC curve values.	11.A – 11.C
ICP FR-6.3C	Editing the Unit Hydrograph Ordinates	ICP UC-18C	The ICP shall use GUI or plotting components to add or edit Unit Hydrograph Ordinate values. The area under the curve represented by the UHG ordinates will be preserved as any editing is performed.	12.A – 12.J
ICP FR-7.0C	WY-PLOT Operation Display	ICP UC-19C/ICP UC-20C	The ICP shall use standard GUI and plotting components for creating the graphical plot of the WY-PLOT operation display.	6.A – 6.E
ICP FR-7.1C	WY-PLOT Operation Display Data	ICP UC-24C/ICP UC-25C/ICP UC-26C	The user shall be able to graphically display an instance of each of the SNOW-17, SAC-SMA, and WY-PLOT operations and have the ability to toggle through these multiple instances to display any model or operation result.	6.A – 6.C
ICP FR-7.1.1C	WY-PLOT Operation Display Vertical Resize	ICP UC-19C/ICP UC-20C	The ICP shall use plotting components to allow the user to resize in the vertical direction each of the sections of the WY-PLOT operation display.	6.A

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ID	Title	Use Case Satisfied	Description	Operational Test Case(s)
ICP FR-7.1.2C	WY-PLOT Operation Display Date-Time Axis	ICP UC-19C/ICP UC-20C	The ICP shall define the X-axis of the WY-PLOT operation display to be the date-time axis.	6.A+
ICP FR-7.1.3C	WY-PLOT Operation Display Legend	ICP UC-19C/ICP UC-20C	The ICP shall use GUI and plotting components to display a color-coded legend of the WY-PLOT operation display.	6.A
ICP FR-7.1.4C	WY-PLOT Operation Display Time Series View	ICP UC-19C/ICP UC-20C	The user shall be able to toggle between arithmetic and log scale on the Y-axis.	6.E
ICP FR-7.1.5C	WY-PLOT Operation Display Data Value	ICP UC-19C/ICP UC-20C	The ICP shall use GUI and plotting components to display a view of chosen date-time and time series value in the WY-PLOT operation display. The user shall be able to ‘click’ in the WY-PLOT near the time series to determine the date/hour and value of the time series.	6.F
ICP FR-7.1.6C	WY-PLOT Operation Display Hydrograph Scrolling	ICP UC-19C/ICP UC-20C	The ICP shall use plotting components to allow the user to scroll through the hydrograph. The user shall be able to do this either continuously with a scrollbar or by selected date-time intervals.	6.D
ICP FR-7.1.7C	WY-PLOT Operation Display SAC-SMA Data Axis	ICP UC-19C	The ICP shall define the Y-axis of the WY-PLOT operation display to be the data axis in units determined by the units of the time series.	6.A+
ICP FR-7.1.8C	WY-PLOT Operation Display SAC-SMA Zone Contents	ICP UC-19C	The ICP shall plot UZTW and LZTW as deficits and UZFW, LZFSW, and LZFPW as contents in the WY-PLOT SAC-SMA operation display.	6.A

ID	Title	Use Case Satisfied	Description	Operational Test Case(s)
ICP FR-7.1.9C	WY-PLOT Operation Display SAC-SMA Runoff	ICP UC-19C	The ICP shall plot the percent of total runoff from each of the six runoff components: surface, direct, impervious, interflow, supplemental base flow, and primary base flow. The ICP shall also show rain plus melt and total runoff.	6.A
ICP FR-7.1.10C	WY-PLOT Operation Display SNOW-17 Plots	ICP UC-20C	The ICP shall plot the following values in the WY-PLOT SNOW-17 operation display: rain/snow elevation, type of precipitation, energy exchange, air temperature, TINDEX, snow temperature, liquid water fraction, rain plus melt and negative heat storage, rain on bare ground, rain plus melt on snow covered area, area extent of snow cover, water equivalent of snow pack, and observed and simulated snow depth.	6.B - 6.C
ICP FR-7.2C	WY-PLOT Time Series Locator	ICP UC-21C	The ICP shall use plotting components to display a small time series plot of the entire WY-PLOT time series. This plot shall be used to locate and scroll to specific events in the time series.	6.D
ICP FR-7.3C	WY-PLOT Time Series Date Range	ICP UC-21C	The ICP shall use GUI and plotting components to allow the user to change the range of allowed date values in the X-direction. The default values shall be obtained from the chosen MCP3 deck.	6.H
ICP FR-7.4C	WY-PLOT Time Series Data Range	ICP UC-22C	The ICP shall use GUI and plotting components to allow the user to change the range of allowed data values in the Y-direction. The default values shall be obtained from the chosen MCP3 deck	6.H

ID	Title	Use Case Satisfied	Description	Operational Test Case(s)
ICP FR-7.5C	Saving WY-PLOT Time Series	ICP UC-23C	The ICP shall be able to save current SQME time series for use on subsequent WY-PLOT displays. The ICP shall use GUI components to select a location to save the time series.	7.A – 7.B
ICP FR-7.6C	Using saved WY-PLOT Time Series	ICP UC-27C	The ICP shall use GUI and plotting components to display saved SQME time series on the current WY-PLOT.	7.A – 7.B
ICP FR-7.7C	Modifying the SAC-SMA Percolation Demand Curve	ICP UC-28C	The ICP shall use GUI and plotting components to allow the user to modify the percolation demand curve by changing the following parameters: ZPERC, REXP, LZFSM, and LZFBM.	9.A – 9.H
ICP FR-8.0C	PLOT-TS Operation Display	ICP UC-29C/ ICP UC-33C	The ICP shall use standard GUI and plotting components for creating the graphical plot of the PLOT-TS operation that is defined by the chosen MCP3 deck.	8.A – 8.D
ICP FR-8.1C	PLOT-TS Operation Display Data	ICP UC-29C	The user shall be able to graphically display any instance of PLOT-TS information.	8.A – 8.D
ICP FR-8.1.1C	PLOT-TS Operation Display Vertical Resize	ICP UC-33C	The ICP shall use plotting components to allow the user to resize in the vertical direction each of the sections of the PLOT-TS operation display.	8.C
ICP FR-8.1.2C	PLOT-TS Operation Display Date-Time Axis	ICP UC-33C	The ICP shall define the X-axis of the PLOT-TS operation display to be the date-time axis.	8.C, 8.G
ICP FR-8.1.3C	PLOT-TS Operation Display Data Axis	ICP UC-33C	The ICP shall define the units of the Y-axis of the PLOT-TS operation display based upon the units of the time series type.	8.C, 8.G

ID	Title	Use Case Satisfied	Description	Operational Test Case(s)
ICP FR-8.1.4C.	PLOT-TS Operation Display Time Series View	ICP UC-33C	The ICP shall use GUI and plotting components to display a view of chosen date-time and time series value in the PLOT-TS operation display. The user can toggle between Log and arithmetic scales in any display pane	8.G
ICP FR-8.1.5C	PLOT-TS Operation Display Hydrograph Scrolling	ICP UC-33C	The ICP shall use plotting components to allow the user to scroll through the display. The user shall be able to do this either continuously with a scrollbar or by selected date-time intervals.	8.E
ICP FR-8.2C	PLOT-TS Operation Display Legend	ICP UC-32C	The ICP shall use GUI and plotting components to display a color-coded legend of the PLOT-TS operation display.	8.C
ICP FR-8.3C	PLOT-TS Time Series Locator	ICP UC-30C.	The ICP shall use plotting components to display a small time series plot of the entire PLOT-TS time series. This plot shall be used to locate and scroll to specific events in the time series	8.E

B.1.2. Operational Test Cases

The test cases listed in the above table above are described in more detail below. The test plan is divided into sections of high-level components, for example the ICP Main Window. There are multiple test cases for each component, and each test case includes a set of setup steps and expected results. The information collected during testing will also be used in preparing the user manual as software features are finalized.

The following steps assume that ICP has been installed. For example, if using the beta installer, the software will have been installed under a directory named “icpnew_beta_1.00.00” or similar and the scripts to run ICP will be located in the test_scripts directory.

The following general comments apply to the test cases:

1. The graphics shown in the following test cases may vary slightly based on window manager preferences and changes made during development that have not been reflected in an updated test plan.

2. Refer to the ICP User Manual documentation for an explanation of the behavior of software features. It is expected that that person executing the test plan is familiar with basic ICP features.

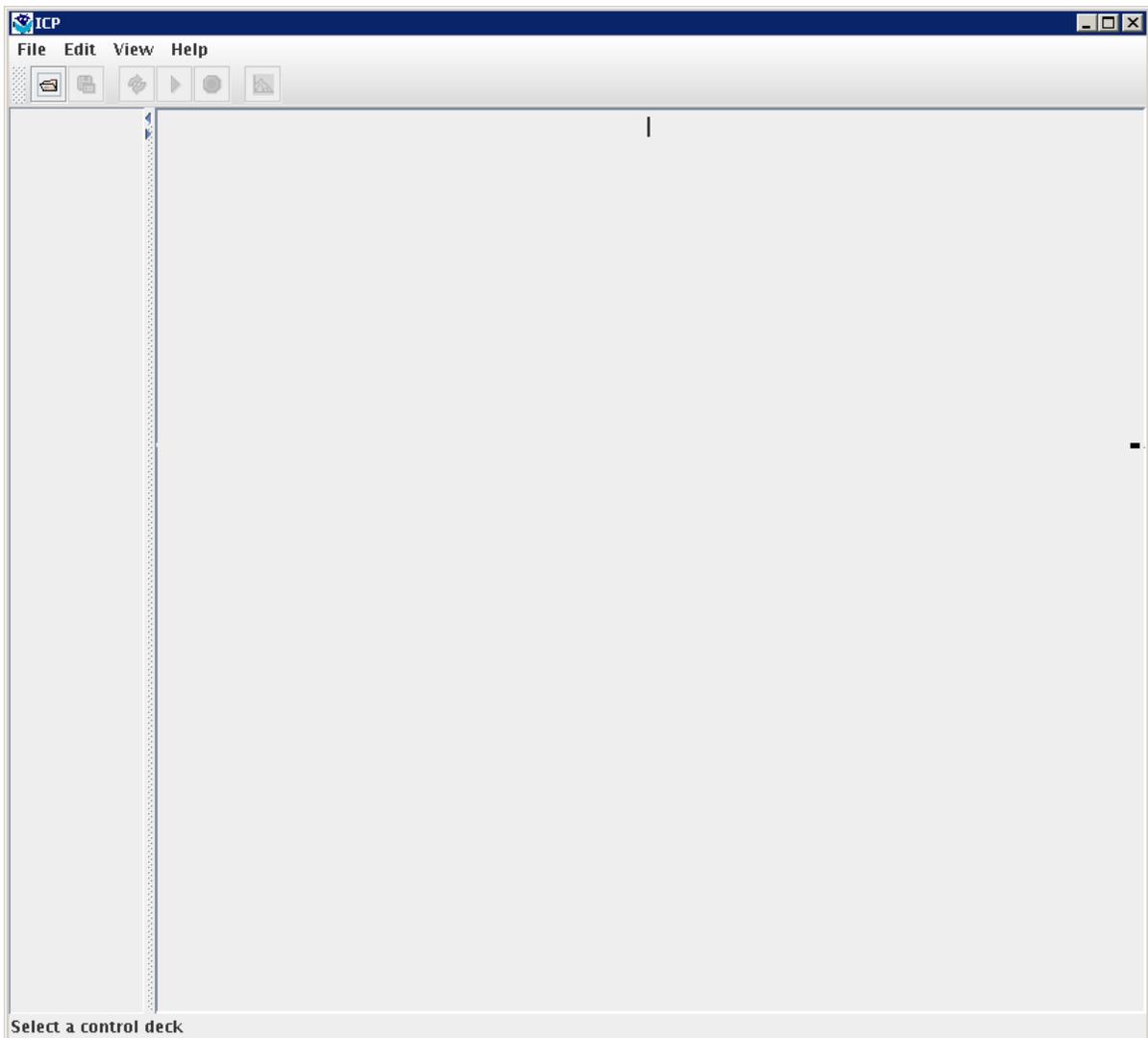
1. ICP Main Window

A. Launch window

- a. Change to the test_scripts directory.
- b. Launch the ICP software by running the “run_icpnew_testdata” script.

Expected Results:

- The ICP Main Window appears.
- Verify the following in the dialog that appears:
 - o The only button enabled on the toolbar should be the Open Deck button.
 - o Hover over the Open Deck button on the toolbar – the tooltip should read “Select a control deck”
- Title bar shows the text “ICP”
- Verify status bar: Shows “Select a control deck”



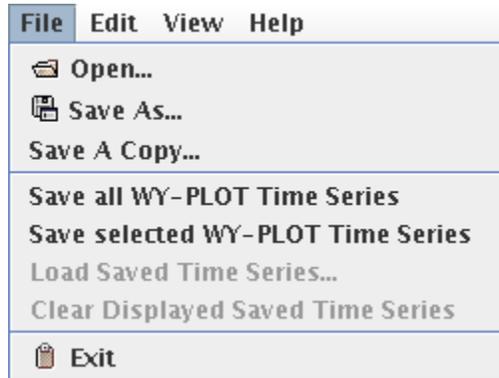
MainWindow_Startup

B. Verify File Menu

- a. Select the File menu item

Expected Results:

- Verify that there are menu items enabled under the File menu as shown in the figure below.



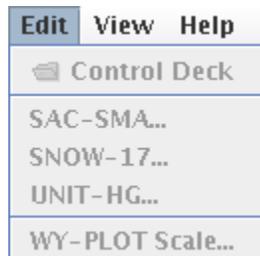
Menu_File

C. Verify Edit Menu

- a. Select the Edit menu item

Expected Results:

- Verify that there are five menu items and that all are disabled: Control Deck, SAC-SMA..., SNOW-17..., UNIT-HG, WY-PLOT Scale...



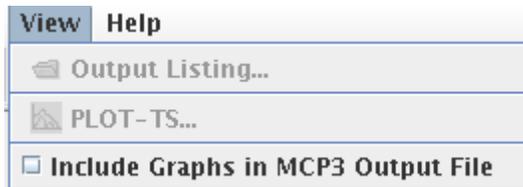
Menu_Edit

D. Verify View Menu

- a. Select the View menu item

Expected Results:

- Verify that the following menus are available: “Output Listing...” (disabled), “PLOT-TS...” (disabled), “Include Graphs in MCP3 Output File”.



Menu_View

E. Launch the Help → About dialog

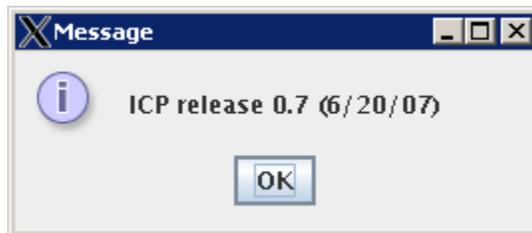
- a. Select the menu item Help → About ICP

Expected Results:

- The Help About dialog is displayed (see screenshot below, although version will be for the current software)
- When OK is clicked, the dialog is dismissed.



Menu_Help



Menu_HelpAbout

F. Verify Window Closes using File → Exit

- a. Click on menu item File → Exit.

Expected Results:

- ICP main window closes.

G. Verify Main Closes with X button

- a. Change to the test_scripts directory (if not already there).
- b. Launch the ICP beta software by running the run_icpnew_testdata script.
- c. After the main window appears, click on the X button in the upper right hand corner of the frame.

Expected Results:

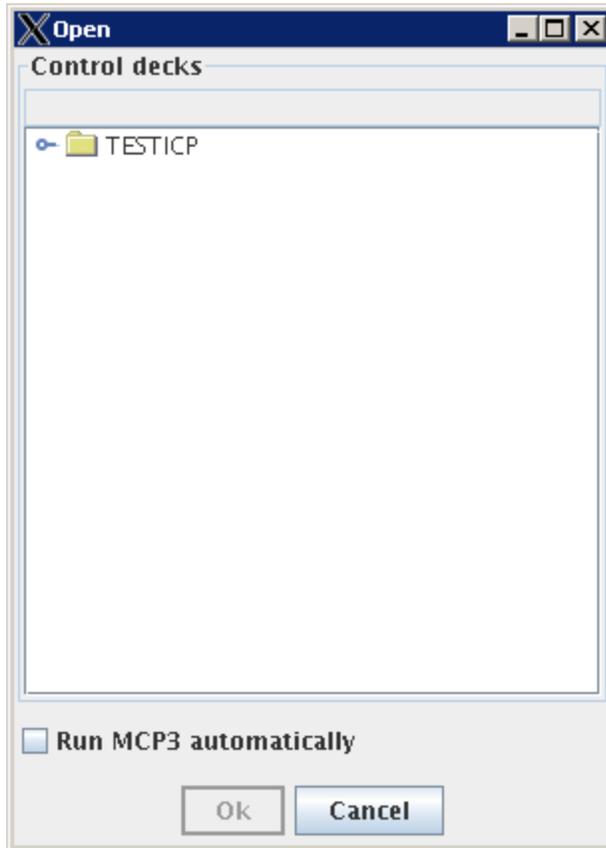
- Verify that the ICP Main Window closes.

2. Open Deck Dialog

- A. Launch Open Deck Dialog
 - a. Change to the test_scripts directory.
 - b. Type run_icpnew_testdata at the command line.
 - c. Open deck by selecting File → Open...

Expected Results:

- Verify Open Deck Dialog appears as shown



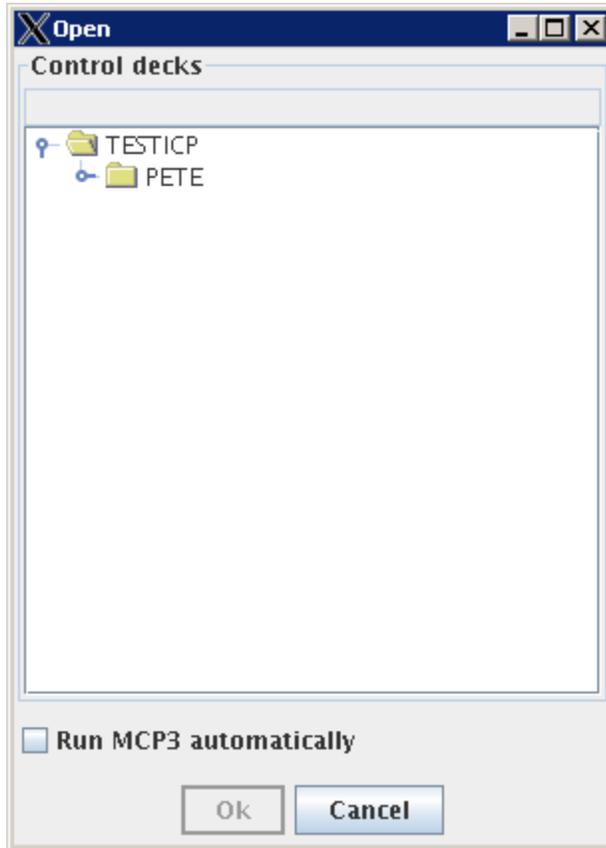
Menu_File_Open

B. Expand Region

- a. Click on the node named TESTICP.
- b. Resize the window to see the full selection (the location will vary by user).

Expected Results:

- Region node expands to show children – PETE.



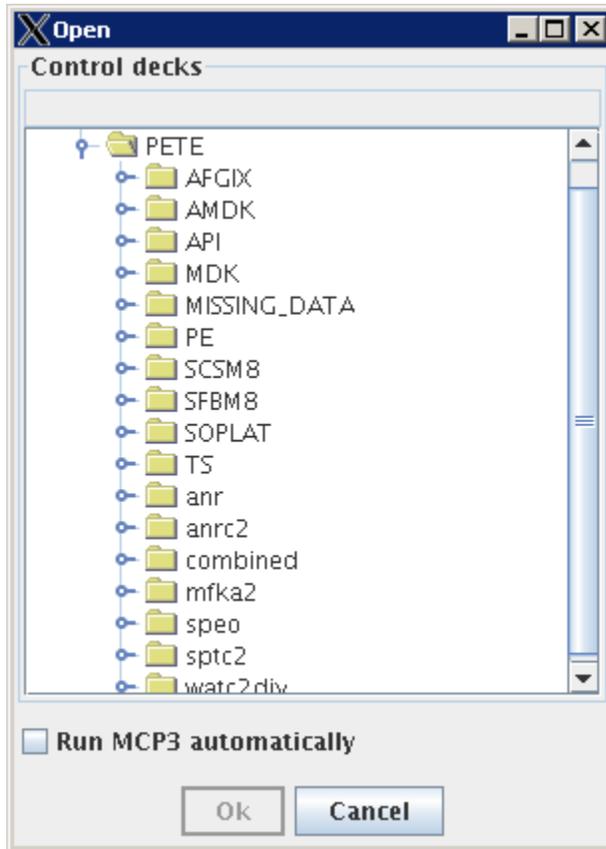
Menu_File_Open_2

C. Expand Basin

- a. Click on the node labeled “PETE” (this is a basin) – either double-click on the word “PETE” or click on the key symbol to the left of the folder.

Expected Results:

- Basin node expands to show children



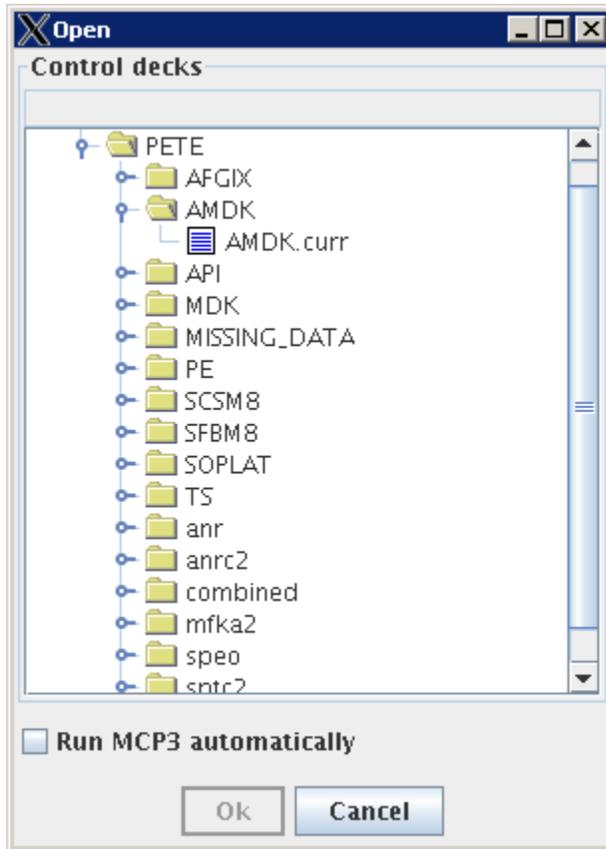
Menu_File_Open_3

D. Expand Watershed

- a. Click on the node labeled “AMDK” (this is a watershed) – double click on the word “AMDK” or single click on the key symbol to the left of the folder.

Expected Results:

- Watershed node expands



Menu_File_Open_4

E. Placeholder to maintain test numbering

F. Placeholder to maintain test numbering

G. Placeholder to maintain test numbering

H. Placeholder to maintain test numbering

I. Verify that double-clicking on Region/Basin/Watershed collapses the children below that node

- a. Expand the node Basin node “PETE” (TESTICP/PETE) if it’s not already expanded.
- b. Double-click the PETE node (word) or single click symbol to left of folder.

Expected Results:

- Verify that the all children underneath the PETE node collapses.

J. Verify that double-clicking on Region/Basin/Watershed expands the children below that node

- a. Double-click on the PETE node (word) or single click symbol to left of folder.

Expected Results:

- Verify that the PETE node expands to show its children (same as it was before the node was collapsed.)

K. Verify Cancel button does not save selection upon cancel

- Expand the nodes TESTICP/PETE/MDK and select the deck MDK.curr
- Click the Cancel button

Expected Results:

- Verify that the dialog dismisses
- Verify that no deck has been selected by the following
 - o The title bar shows only ICP
 - o The status bar still shows the text “Select a control deck”.

L. Verify Deck Selection (Double-clicking on deck)

- Re-open the Deck Dialog by selecting the Open Deck toolbar button
- Expand the nodes TESTICP → PETE → AFGIX
- Select the deck AFGIX.curr
- Double-click on the deck

Expected Results:

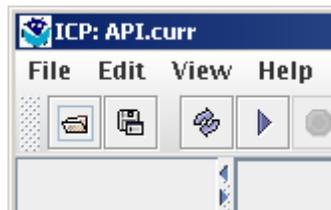
- Verify that the Open Deck dialog is dismissed
- The title bar now shows the name of the selected deck: AFGIX.curr
- The status bar now shows the text “Deck selected: AFGIX.curr”
- MCP3 should automatically run and display WY-PLOT results.

M. Verify Deck Selection (OK Button)

- Re-open Deck Dialog by clicking on the Open Deck toolbar button
- Expand the nodes TESTICP → PETE → API
- Select the deck API.curr
- Click the OK button.

Expected Results:

- The Open Deck Dialog is dismissed.
- The title bar now shows the name of the selected deck: API.curr
- The status bar now shows the text “Deck selected: API.curr”
- Verify that the “Save deck as” (disc symbol), “Refresh” (circular arrows), and “Run MCP3” (arrow symbol) buttons on the ICP Main Window toolbar are now enabled.



Toolbar

- MCP3 will automatically run and display the WY-PLOT.

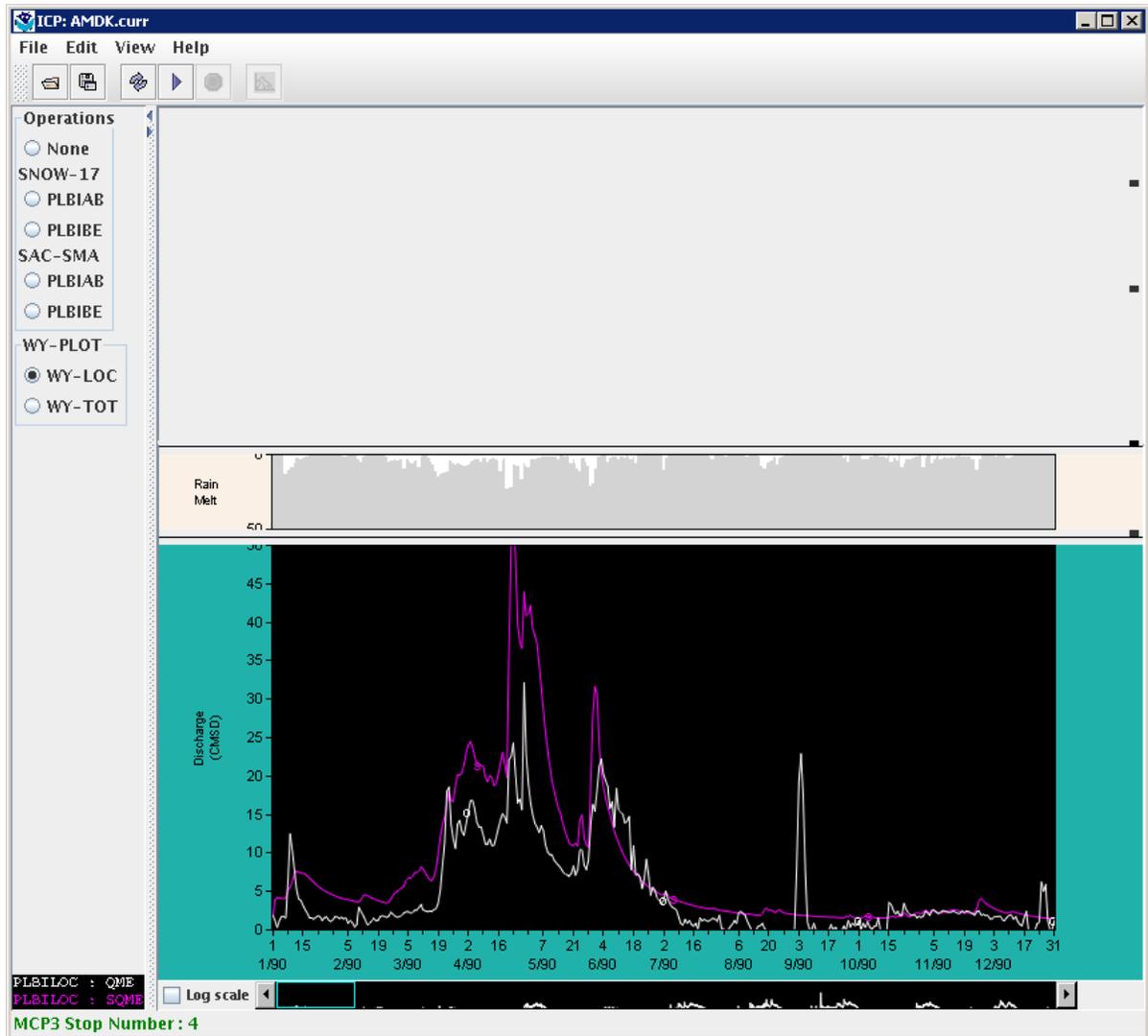
N. Execute MCP and Verify the Run Automatically Checkbox (Double-Clicking)

- Re-open Deck Dialog by clicking the Open Deck (“Select a control deck”) button on the toolbar

- b. Check the checkbox “Run MCP Automatically”.
- c. Expand the nodes TESTICP → PETE → AMDK
- d. Select the deck AMDK.curr
- e. Double-click the selected deck.
- f. When the plot appears, deselect the Log Scale in the lower left.

Expected Results:

- The Open Deck Dialog disappears
- The status bar shows the text “Running MCP...” while MCP is executing.
- After MCP has executed the status bar displays the text “MCP Stop Number: 4” to indicate that the MCP execution was successful.
- The title bar also changes to show “ICP: AMDK.curr”
- Verify that no exceptions have occurred by looking at the text that is output to the terminal window.
- Operations will be displayed in the left side of the main window.
- Initial water year plot data will be displayed at the bottom of the main window with the legend in the lower left corner



AMDK_AfterRun

O. Verify Run MCP Automatically checkbox is still enabled

- a. Re-open the Deck Dialog by clicking on the Open Deck toolbar button

Expected Results:

- Verify that the “Run MCP Automatically” checkbox is still checked.

P. Execute MCP and Verify the Run Automatically Checkbox (OK Button)

- a. Select the deck API.curr (TESTICP → PETE → API → API.curr)
- b. Click the OK button

Expected Results:

- The Open Deck Dialog disappears
- The status bar displays the text “Running MCP...” while MCP is executing.
- After MCP has executed the status bar displays the text “MCP Stop Number: 4” to indicate that the MCP execution was successful.
- The title bar shows “ICP: API.curr”

- The main window is updated to display a new water year plot and list of operations.
- Verify that no exceptions have occurred by looking at the text that is output to the command prompt.

Q. Execute MCP via the Run button in the toolbar

- Open the Open Deck Dialog by clicking on the toolbar button
- Select the deck AFGIX.curr (TESTICP → PETE → AFGIX → AFGIX.curr)
- Uncheck the “Run MCP Automatically” checkbox (verify)
- Click OK. A run will automatically occur when the deck is opened.
- After the Open Deck Dialog is dismissed, on the ICP Main Window toolbar click the Run button (forward arrow button)

Expected Results:

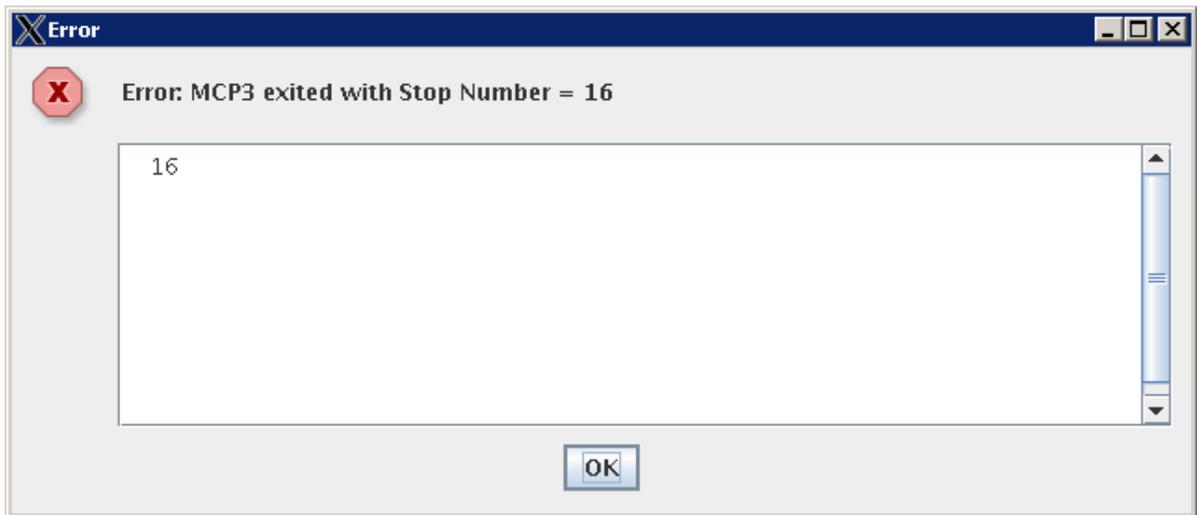
- While MCP is executing the status bar displays the text “Running MCP...”
- The status bar displays the text “MCP Stop Number: 4” to indicate that the MCP execution was successful.

R. Execute MCP on a Deck that Returns a non-4 Stop Code

- Open the Deck Dialog by clicking on the toolbar button
- Select the deck TESTICP → PETE → AFGIX → AFGIX.err1
- Check the Run MCP Automatically checkbox.
- Click OK.

Expected Results:

- The Open Deck Dialog is dismissed
- An Error Dialog appears displaying that the stop number was > 4.
- See screenshot below:



Main_MCP3_Error

S. Dismiss Stop Number Error Dialog

- Click OK on the Error dialog

Expected Results:

- The Error Dialog disappears.

- Prior to OK, the status bar shows the text “MCP Stop Number: 16”. It subsequently says “No WY-PLOT operation defined for this deck.”
- T. Close ICP Main Window
- a. Click File → Exit on the ICP Main Window menu bar.
- Expected Results:*
- The ICP Main Window closes.

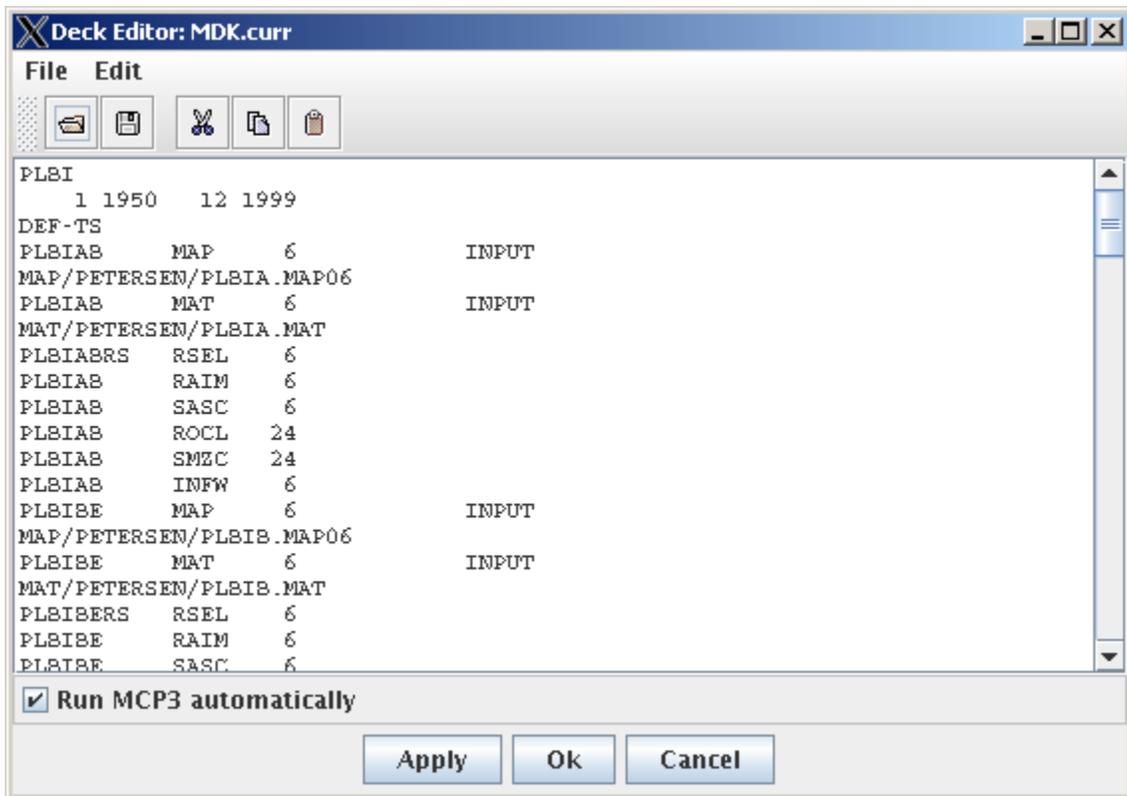
3. Control Deck Editor – NOTE: the “icp_editor” environment variable should NOT be set. If it is set, the user’s editor of choice will be used instead of the build-in editor shown below.

A. Launch the Control Deck Editor

- a. Launch ICP beta software by going to the test_scripts directory.
- b. Type run_icpnew_testdata at the command line.
- c. Open the Open Deck Dialog by choosing File → Open... from the ICP Main Window menu bar.
- d. Select the deck TESTICP → PETE → MDK → MDK.curr
- e. Note – the Run MCP Automatically checkbox does not need to be checked
- f. Click OK.
- g. Open the Control Deck Editor by choosing Edit → Control Deck

Expected Results:

- The Deck Dialog appears with the contents of the deck. See screenshot below.



Menu_Edit_ControlDeck

B. Verify Scrolling

- a. Scroll up/down

Expected results:

- Scrollbar moves to show more on the lower or upper part of the window

C. Dialog closes using X button

- a. Close using the “X” button at the top right hand corner.

Expected Results:

- Deck editor closes

D. Edit a new deck in the Control Deck Dialog

- a. Open the Open Deck Dialog by clicking on the open button in the main window toolbar
- b. Select the deck TESTICP → PETE → TS → APLOTTTS.curr
- c. Click OK.
- d. Open the Control Deck Editor by choosing Edit → Control Deck.

Expected Results:

- The Control Deck Dialog appears with the contents of the newly selected deck.

E. Edit control deck and verify changes are not saved

- a. Now edit a parameter in the dialog. Find the 4th line of the text displayed in the dialog. The text is:

```
PMKIBE      MAP  6          INPUT
```

- b. Change the text in the editor by deleting the 6 in this line and typing a 5.
- c. Click the X button in the upper right hand corner of the dialog.
- d. Re-open the same deck disk by selecting Edit → Control Deck again.

Expected Results:

- Verify that the change was NOT saved to the deck. The 4th line of text in the dialog should still be

```
PMKIBE      MAP  6          INPUT
```

F. Edit control deck and verify changes are saved

- a. Open the Control Deck Editor again by selecting Edit → Control Deck.
 - b. Find the 4th line of text in the dialog – it is
- ```
PMKIBE MAP 6 INPUT
```
- c. Change the text in the editor by deleting the 6 in this line and typing a 5.
  - d. Click the Save file button on the toolbar of the Control Deck Editor Dialog.
  - e. If Run MCP3 automatically is selected, a warning should be generated because the input is not valid.
  - f. Click the X button in the upper right hand corner of the dialog.
  - g. Re-open the Control Deck dialog by selecting Edit → Control Deck.

*Expected Results:*

- Verify that the dialog is dismissed after clicking X in the upper-right corner of the window.

- The 4<sup>th</sup> line of text displayed in the editor is

```
PMKIBE MAP 5 INPUT
```

G. Re-set changed value to the original value

- a. Change the 4<sup>th</sup> line of text displayed in the dialog to its original value. Delete the 5 and type a 6 in the 4<sup>th</sup> line.
- b. Click the Save button on the Control Deck Dialog toolbar.
- c. Click the X button in the upper right hand corner of the dialog.

*Expected Results:*

- Control Deck dialog is dismissed.

H. Control Deck that returns a stop code > 4 can still be opened using the Control Editor

- a. Use the Open tool on the main window to select the TESTICP → PETE → AFGIX → AFGIX.err1.
- b. Dismiss the Stop Number Error dialog when it appears.
- c. Select Edit → Control Deck.

*Expected Results:*

- The Control Deck dialog displays the AFGIX.err1 deck.
- I. Close the Control Deck Editor and the ICP Main Window
    - a. Click the X button in the upper right hand corner of the Control Deck Dialog.
    - b. Select File → Exit from the ICP Main Window.

*Expected Results:*

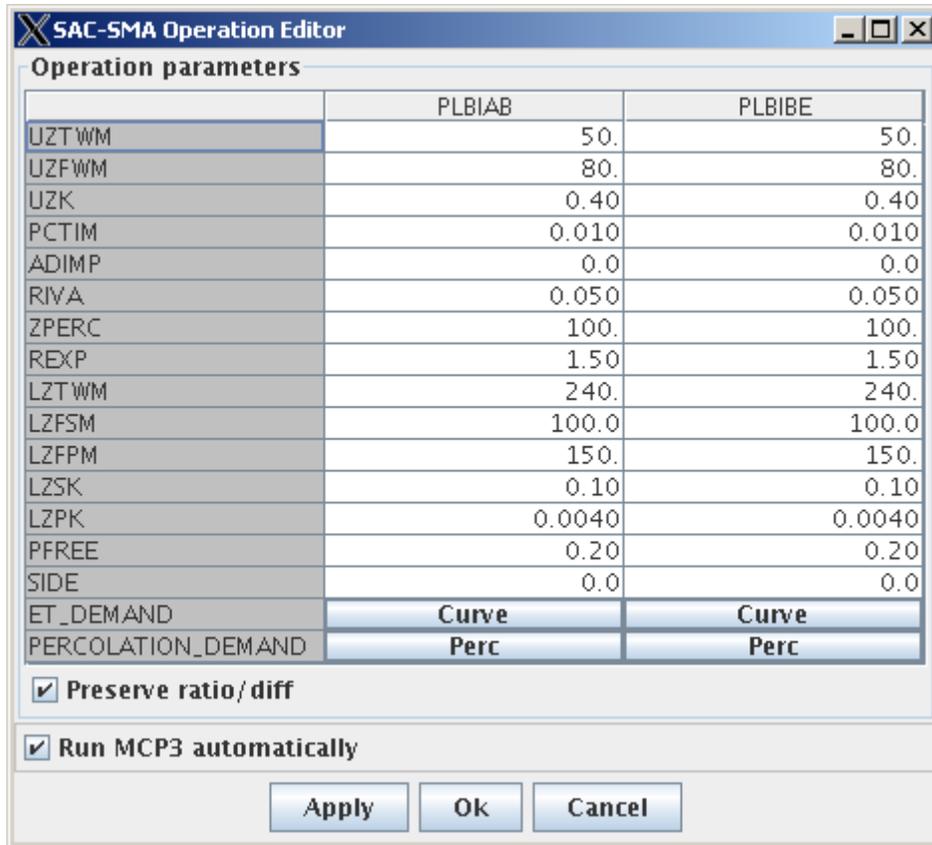
- The Control Deck Dialog and the ICP Main Window frame close.

#### **4. SAC-SMA Parameter Dialog**

- A. Open the SAC-SMA Parameter dialog and verify general layout
  - a. Start the ICP beta software by going to the test\_scripts directory
  - b. Type the following at the command line: run\_icpnew\_testdata
  - c. After the ICP main window appears, select a deck by clicking on the Open toolbar button.
  - d. In the Open dialog, select the deck TESTICP → PETE → AMDK → AMDK.curr
  - e. Click the OK button. Note – the Run MCP Automatically checkbox does not need to be checked.
  - f. Open the deck by selecting Edit → Control Deck...
  - g. Now open the SAC-SMA parameter dialog by selecting Edit → SAC-SMA...
  - h. Position the windows so that both the SAC-SMA parameter editor and control deck editor are visible.

*Expected Results:*

- Verify that the SAC-SMA dialog (and control deck editors) appear. See screenshot below for look and feel (values may be slightly different):



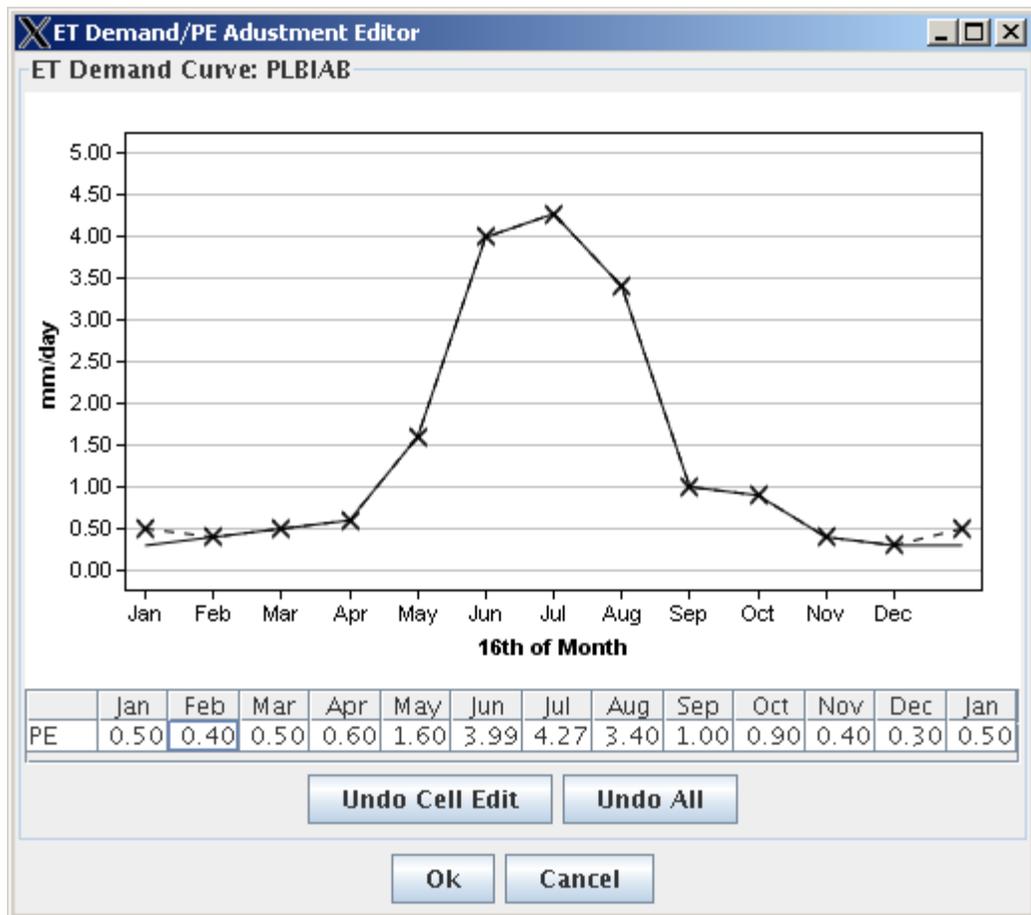
Edit\_SAC-SMA

- B. SAC-SMA Parameter dialog closes using the X button
- Close the SAC-SMA parameter dialog by clicking the upper right-hand X button
- Expected Results:*
- Dialog is dismissed
- C. Edit SAC-SMA Parameter
- Open the SAC-SMA parameter editor with Edit→SAC-SMA
  - Click on the UZTWM PLBIAB cell (first column).
  - Enter 100 (change the value from 50 to 100).
  - Press the Apply button.
  - Press the X in upper right to close the window.
  - Open the SAC-SMA parameter editor again with Edit→SAC-SMA and inspect the data values.
- Expected Results:*
- Value in UZTWM PLBIAB cell is 100.
  - The control deck value is also 100 for the operation and parameter in question.
- D. Edit SAC-SMA ET Demand Curve by entering value in table
- Open the SAC-SMA parameter editor with Edit→SAC-SMA
  - Click on the Curve button in the first column – the ET/Demand editor dialog should appear
  - Click in the cell under “Jan”.

- d. Change the value to .5 – press Enter. The curve should show the new values in dashed lines (for both January values that are shown). See figure below.
- e. Press the OK button in the dialog to apply the change and close the dialog.
- f. Press Apply in the SAC-SMA parameter dialog. If “Run MCP3 automatically” is checked MCP3 will run and output displays will be updated.
- g. Open the curve editor again by pressing the Curve button in the SAC-SMA parameters dialog.
- h. Check that the value for Jan is .5.
- i. Press the OK button in the dialog to close.

*Expected Results:*

- Value in the Jan Cell is .5.
- The parameter values will also be updated if the control deck editor is open.
- Curve shows new Jan values as .5 in dashed lines initially and as solid lines later.



SAC-SMA\_ET\_Jan

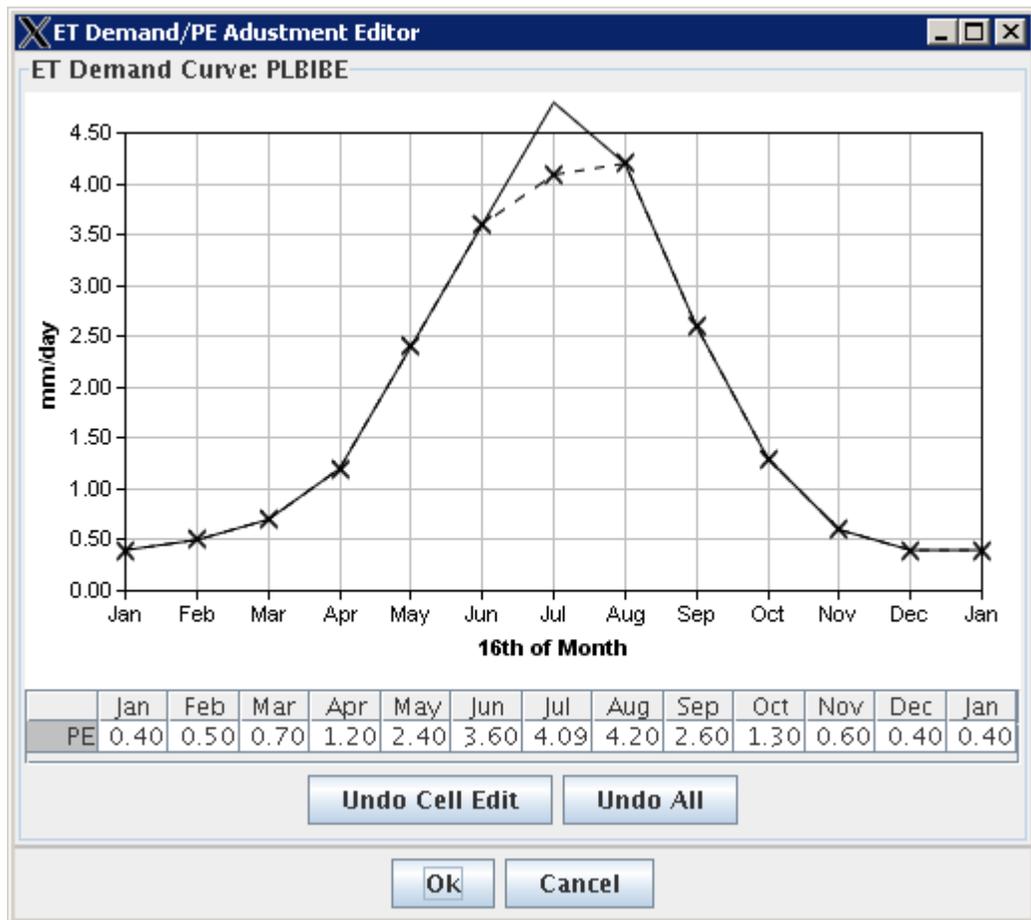
E. Edit SAC-SMA Parameter by dragging curve.

- a. Continue from the previous test.
- b. Click on the Curve button in the **second** column of the SAC-SMA parameters dialog – the ET/Demand editor dialog should appear

- c. Press the left mouse button down over the highest point on the curve (Jul) and slowly drag downwards. The point on the curve will follow the mouse (see image below).
- d. Press the OK button.
- e. Press the Apply button in the SAC-SMA parameters window.
- f. Press the Curve button in the second column for the ET\_DEMAND parameter. Verify that the change is recognized for the PLBIBE operation..
- g. Press the OK button in the curve window.
- h. In the SAC-SMA operation parameters dialog, press OK. If the Run MCP3 automatically checkbox is selected, an MCP3 run will run automatically and the main WY-PLOT will be updated. **The curve edits will only be saved to the deck if Apply or OK is pressed in the SAC-SMA parameters window.**

*Expected Results:*

- Value in Jul cell in the table should adjust as the curve is dragged. See image below. Note the y-axis is scaled to the new values.
- Control deck is also updated.



SAC-SMA\_ET\_DragGraph

F. Test Preserve ratio/diff

- a. Open the SAC-SMA parameter editor with Edit→SAC-SMA
- b. Verify that the Preserve ratio/diff checkbox is NOT checked.

- c. Change the value of UZK in the PLBIAB column to .8 and press Enter.
- d. Change the Preserve ratio/diff checkbox to be checked.
- e. Change the value of UZK in the PLBIAB column to .2 and press Enter.
- f. Press OK in the SAC-SMA parameter editor dialog.
- g. After verifying the results (below) exit ICP by pressing the upper right X in the main window.

*Expected Results:*

- Value in second column for UZK (.1) will be half of that entered in the first column (.2)
- Dialog is dismissed

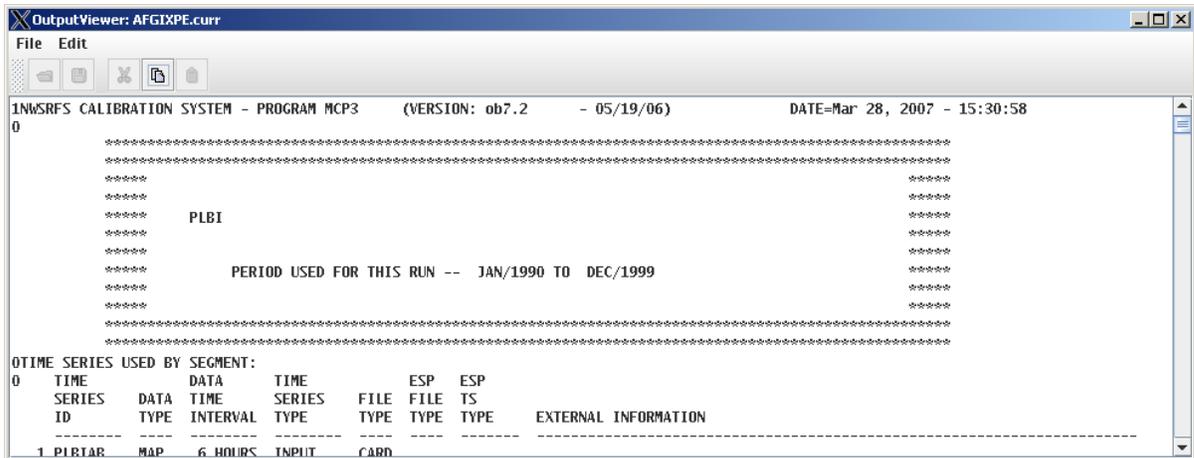
**5. View Output Listing Dialog**

A. Open the Output Listing Dialog and verify general layout

- a. Start the ICP beta software by going to the test\_scripts directory
- b. Type the following at the command line: run\_icpnew\_testdata
- c. Select a deck by clicking on the Open toolbar button
- d. Select deck TESTICP → PETE → PE → AFGIXPE.curr
- e. Check the “Run MCP Automatically” checkbox
- f. Click the OK button
- g. After MCP has finished executing, open the Output Listing Dialog by selecting the menu item View → Output Listing...

*Expected Results:*

- The Wide Output Listing Dialog should appear (see screenshot below)
- Title bar shows “Output Viewer” and shows the name of the selected deck “AFGIXPE.curr”



View\_OutputListing

B. Verify scrollbars are working

- a. Scroll horizontally and vertically (may need to resize window to demonstrate horizontal scrolling).

*Expected Results:*

- Verify that the rest of the dialog can be viewed by scrolling horizontally or vertically.

C. View new output listing in the Wide Output Listing Dialog

- Leave the output viewer window open.
- Click the Open Deck (“Select a control deck”) toolbar button to select a new deck.
- Select deck TESTICP → PETE → TS → TS.curr,
- The “Run MCP Automatically” checkbox should be checked. Click the OK button.
- After the MCP has finished executing (MCP Stop Number is 0), the Output Listing Dialog will display output from the new run.

*Expected Results:*

- The Output Listing Dialog should correspond to the new deck (look for “PAYI” in header).
- While running, the output listing window reads “Run MCP3 to generate output listing”

D. Close Output Listing Dialog (X Button)

- Close the Wide Output Listing Dialog by clicking on the X button in the upper right hand corner.

*Expected Results:*

- The Wide Output Listing dialog dismisses

## 6. WY-PLOT

A. Generate WY-PLOT results and show SAC-SMA Plot

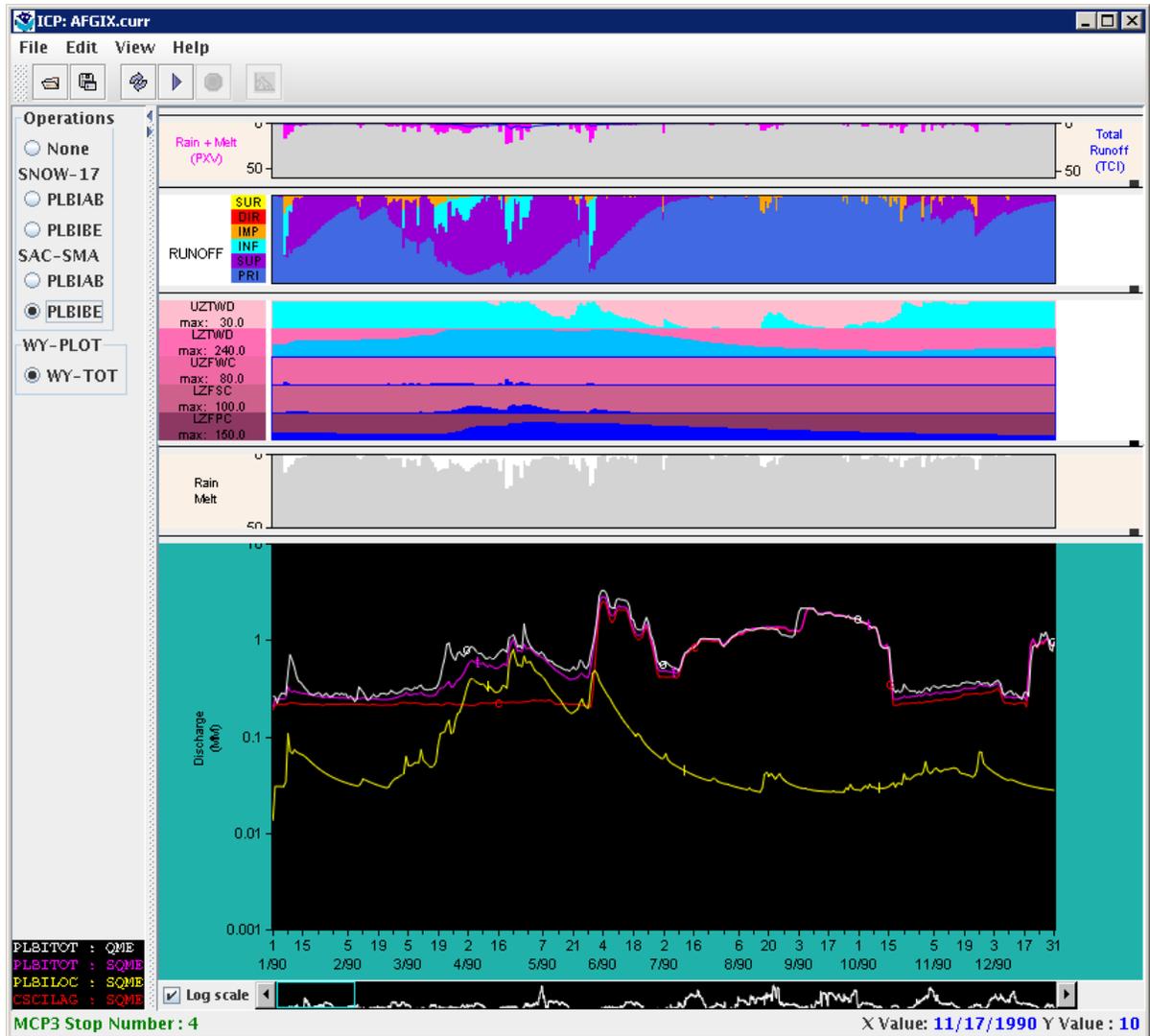
- Start the ICP beta software by going to the test\_scripts directory
- Type the following at the command line: run\_icpnew\_testdata
- Select a deck by clicking on the Open toolbar button
- Select deck TESTICP → PETE → AFGIX → AFGIX.curr
- Check the “Run MCP Automatically” checkbox
- Click the OK button
- After MCP has finished executing, the WY-PLOT graph will be shown in the bottom of the main ICP window.
- Select the PLBIBE SAC-SMA operation from the choices in the upper left of the main window.
- Make sure the Log scale checkbox in the lower left of the WY-PLOT is checked.

*Expected Results:*

- The main ICP window will show the select SAC-SMA and WY-PLOT output as shown below.
- k. Resize subplots by clicking on small rectangle handles on right side of plot and dragging to resize the plot.

*Expected Results:*

- The plots on either side of the divider resize.



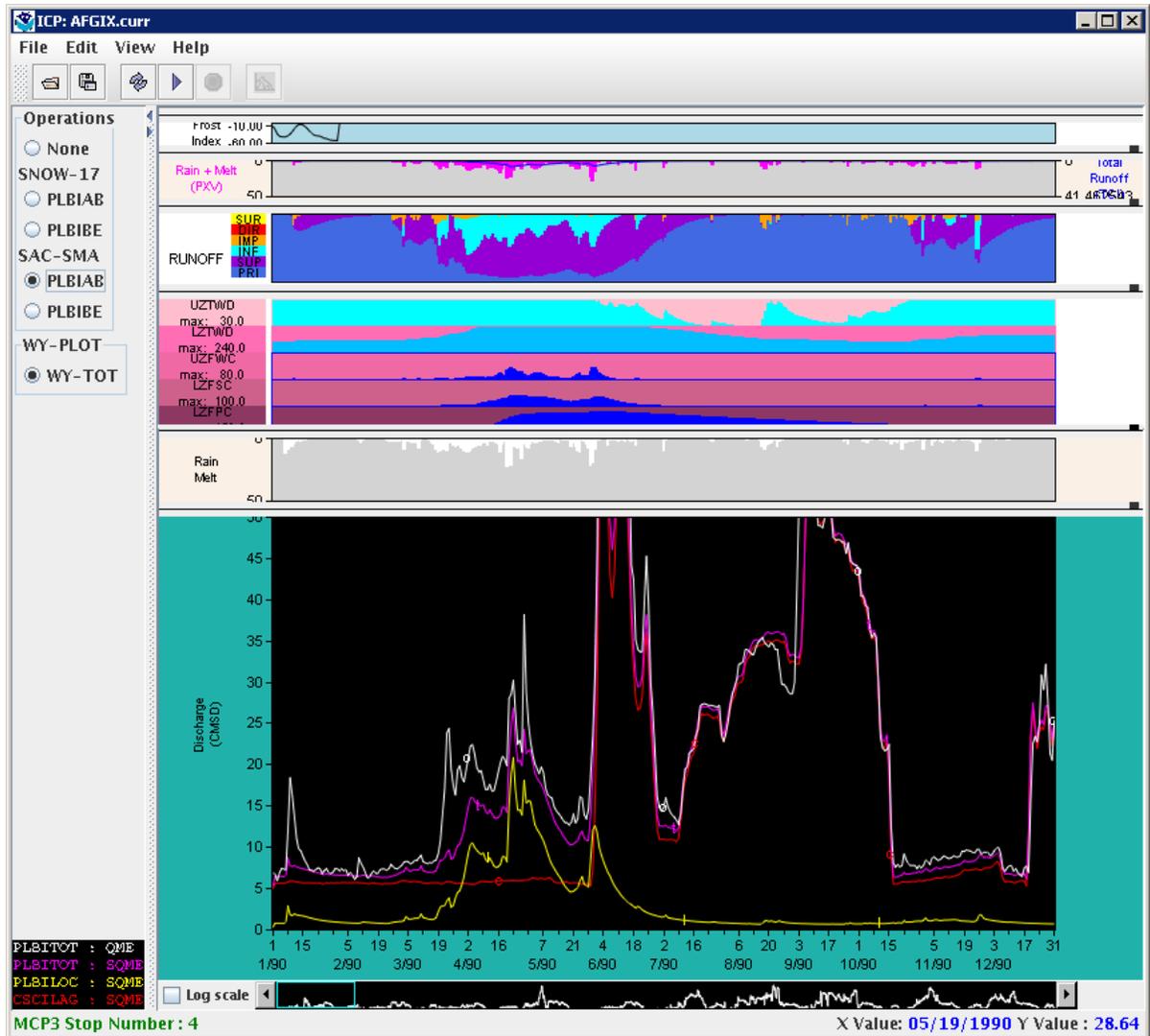
Main\_AFGIX\_SAC-SMA

B. Display frozen ground

- a. Continue from previous test.
- b. Select the PLBIAB SAC-SMA operation from the choices on the left.

*Expected Results:*

- The main ICP window will show the selected SAC-SMA and WY-PLOT output as shown below – in this case the frozen ground (Frost Index) graph will be shown at the top.



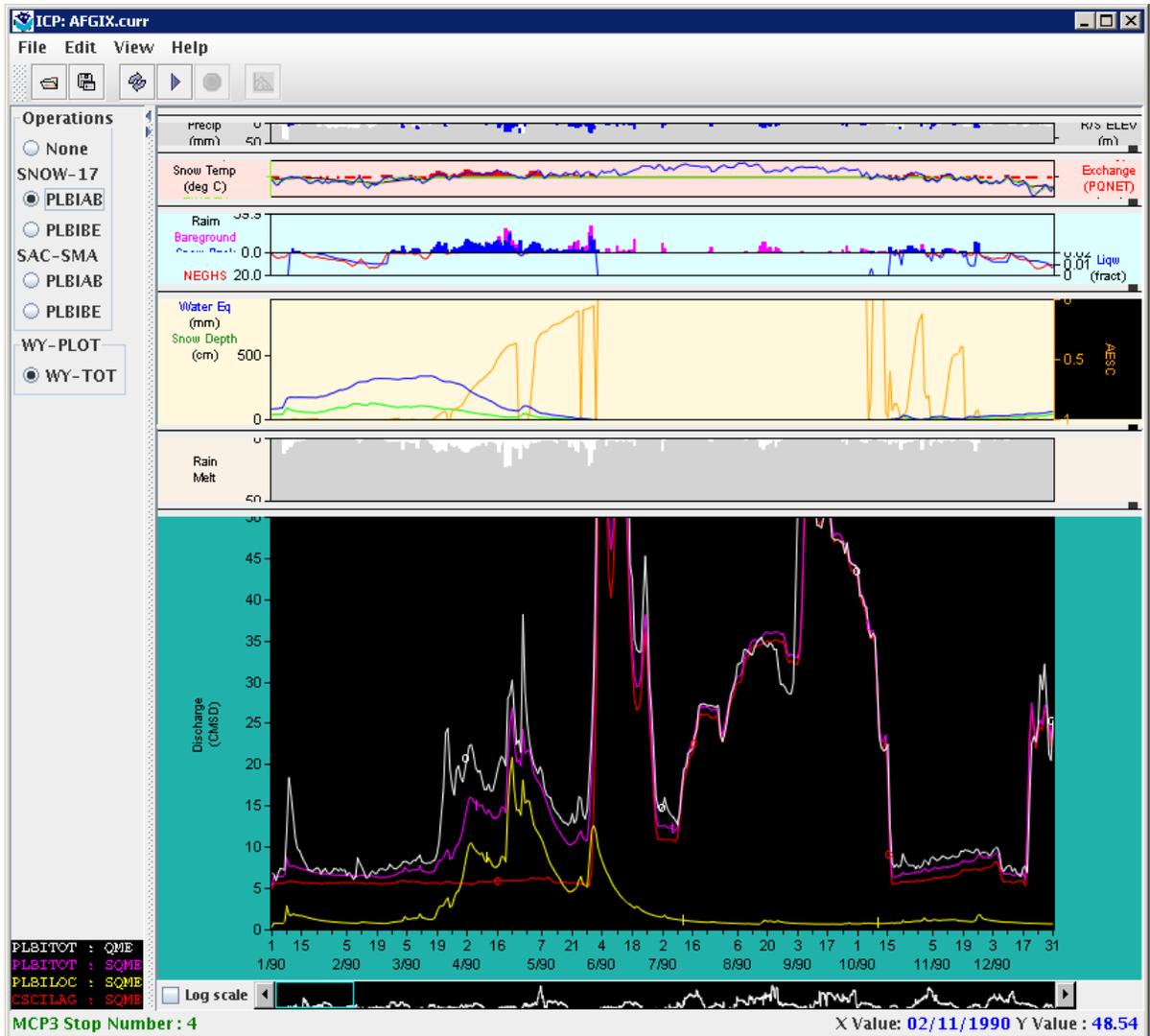
Main\_AFGIX\_SAC-SMA\_Frozen

C. Display SNOW-17 plots

- a. Continue from previous test.
- b. Select the PLBIBE SNOW-17 operation from the choices on the left. The snow plots should display instead of the SAC-SMA plots.
- c. Select the PLBIAB SNOW-17 operation from the choices on the left. The snow plots should update for the selected operation.

*Expected Results:*

- The main ICP window will show the selected SNOW-17 and WY-PLOT output as shown below.



Main\_AFGIX\_SNOW-17

D. WY-PLOT Plot panner

- a. Continue from previous test.
- b. The panner window shown at the bottom of the main window shows the visible extent of the graph. Click with the left mouse button to the right of the highlighted cyan box.

*Expected Results:* The cyan box in the panner should move to the next position to the right of the previous location and the graphs will be updated to reflect the new period being shown. See below.

- c. Click on the right scroll-bar arrow.

*Expected Results:* The graph should scroll to the right by one day.

- d. Hold the mouse down on the right scroll-bar arrow.

*Expected results:* The graph should continuously scroll by one day at a time.

- e. Drag the cyan box in the panner.

*Expected results:* The graph should scroll as the box is dragged.

- f. Using the left or right mouse button, click to the right or left of the cyan box in the panner.

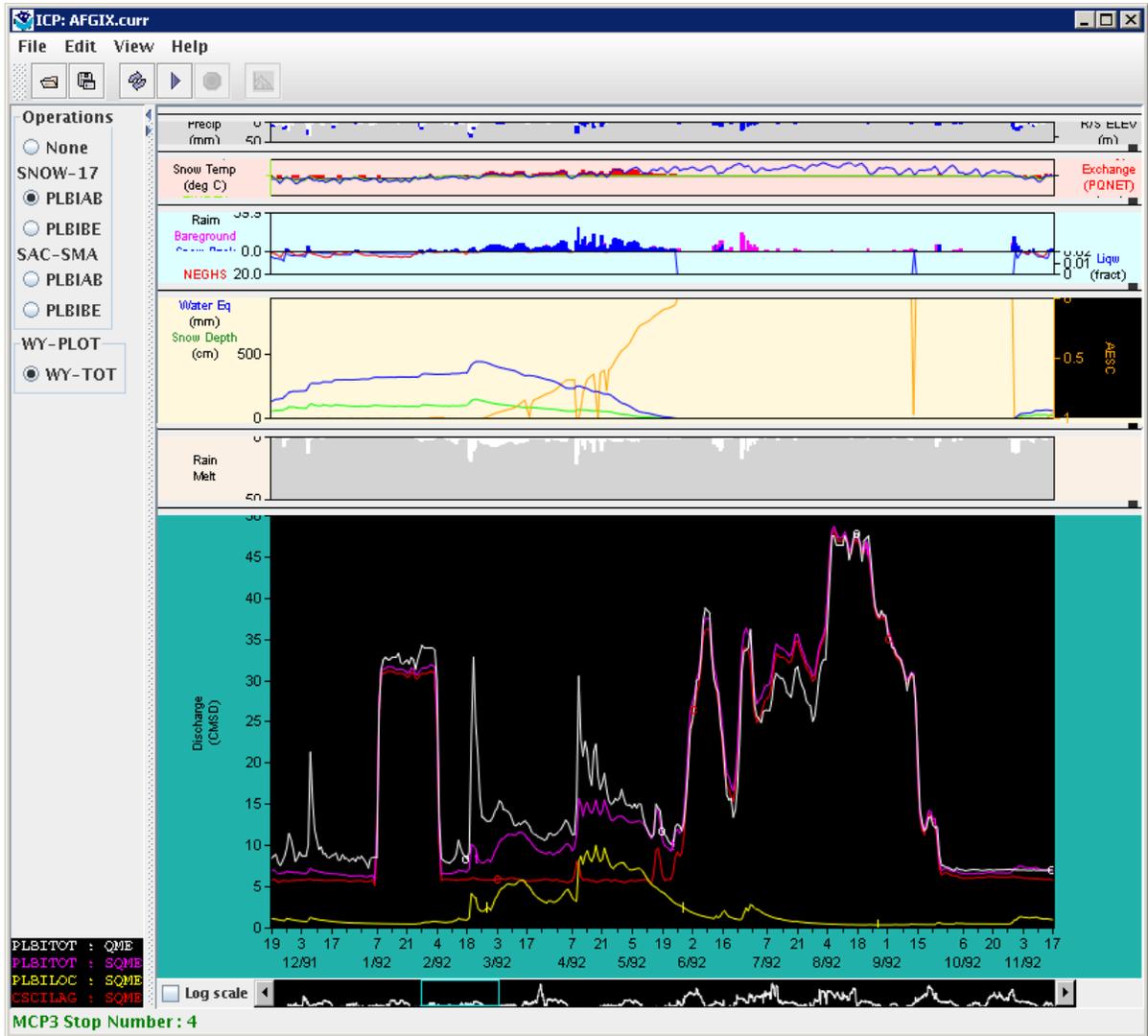
*Expected results:* The graph should page one screen to the right or left, on the same side that was clicked.

- g. Using the middle mouse button, click in the panner.

*Expected results:* The graph should reposition to be left-justified on the selected point.

- h. Drag the main graph.

*Expected results:* The main graph will scroll as it is graphed and the panner box will scroll similarly.



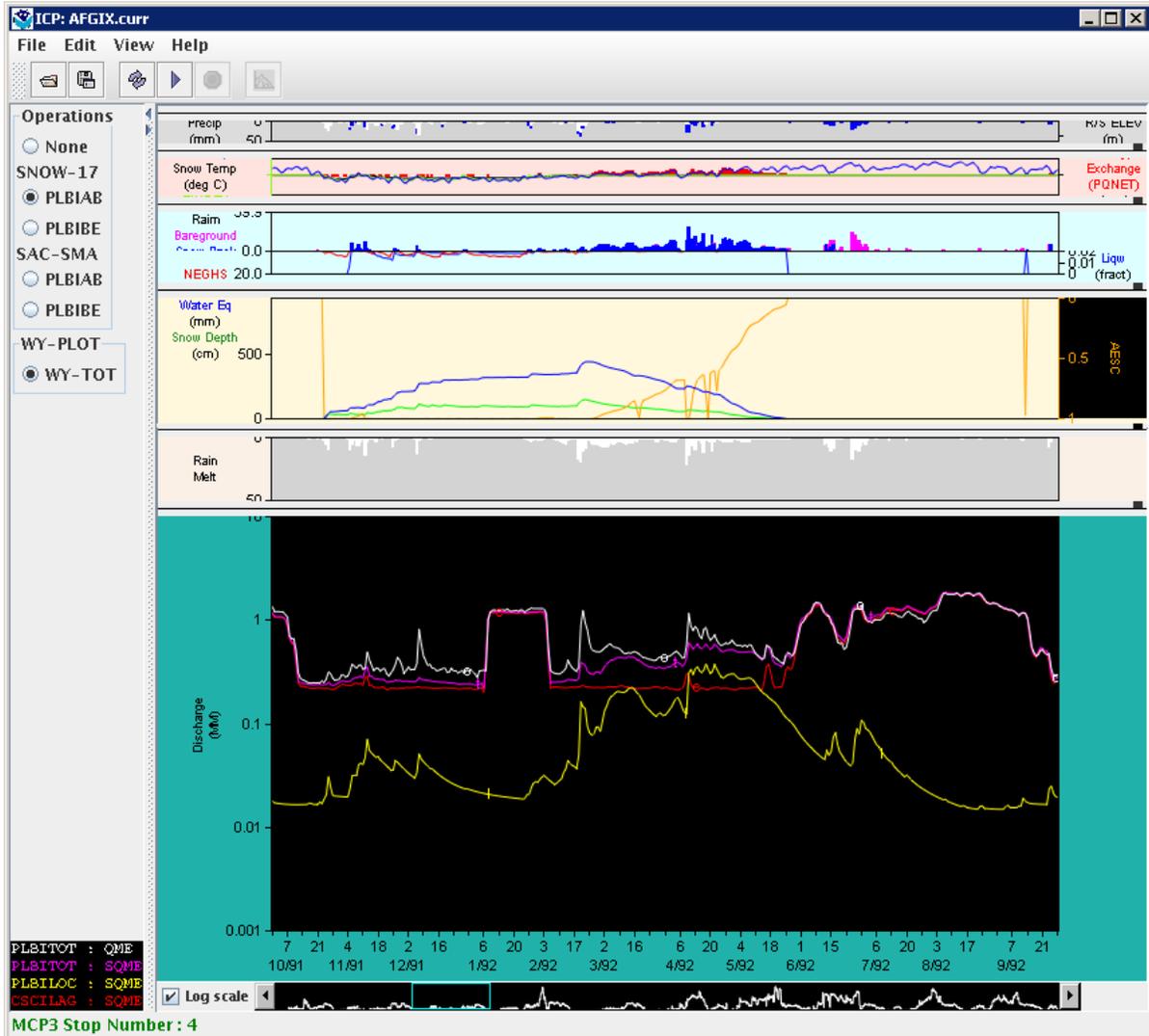
Main\_AFGIX\_Panner

E. Log Scale

- a. Continue from previous test.
- b. Select the “Log scale” checkbox in the lower left of the window, next to the panner.

*Expected Results:*

The lower (discharge) graph should be redrawn using log scale. Note that the units are also changed to mm. See below.



Main\_AFGIX\_LogScale

F. WY-PLOT Data Value Display – Mouse-over

- a. Continue from previous test.
- b. Position the cursor over any point on any time series in the bottom graph.

*Expected Results:*

The position of the mouse is shown in the lower right and is updated as the mouse moves.

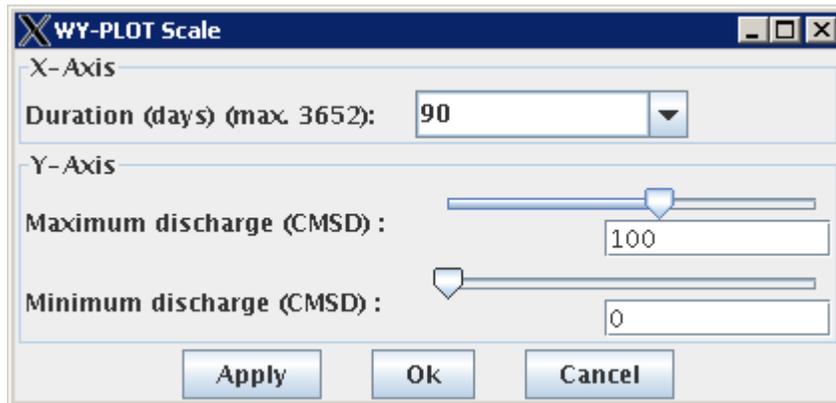
**G. Placeholder to maintain test numbering**

**H. WY-PLOT – Change Scale**

- a. Continue from previous test (WY-PLOT discharge plot should NOT be in log scale).
- b. Select Edit → WY plot Scale...
- c. In the dialog, change the Duration to 90 days and change the maximum discharge to 100.
- d. Press OK in the dialog.
- e. After verifying the results (below) exit ICP by pressing the upper right X in the main window.

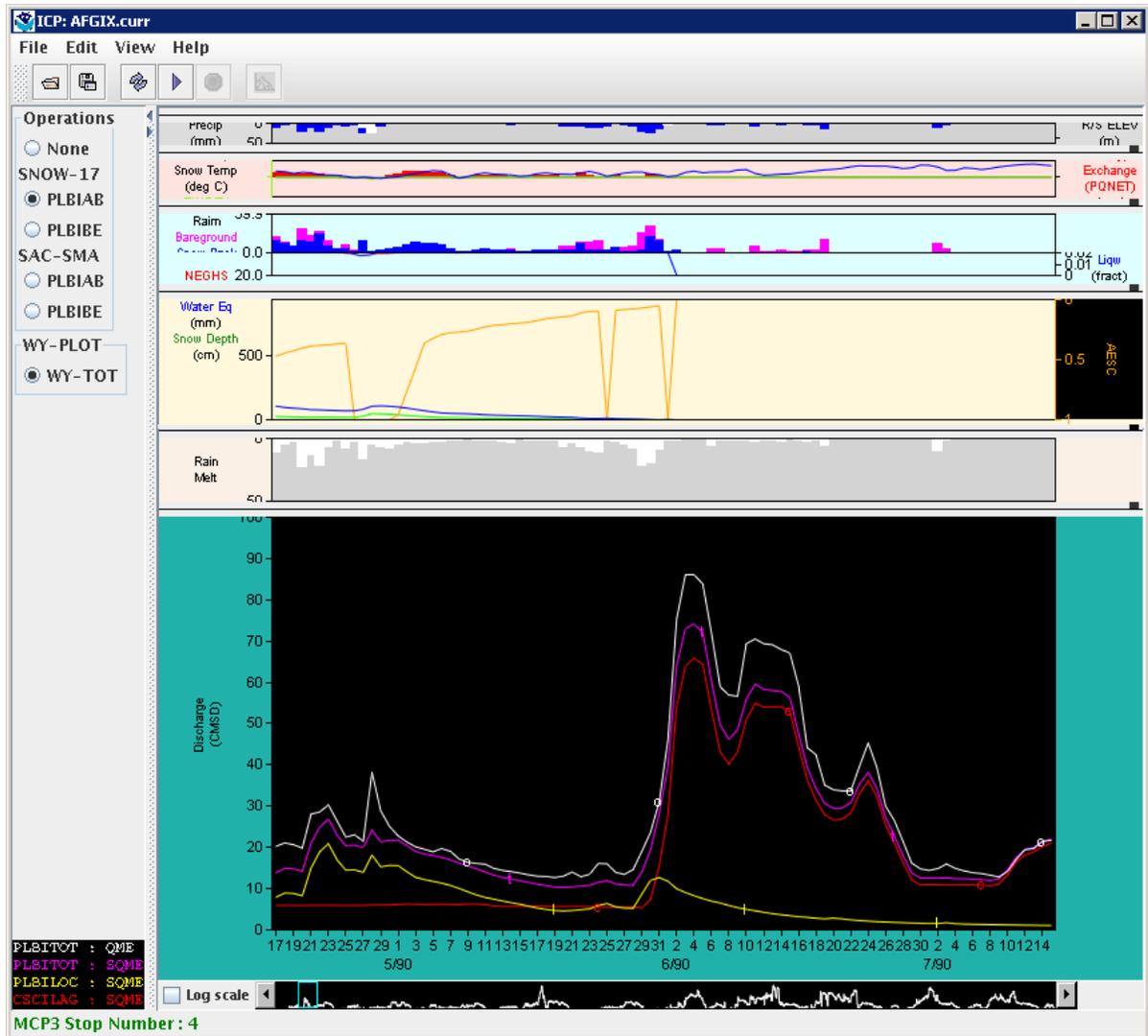
*Expected Results:*

- The X and Y axis scales are changed as requested.



WY-PLOT\_Scale

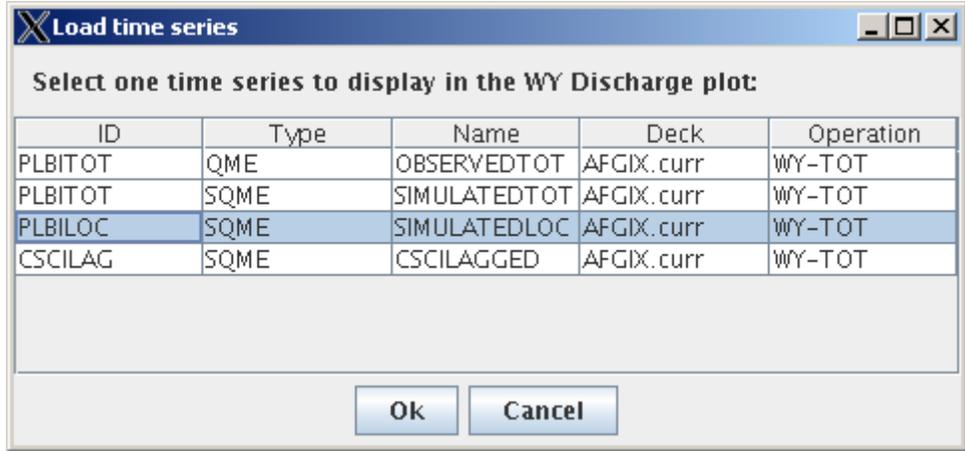
The visible period in the graphs will change to 90 days as shown below:



WY-PLOT\_Scale2

### I. WY-PLOT – Save and Display SQME

- a. If necessary, restart ICP by running the run\_icpnew\_testdata script, or continue from previous tests.
- b. Select deck with the Open (“Select a control deck”) tool and select: TESTICP → PETE → AFGIX → AFGIX.curr. Make sure that the Run MCP3 Automatically checkbox is selected and press OK.
- c. After the run is complete, select File → Save all WY-PLOT Time Series
- d. Open the SAC-SMA parameter editor with Edit → SAC-SMA...
- e. Change the UZTWM parameter by a large amount (e.g., from 30 to 300, or the opposite) and press Ok. MCP3 will rerun and the graphs will redraw.
- f. Load a saved SQME using File → Load Saved Time Series... Select the PLBILOC SQME time series as shown below and press OK:

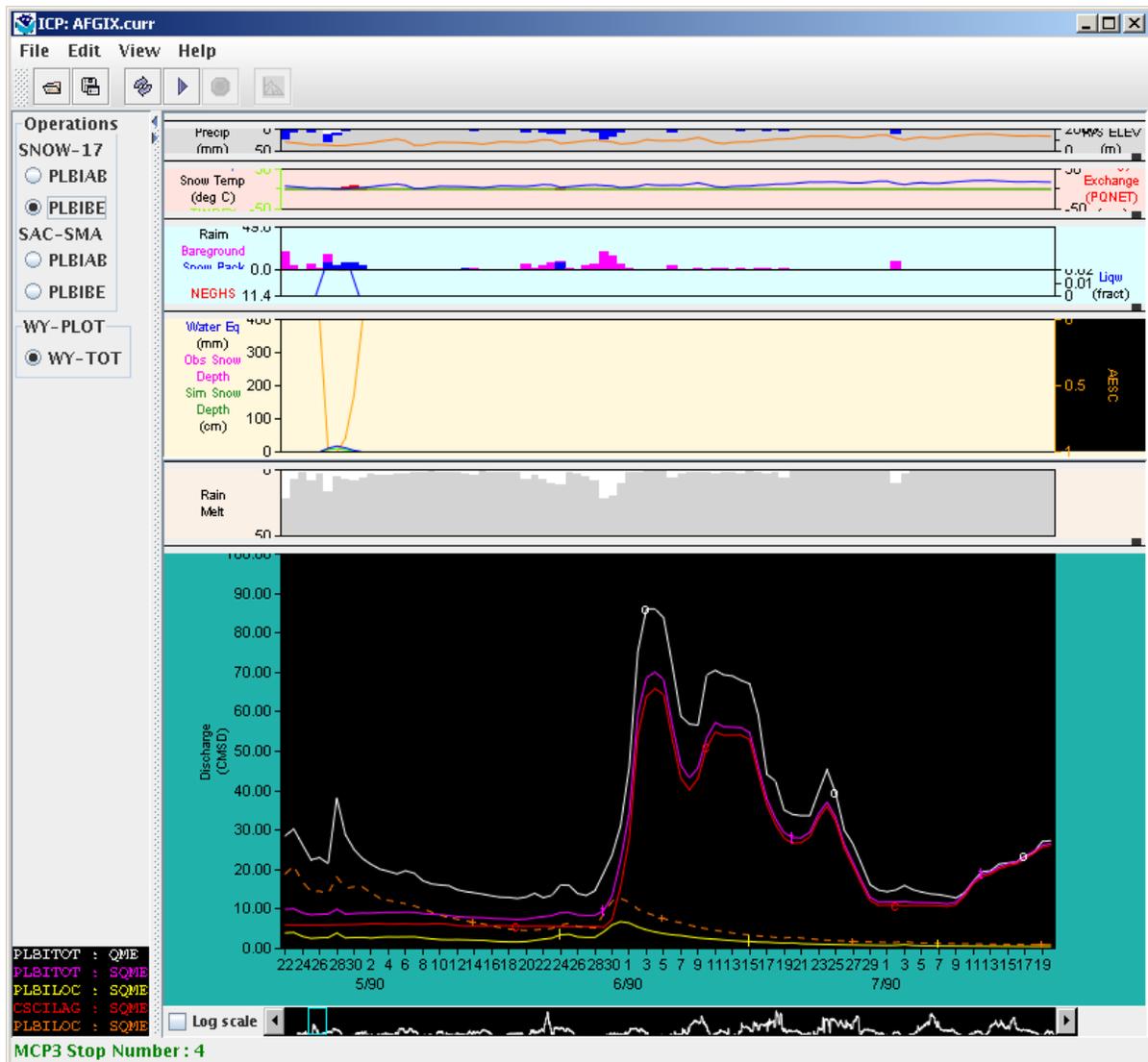


Load\_SQME

- g. The graph should update as shown below.

*Expected Results:*

The previously saved SQME time series will be loaded and displayed as an orange dashed line with + symbol and be listed in the legend.



Load\_SQME2

#### J. WY-PLOT – Clear Saved Time Series

- a. Continue from the previous test.
- b. Clear the displayed time series by selecting File → Clear Displayed Saved Time Series

*Expected Results:*

- The SQME time series as shown in the previous test should be cleared from the graph and the legend.

### 7. Saving Decks

#### A. Rename current Deck using Save As

- a. Start the ICP beta software by going to the test\_scripts directory
- b. Type the following at the command line: run\_icpnew\_testdata
- c. Select a deck by clicking on the Open toolbar button
- d. Select deck TESTICP → PETE → AFGIX → AFGIX.curr

- e. Verify that “Run MCP Automatically” is checked.
- f. Click the OK button
- g. After MCP has finished executing, the WY-PLOT graph will be shown in the bottom of the main ICP window. The reason that MCP3 must rerun is to update the files in the MCP3 to ICP interface directory.
- h. Save the deck with a new name by selecting File → Save As. Enter AFGIX.test and press Save. **WARNING: for MCP3 the file extension can be no more than 4 characters because of file naming conventions in the MCP3 to ICP transfer directory.** MCP3 will rerun automatically.
- i. Edit the deck with Edit → Control Deck.
- j. Make a change and save the deck.

*Expected Results:*

The main ICP window will display AFGIX.test in the title bar.

The file system will show the new file (check in the data directory). Verify that the new deck is different from the original deck.

B. Archive current deck using Save a Copy

- a. Continue the previous test.
- b. Save a copy of the file using File → Save a Copy.
- c. Enter “AFGIX.copy” for the file name. **WARNING: for MCP3 the file extension can be no more than 4 characters because of file naming conventions in the MCP3 to ICP transfer directory.**

*Expected Results:*

A file named AFGIX.copy will be created in the MCP3 decks directory.

The main ICP window will continue showing the current file. AFGIX.test in the title bar.

## 8. PLOT-TS

A. Verify that PLOT-TS view is disabled when no PLOT-TS operations are present.

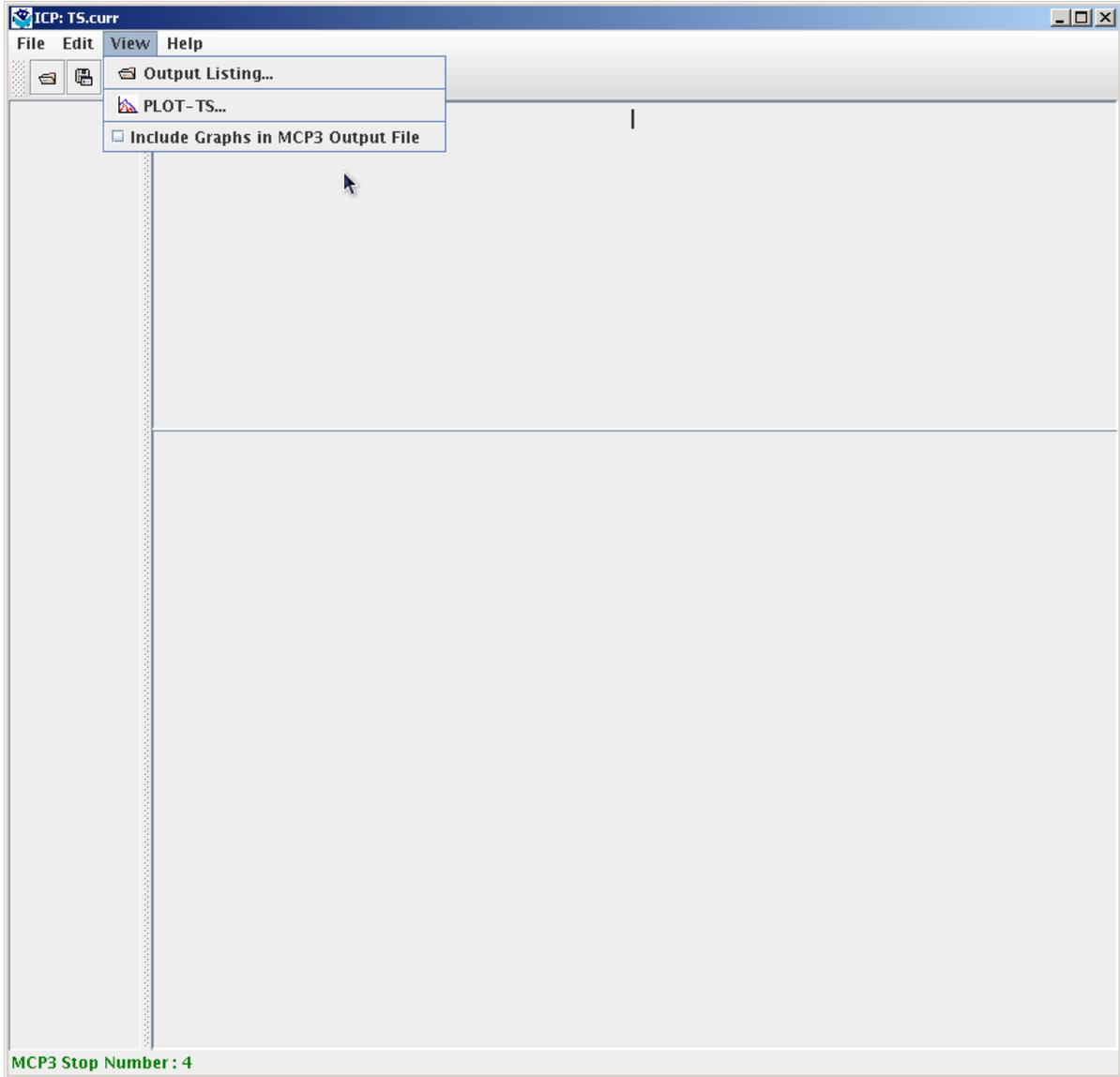
1. Open deck TESTICP→PETE→AFGIX→AFGIX.curr and run MCP3.

**Expected Results:** Verify that the View → PLOT-TS... menu item is disabled.

B. Verify that the WY-PLOT display does not show results when no WY-PLOT operations are used.

1. Open the TESTICP→PETE→TS→ TS.curr deck and run MCP3.

**Expected Results:** MCP3 executes successfully but no WY plots should be displayed in the ICP main window. The View → Plot-TS... menu item is enabled.

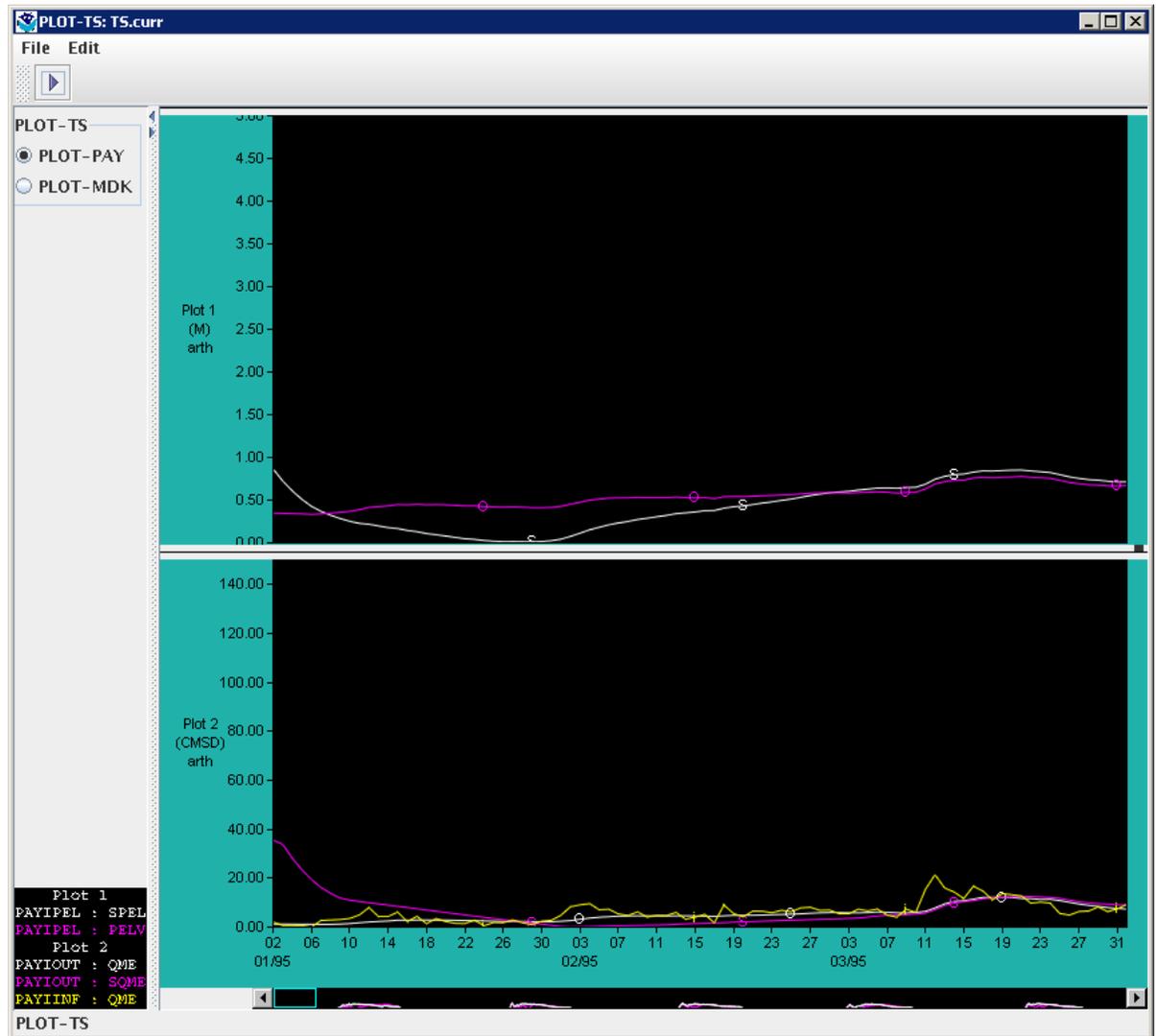


Menu\_View\_PlotTSEnabled

C. Verify that PLOT\_TS window shows results.

1. Continue the previous test.
2. Select View → PLOT-TS....

**Expected Results:** PLOT-TS window opens. The PLOT-PAY operation is selected by default and displays two subplots with 2 and 3 time series displays in the subplots.



TS.curr-Plot-TS

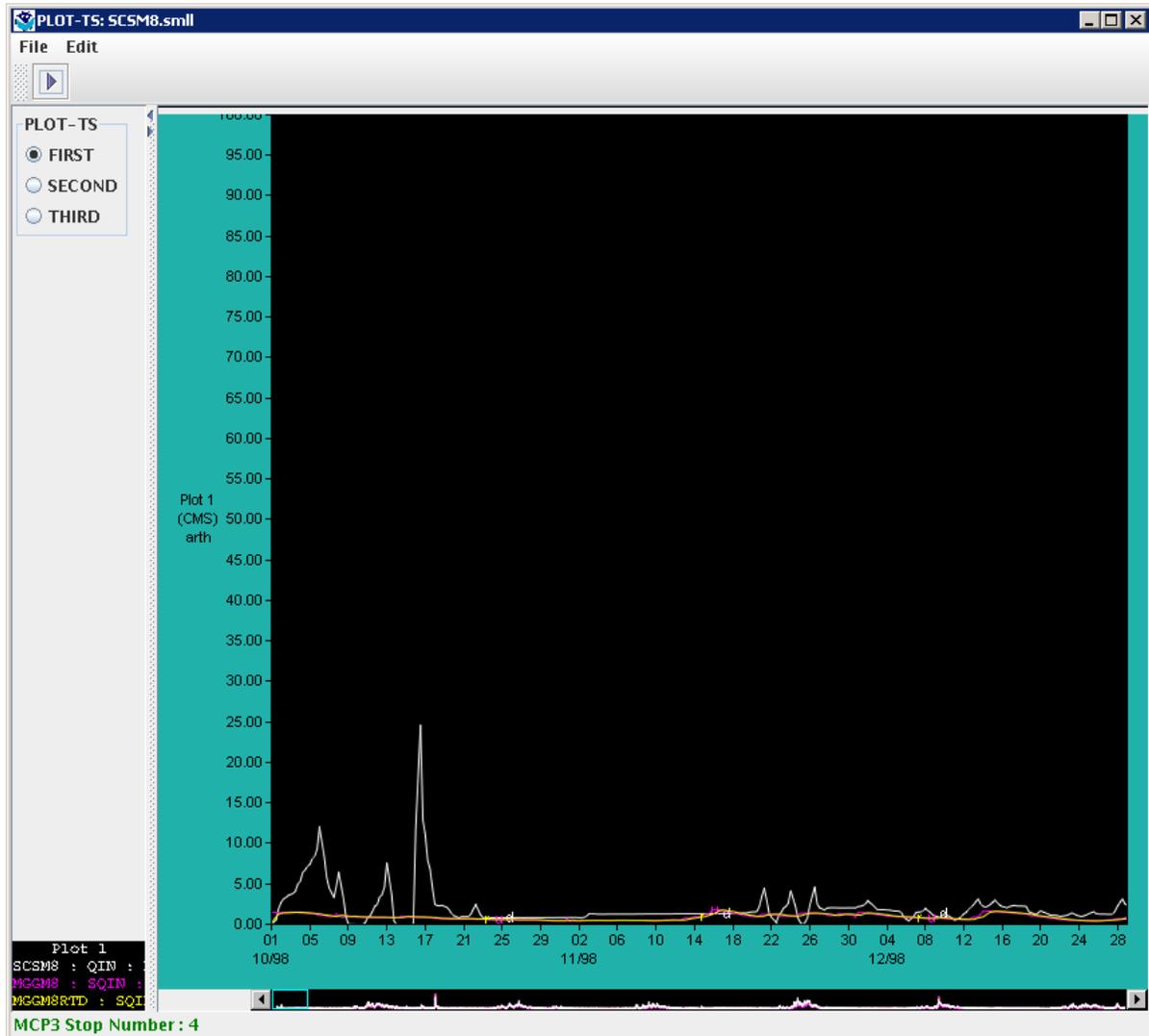
D. Verify that WY-PLOT and PLOT-TS operations can both be displayed.

1. Open the TESTICP→PETE→SCSM8→ SCSM8.sml deck and run MCP3

**Expected Results:** MCP3 executes successfully and WY plots should be displayed in the main window. The View → PLOT-TS... menu item is enabled.

2. Select the PLOT-TS window (and/or position to make visible).

**Expected Results:** PLOT-TS window that was previously shown is updated with the SCSM8 plot output. The FIRST operation is selected by default and displays one subplot with 3 time series.



SCSM8.sml-Plot-TS

E. Verify PLOT-TS Scrolling

1. Continue previous test with the SCSM8.sml deck.
2. Scroll by clicking on the scrollbar arrows at the edges of the panner window. Hold the mouse down on a scrollbar to continuously scroll.

**Expected Results:** The X-axis of the plot shifts by one day at a time to display a different range of dates.

3. Scroll by clicking in the panner to the right or left of the box.

**Expected Results:** The X-axis of the plot shifts by one screen at a time to display a different range of dates.

4. Scroll by holding the mouse down in the panner on either side of the panner box:

**Expected Results:** The plot scrolls one screen at a time.

5. Scroll by dragging the panner box to the left or right.

**Expected Results:** The X-axis of the plot shifts to follow the panner box.

6. Reposition the plot by clicking with the middle mouse button anywhere in the panner window.

**Expected Results:** The plot will reposition to be left-justified on the selected point.

7. Scroll by dragging the plot window.

**Expected results:** The X-axis of the plot shifts quickly and the panner box moves parallel to the visible period in the plot window.

F. Verify Shifting Between PLOT-TS Operations

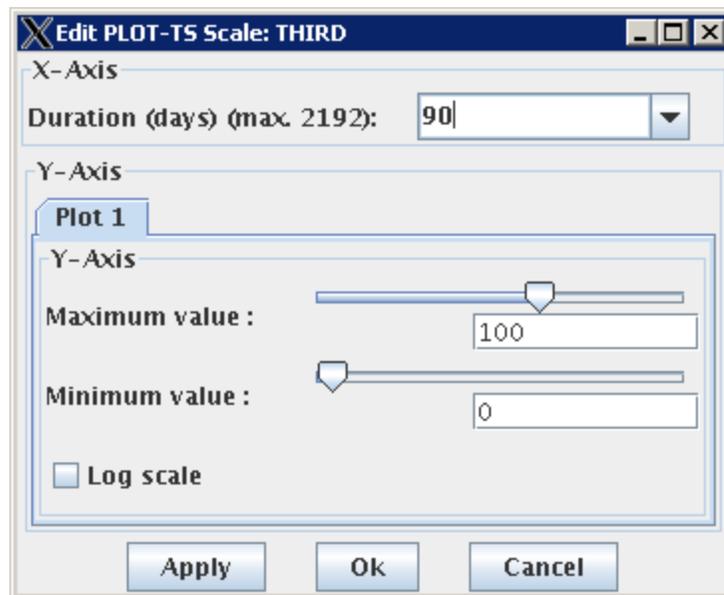
1. Continue the previous test with the SCSM8.smll deck and PLOT-TS window open.
2. Switch between the operations displayed in the navigator (FIRST, SECOND, THIRD).

**Expected Results:** The window updates to display the subplots defined for the selected operation.

G. Change PLOT-TS Scale

1. Continue the previous test with the SCSM8.smll deck still selected.
2. Choose the FIRST radio button in the navigator. Choose Edit → Plot-TS scale....

**Expected Results:** The Edit PLOT-TS scale dialog appears



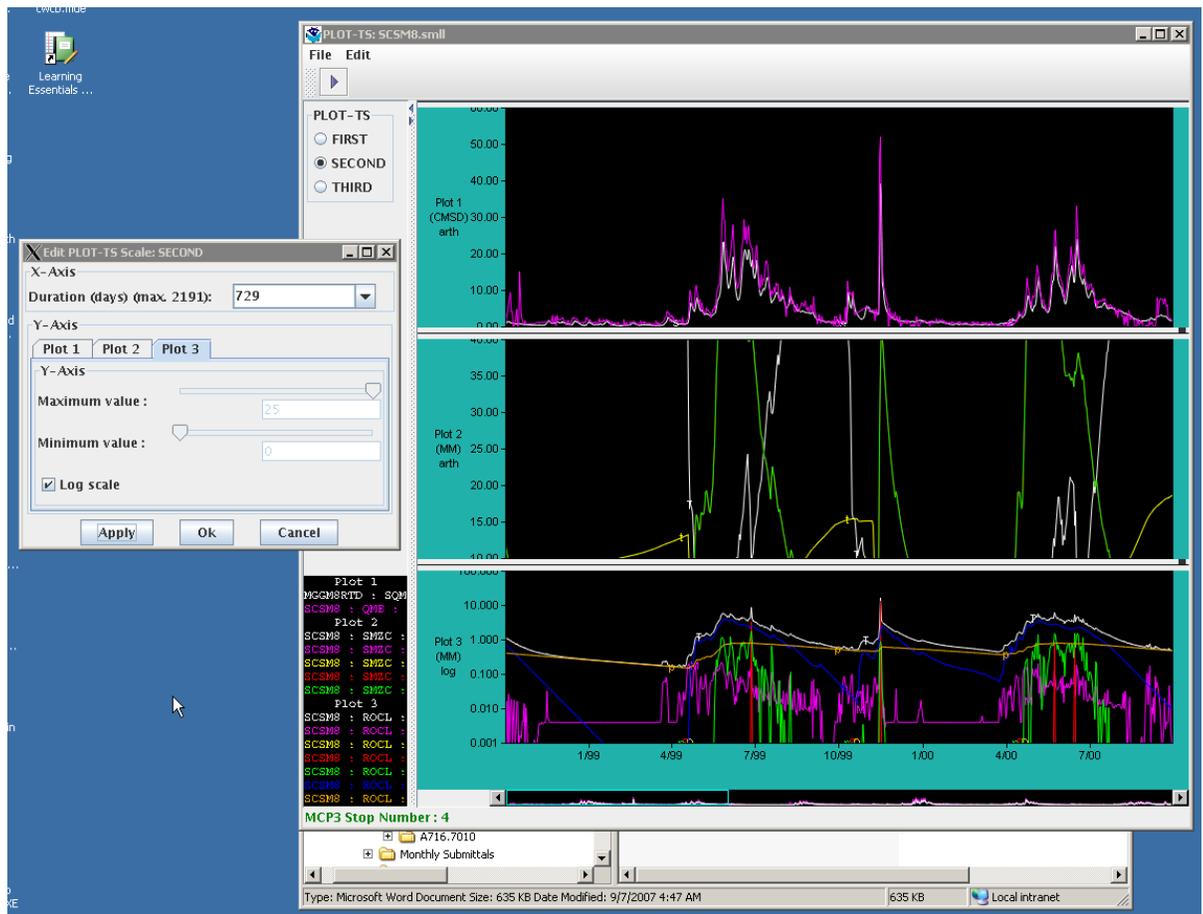
Edit-plot-ts-scale-SCSM8.smll-plot-2

3. Change the duration of the plot from 90 to 730 by changing the “Duration” field. Click OK.
4. Slide the panner to the left edge of the period.

**Expected Results:** The Edit Plot-TS scale dialog disappears and the dates displayed now range from 10/98 to 7/00. The panner range (the cyan colored box in the panner) also updates to a bigger rectangle to reflect the new number of days that are displayed in the main plot.

5. Select the SECOND operation. Choose Edit → PLOT-TS scale...
6. Change the following for each tab:
  - a. On the “Plot 1” tab, change the maximum value to 60
  - b. On the “Plot 2” tab change the minimum value to 10 and the maximum value to 40
  - c. On the “Plot 3” tab click the Log Scale checkbox. Note that when log scale is used, the plot limits cannot be changed.
  - d. Click Apply.

**Expected Results:** The Edit PLOT-TS Scale dialog remains open. The plots change to show the specified min/max or log scales:



Edit-multiple-plot-ts-scales

7. Move mouse over the different plots.

**Expected results:** Verify that the date and value information displayed in the lower right hand corner of the status bar is correct, for plots showing log or linear scales.

8. In the Edit PLOT-TS scale dialog, change the duration to 365.
9. Press OK.

**Expected Results:** The PLOT-TS scale window closes. The plot now shows dates 10/98-10/99. The panner range (the cyan colored box in the panner) updates to show a smaller colored rectangle for the new dates that are displayed.

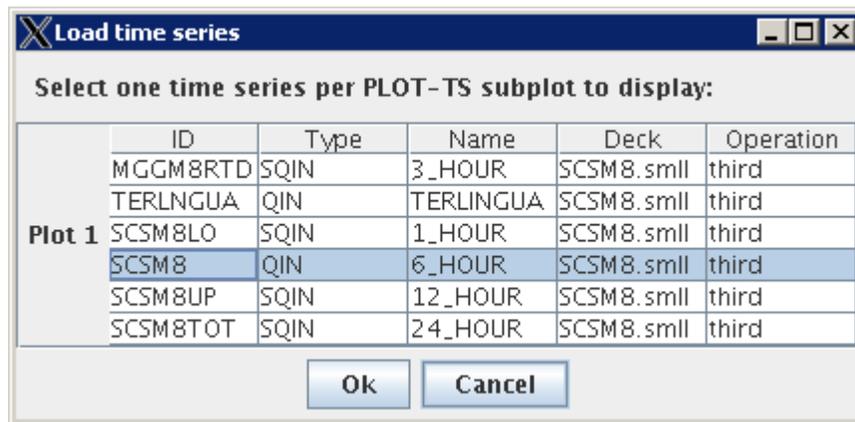
H. Save Time Series and Load to Display

1. Continue using the SCSM8.smll deck.
2. Select the THIRD operation if not already selected.
3. Save the time series by selecting File → Save the Time Series for selected PLOT-TS subplot.

**Expected Results:** Saving of time series succeeds. The PLOT-TS status area will display “Save Time Series: Successful”

4. Still looking at THIRD operation
5. Load a saved time series by selecting File→ Load Saved Time Series....

**Expected Results:** The Load Saved Time Series dialog appears.

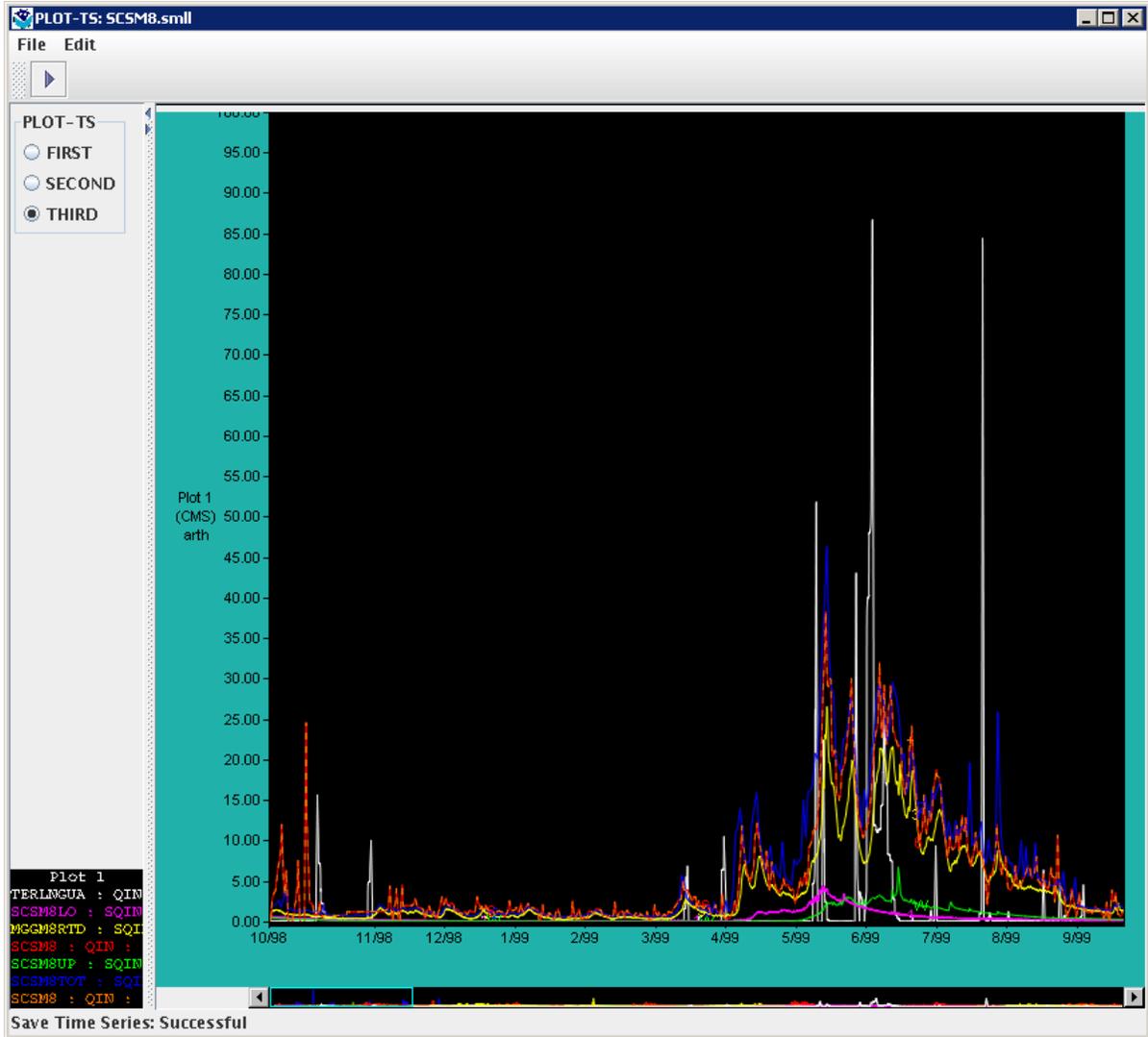


Load-time-series-dialog

6. Select the time series with the ID “6\_HOUR” (as shown above).

**Expected Results:** The selection is highlighted in the table. Note: Only one time series can be selected at a time in the table. The OK button is enabled after a selection is made.

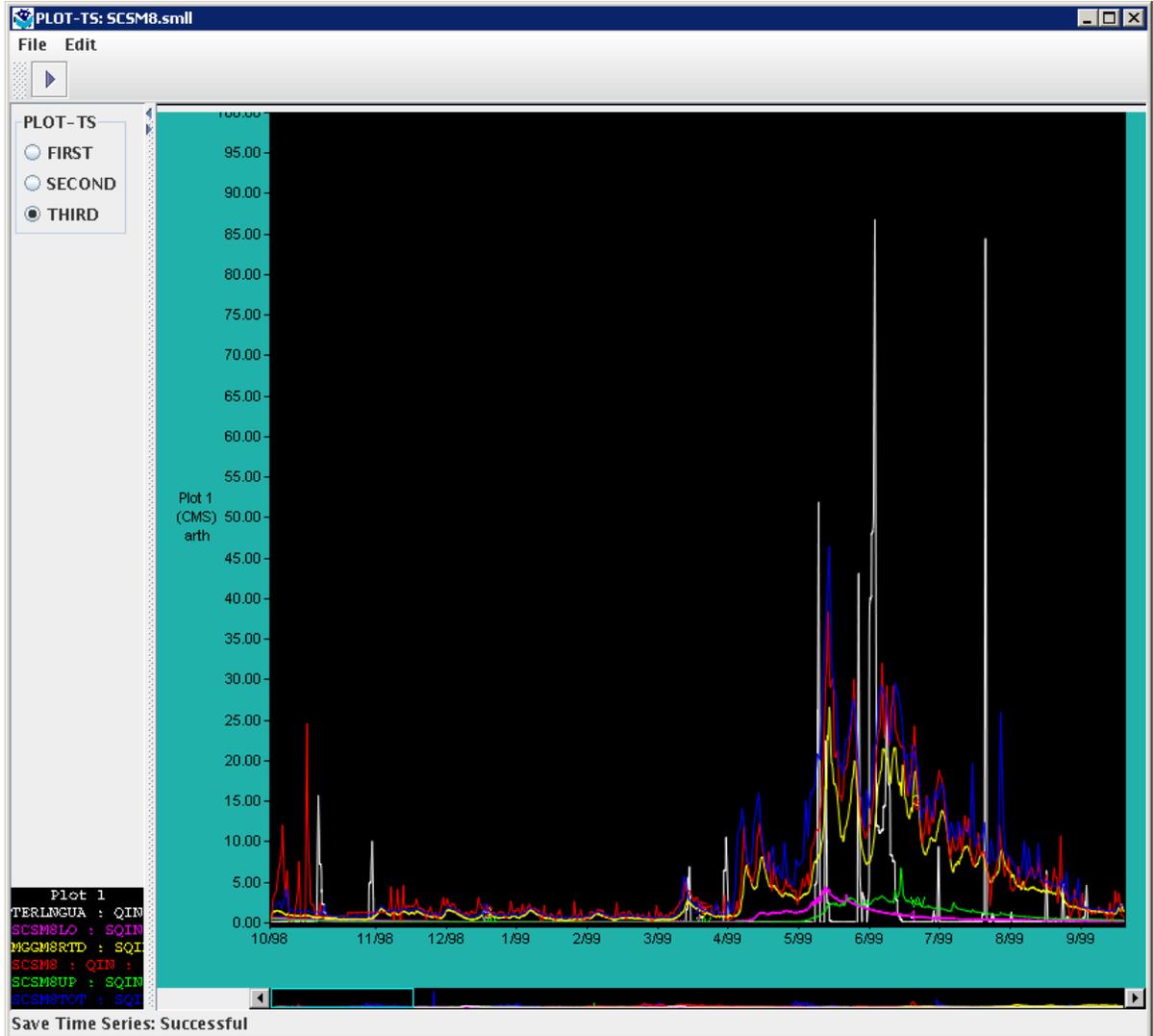
7. Click OK. **Expected Results:** The plot updates to display the selected saved time series as an orange dashed line, and the legend updates to show the saved time series. Note that since parameters were not changed, the saved time series will display on top of another time series.



Plot-TS-displaying-saved-time-series

8. With the THIRD operation still displayed, and the saved time series displayed, select File → Clear Displayed Saved Time Series....

**Expected Results:** The plot updates and clears the saved time series from the plot.

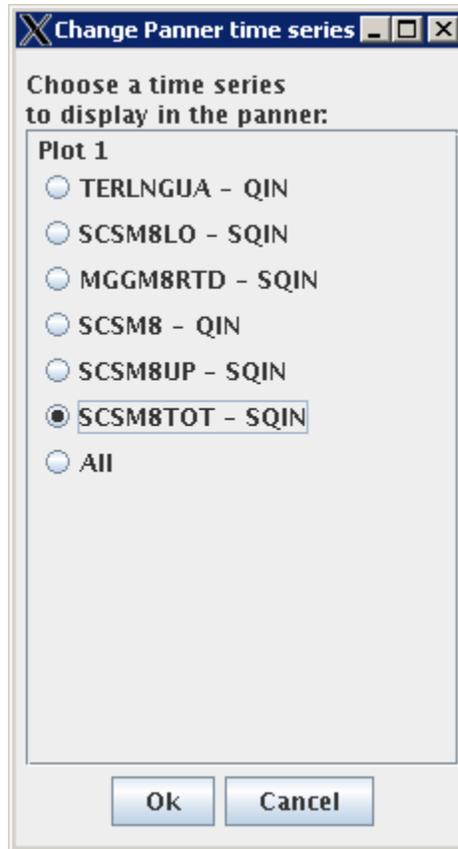


Plot-TS-clear-saved-time-series

I. Change Time Series Used in the PLOT-TS Panner

1. Continue with the SCSM8.sml deck THIRD operation.
2. To change the time series displayed in the panner/scrollbar, select File → Change Panner Time Series....

**Expected Results:** The change panner time series dialog appears displaying the subplots and available time series for the selected operation.



Change-plot-ts-panner-timeseries

3. Select the “SCSM8TOT - SQIN” radio button under the Plot 1 heading (as shown above). Click OK.

**Expected Results:** The panner image updates to show only the SCSM8TOT – SQIN time series.



Panner-with-one-time-series

4. Scroll by clicking the arrow buttons on the left or right side of the panner.

**Expected Results:** The plot X-axis shifts by ~ 1 day up or down.

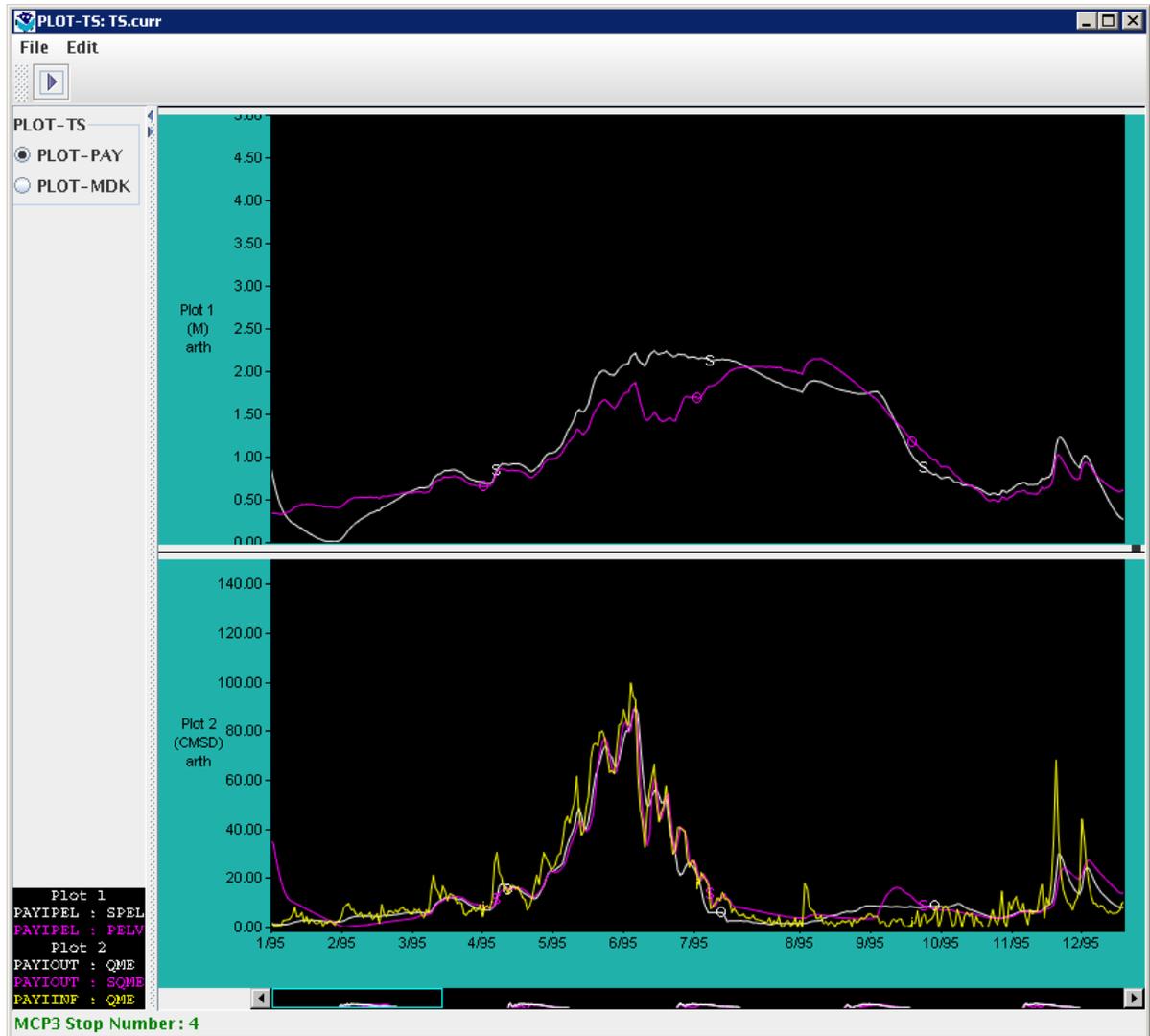
5. Scroll by pressing and holding down the arrow buttons on the left or right side of the panner.

**Expected Results:** The plot X-axis continuously scrolls left or right.

#### J. Verify Automatic Update of PLOT-TS Window

1. Leave the PLOT-TS window open but go back to the ICP main window. Choose a different deck by selecting File → Open... Choose the TS/TS.curr deck. Click OK. Run MCP (manually or automatically).

**Expected Results:** The PLOT-TS window automatically updates to display the most recent PLOT-TS results

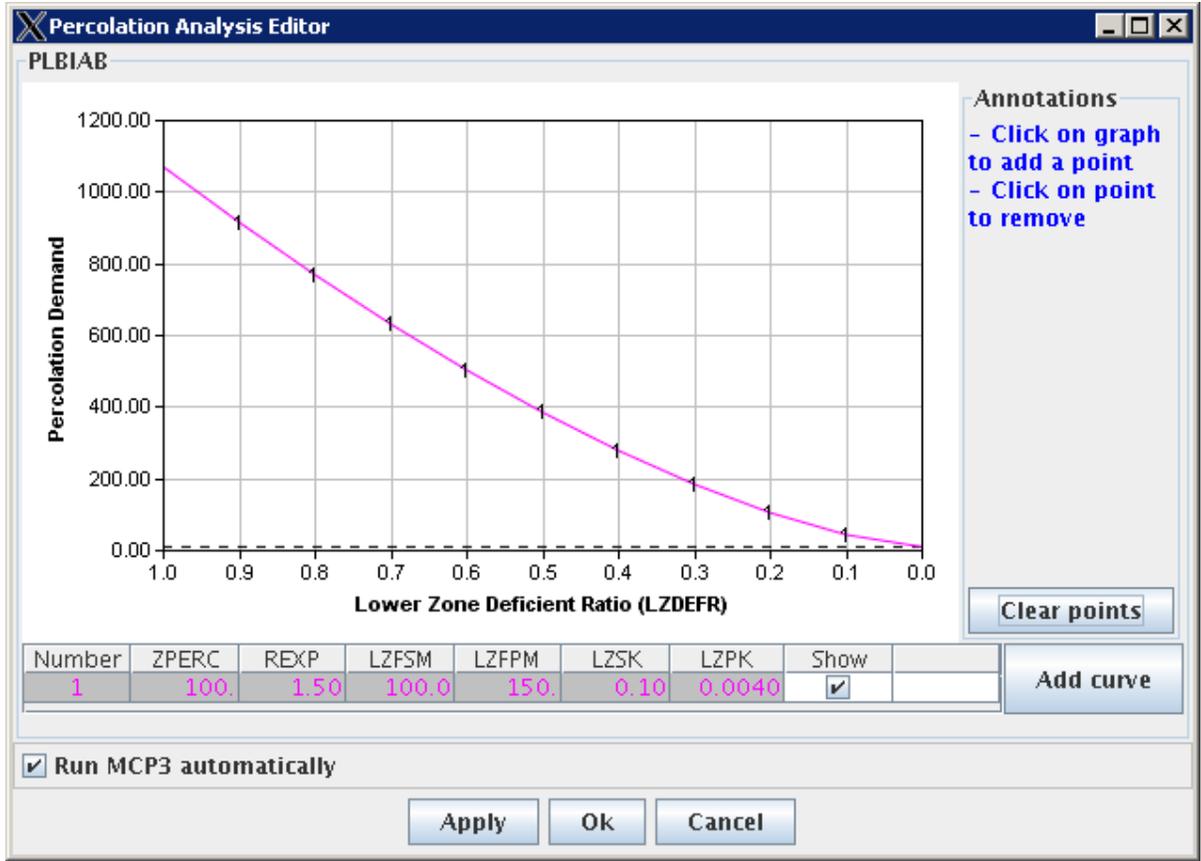


TS.curr-Plot-TS

## 9. Editing Percolation Curve

- A. Open the Percolation Analysis Editor and verify general layout.
  - a. Select the deck AFGIX.curr (TESTICP → PETE → AFGIX → AFGIX.curr)
  - b. Open the parameter window with Edit → SAC-SMA...
  - c. Click the Perc button on the PLBIAB column to open the Percolation Analysis window.

**Expected results:** The window should display similar to the following, with the operation name in the upper left and the tabular parameters matching those in the control deck):

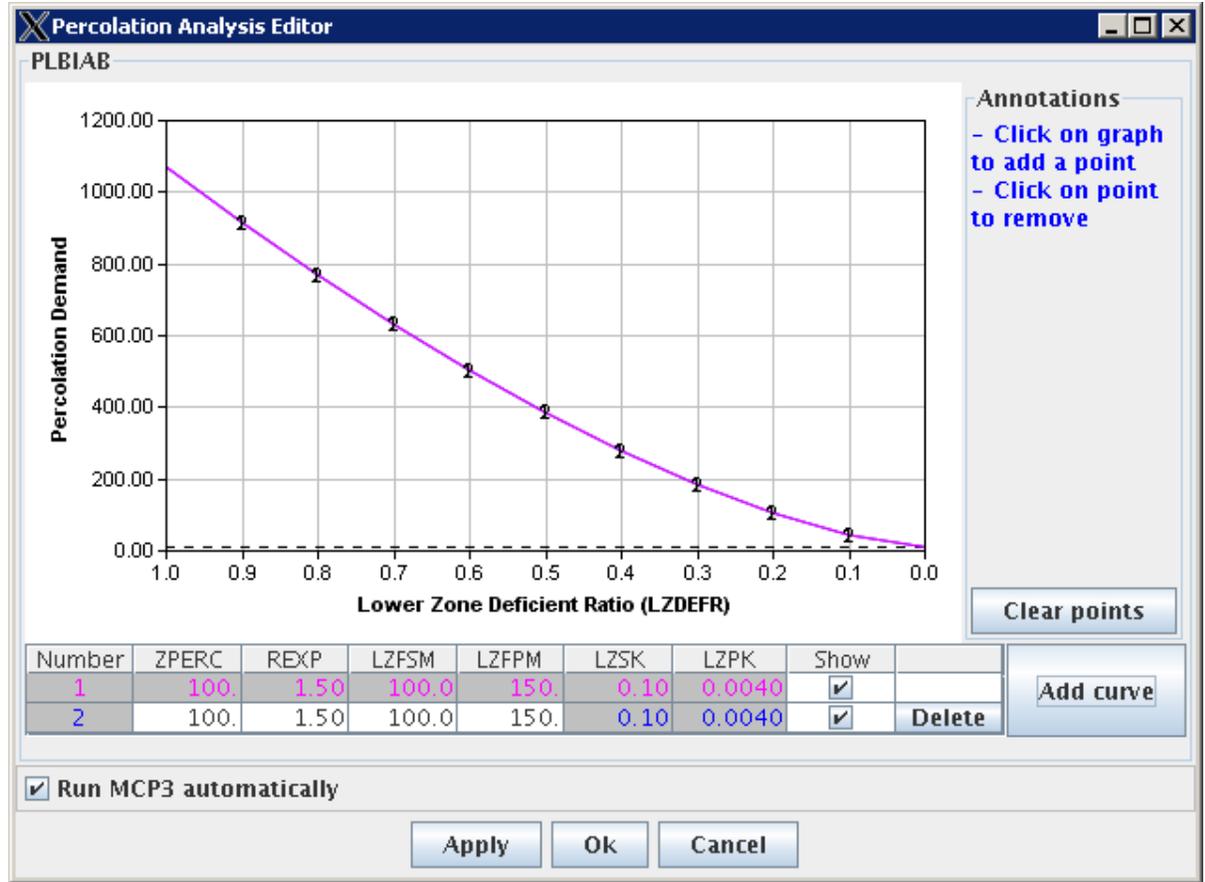


Percolation\_Analysis\_Editor0

B. Verify that a new set of parameters can be added:

- a. Continue the previous test.
- b. Click “Add curve” to add a row the table.

**Expected Results:** A row will be added at the bottom of the table with the same values as the previous last row. An additional curve with the same data points as those corresponding to the previous last row will be drawn on the graph.



Percolation\_Analysis\_Editor\_New

C. Verify that the selected row is highlighted by a blue rectangle.

- a. Continue the previous test.
- b. Select the first row.

**Expected Results:** The selected row will have a blue rectangle around the cells.

D. Verify that the display of a curve resulting from a parameter set can be selectively displayed.

- a. Continue the previous test.
- b. Click on the checkbox in the “Show” column in the second row (the first row is always shown).

**Expected Results:** When the check is displayed in the “Show” column a curve will be displayed. If the check is not displayed, then the corresponding curve will not be displayed

E. Verify that a parameter set can be deleted

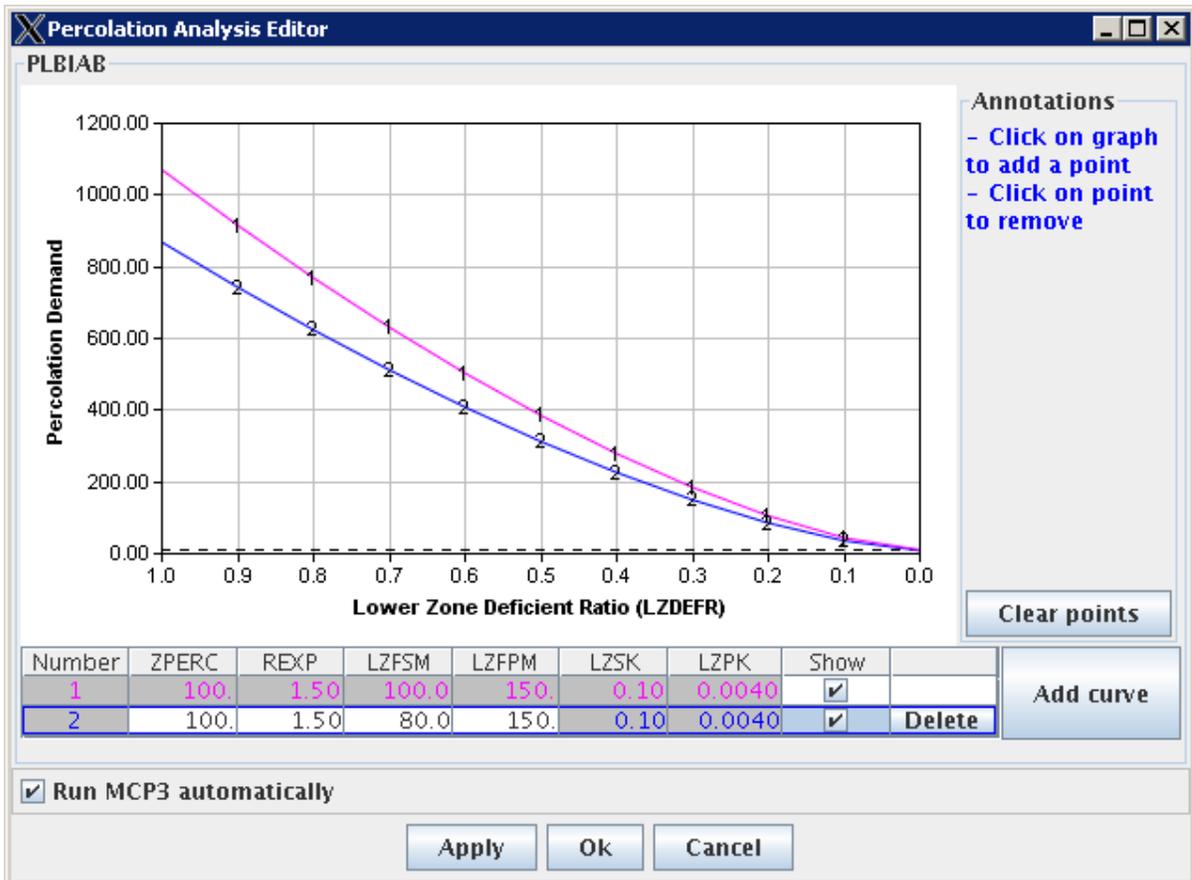
- a. Continue the previous test.
- b. Click on the “Delete” button in the second (new) row.

**Expected Results:** The row containing the “Delete” button and the corresponding curve will be removed.

F. Verify that parameters can be edited.

- a. Continue the previous test.
- b. Press Cancel in the Percolation Analysis Editor to close the previous window.
- c. Press Perc in the SAC-SMA editor (first column) to restart the Percolation Analysis Editor window.
- d. Press Add Curve to create a new curve.
- e. Click in a cell in the new curve and change data values. For example, change LZFSM from 100 to 80. Press Enter or tab when editing values.

**Expected Result:** The curve shape will change, as shown in the following figure (the original curve will continue to be displayed):



Percolation\_Analysis\_Editor

- f. Select the second row.
- g. Press Apply to save the results and cause MCP3 to be run.

**Expected Result:** The SAC-SMA parameters will be updated based on the values in the percolation analysis window (for the selected row), MCP3 will run, and output plots will be updated reflecting the changes.

G. Verify that when out-of-range values are entered a range message is displayed.

- a. Enter a value of -10 for ZPERC in the second row and press Enter.

**Expected Result:** A warning will be shown that the value must be  $\geq 0$ .

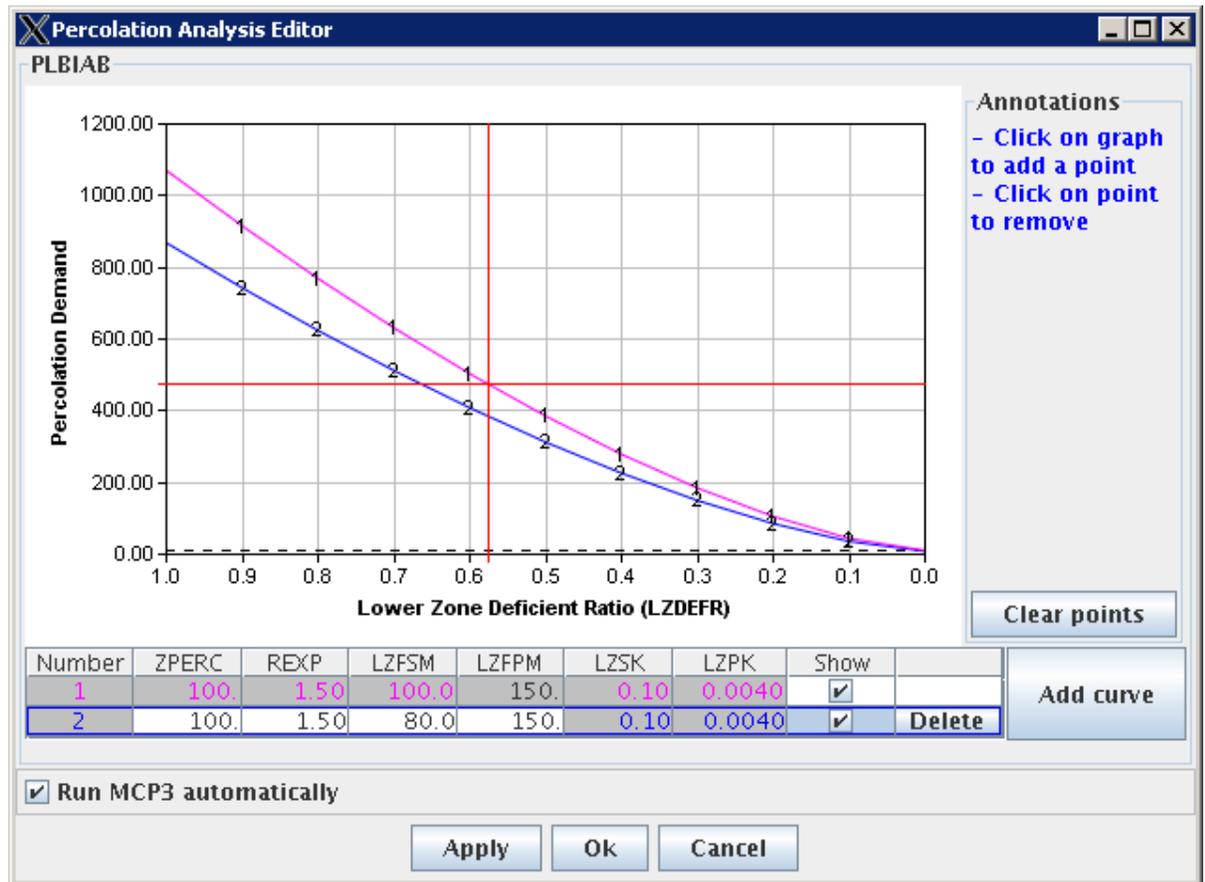
- b. Change the value of ZPERC back to 100 and press Enter or press Esc.

**Expected Result:** The value will be accepted as valid.

H. Verify the Percolation Demand corresponding to a time can be displayed.

- a. Continue the previous test (the Percolation Analysis Editor should be displayed).
- b. Select the PLBIAB SAC-SMA operation in the navigator on the main window.
- c. (Left or right) click in the WY-PLOT discharge plot at a point of interest. The date associated with the click is used to determine the point on the percolation curve.

**Expected Results:** The corresponding point will be indicated by intersecting red lines on the Percolation Demand curve for the selected row.

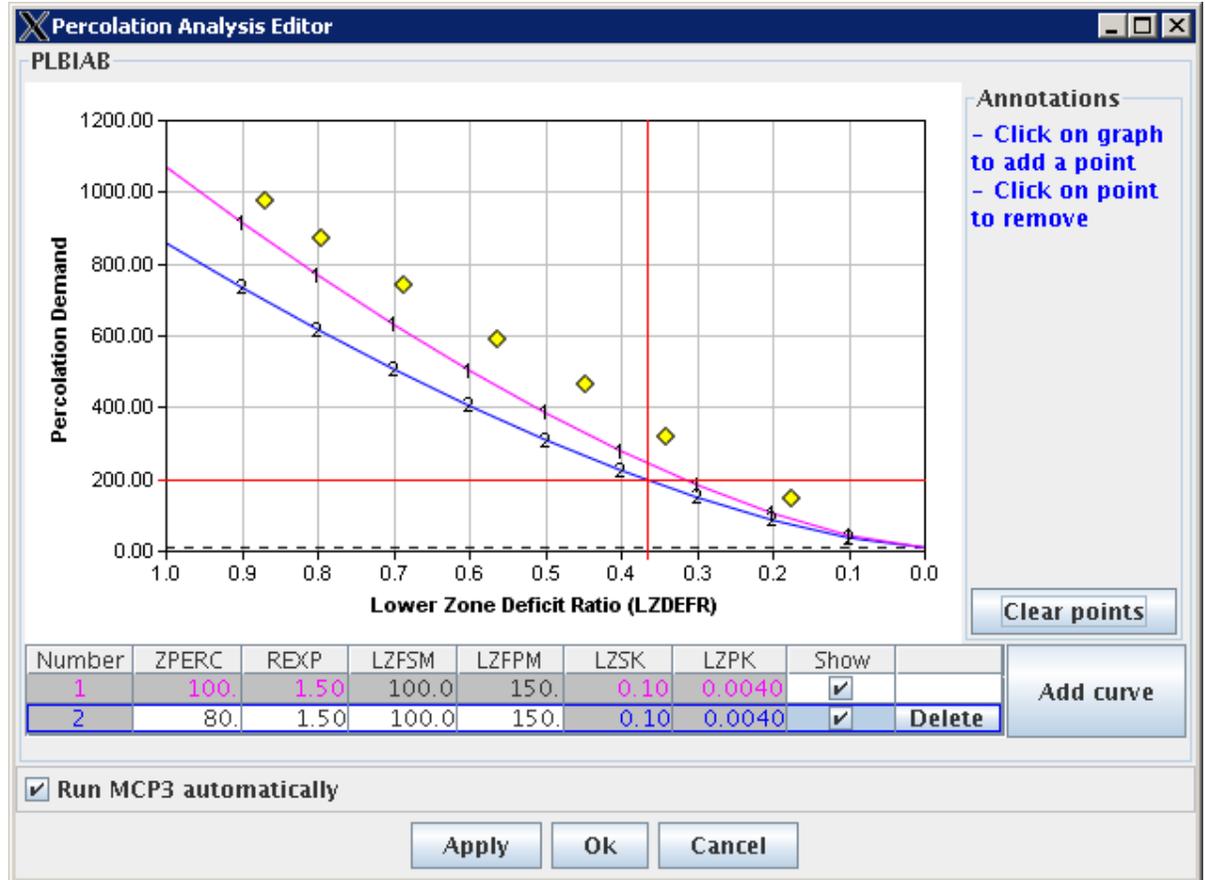


PercolationAnalysis-with-cross-hair.png

I. Verify that annotation points can be displayed.

- a. Continue the previous test (the Percolation Analysis Editor should be displayed).
- b. Click on the graph to add points, which are used to construct a target curve.

**Expected Results:** The graph will display the points as shown below



Percolation\_Analysis\_Edit\_WithPoints

J. Verify that annotation points can be cleared.

- a. Click on an individual point to clear a single point.
- b. Click on the Clear points button to clear all points.

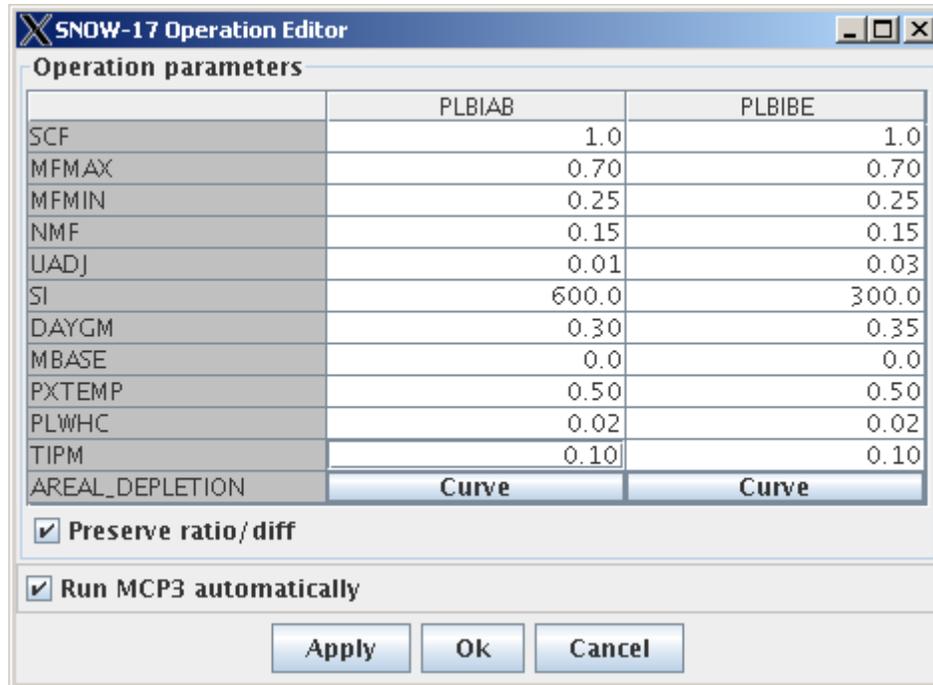
**Expected Results:** The percolation curve graph will be cleared of annotation points.

10. **Editing SNOW-17 Parameters**

A. Open the SNOW-17 Parameter dialog and verify general layout.

- d. Select the deck AFGIX.curr (TESTICP → PETE → AFGIX → AFGIX.curr)
- e. Open the parameter window with Edit → SNOW-17...

**Expected results:** Window should display similar to below.



SNOW Operation Editor

B. Edit a parameter in the table & verify.

- a. Continue the previous test.
- b. Enter a value for SCF (change 1.0 to 0.5 in first column).
- c. Press OK to close the window.
- d. Reopen the parameter window with Edit → SNOW-17

**Expected results:** The edited value should be shown

C. Verify that pressing ESC in a data cell restores the value.

- a. Continue with the previous test (open SNOW-17 editor if not already shown).
- b. Enter a value of 2 in SCF cell in first column. DO NOT press enter.
- c. Press ESC.

**Expected results:** The value in the cell should revert back to the previous value.

D. Verify that when out-of-range values are entered a range message is displayed.

- a. Enter a value of –1 for SCF in the first column and press Enter.

**Expected result:** A warning will be shown indicating that the value must be greater than zero and less than 999.9.

- b. Enter a value of 1 for SCF in the first column and press Enter.

**Expected result:** The correct value will be accepted.

E. Test Preserve ratio/diff

- a. Continue previous test.
- b. Verify that the Preserve ratio/diff checkbox is NOT checked.

- c. Change the value of SCF in the PLBIAB column to .5 and press Enter. Only the edited value should change. Change the value in the PLBIBE column to 1.
- d. Change the Preserve ratio/diff checkbox to be checked.
- e. Change the value of SCF in the PLBIAB column to .2 and press Enter. The value in the PLBIBE column will change to .4 (twice that of the first value).
- f. Press OK in the SNOW-17 parameter editor dialog.

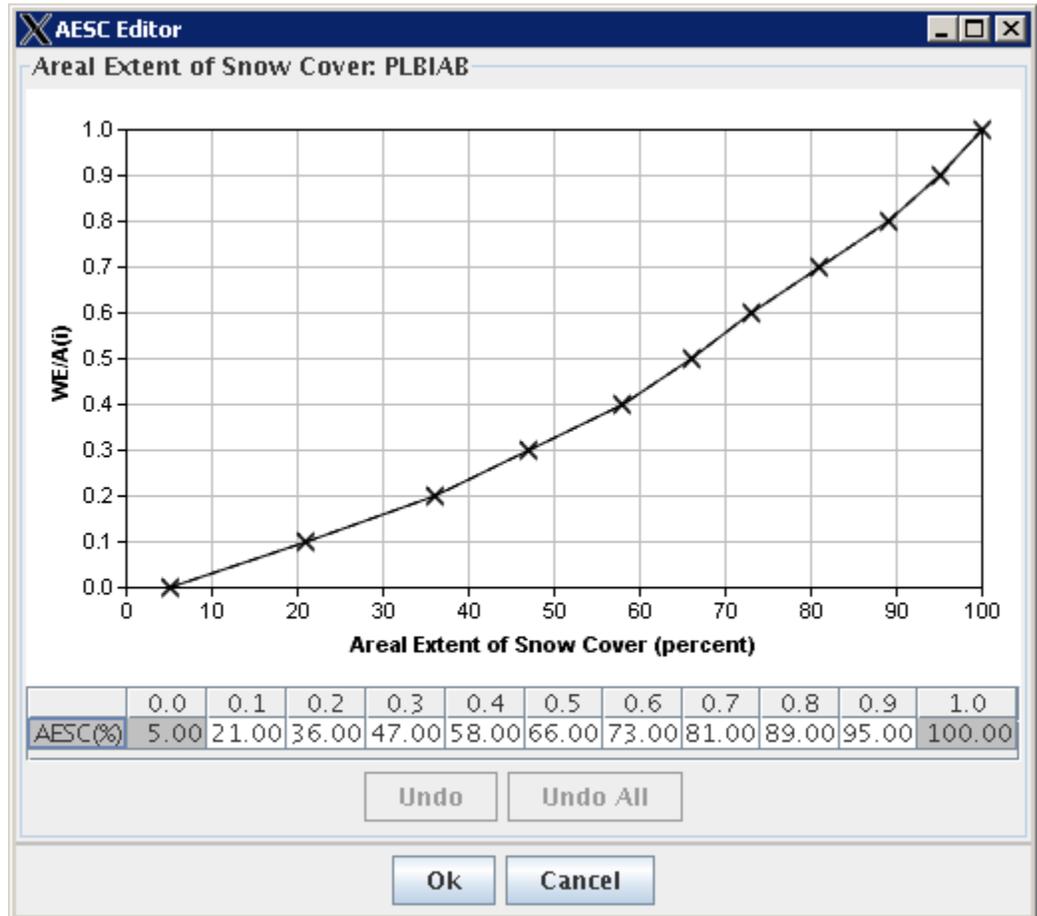
*Expected Results:*

- Value in second column for SCF will be twice that entered in the second column.
- Dialog is dismissed.

### 11. Editing SNOW-17 AESC Curve

- A. Open the AESC Editor by clicking on a “Curve” button in the SNOW-17 Parameters dialog and verify general layout.
  - f. Select the deck AFGIX.curr (TESTICP → PETE → AFGIX → AFGIX.curr)
  - g. Open the parameter window with Edit → SNOW-17...
  - h. Press the Curve button in the first column.

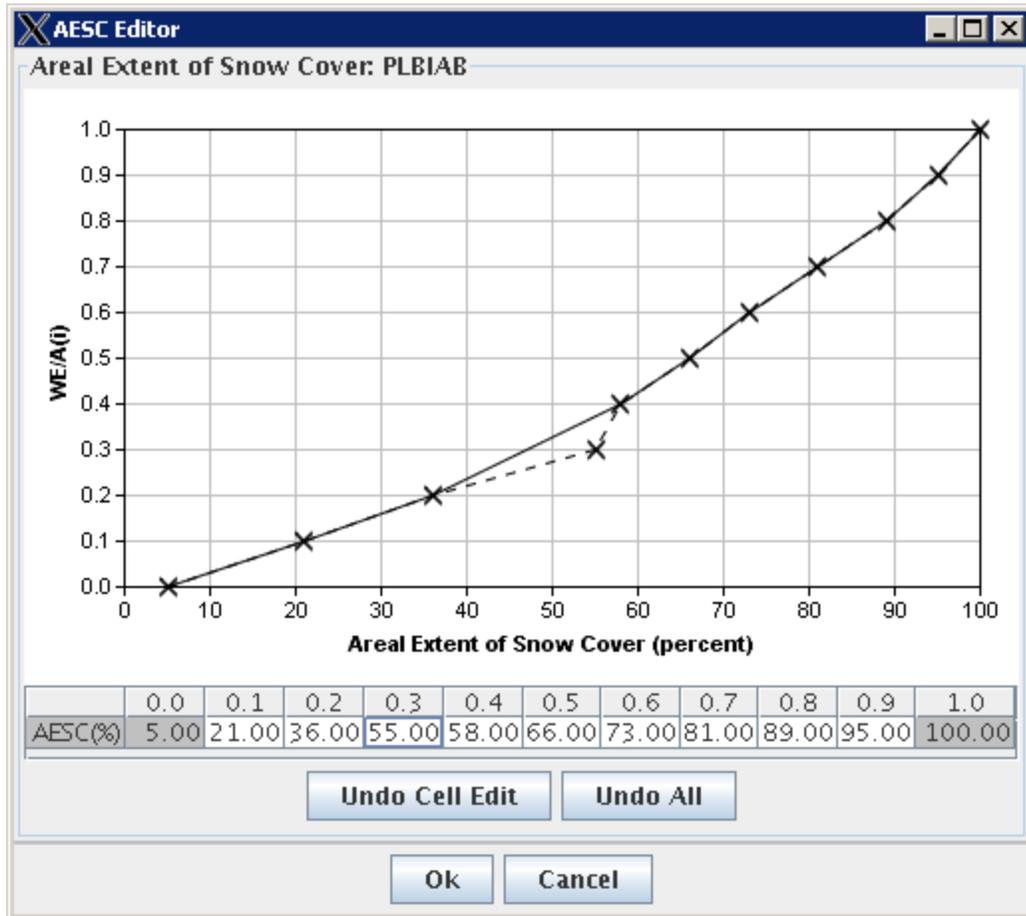
**Expected results:** The AESC curve editor should display similar to the following:



B. Edit a parameter in the table & verify that the data point on the curve updates.

- a. Continue the previous test.
- b. Change the Y-axis WE/A(i) value by changing the table value under 0.3. For example, click in the cell and enter 55, press Enter.

**Expected result:** The graph will change in response to the cell edit, as shown below:



- c. Press OK to save the result.

**Expected result:** The AESC curve window closes.

- d. Press Apply in the SNOW-17 parameter window to apply the changes and run MCP3.

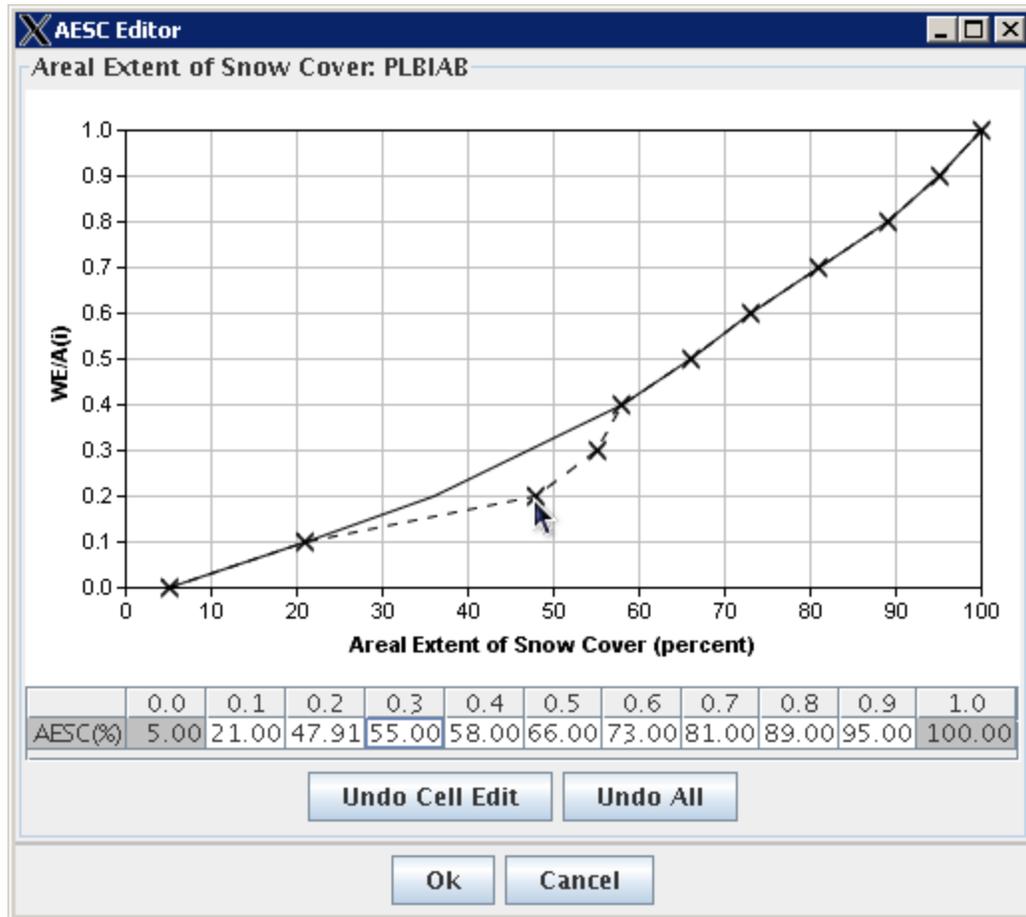
**Expected result:** The new output will be shown in plots.

C. Edit a parameter by dragging symbols to right or left & verify that the corresponding table cell updates as the point is being dragged.

- a. Continue the previous test.
- i. Open the parameter window with Edit → SNOW-17...
- b. Press the Curve button in the first column.

- c. Select a point and drag (for example, see the following example).

**Expected result:** As the point is dragged on the graph, the corresponding value will be updated in the table.



AESC\_Editor\_Drag

- d. Undo the most recent change by pressing the Undo button.

**Expected result:** The data will revert to the previous values.

- e. Make several edits in the table and/or by dragging points.

- f. Undo all changes by pressing the Undo All button.

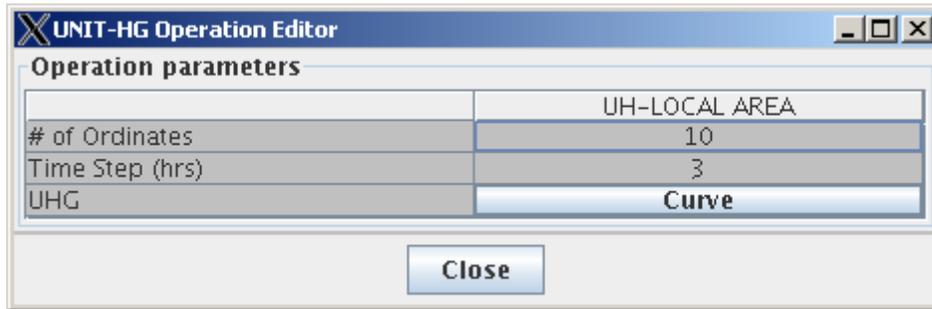
**Expected result:** The data will revert to the original values when the curve was first opened.

## 12. Editing UNIT-HG Parameters

### A. Open the Unit Hydrograph Editor and Verify Layout

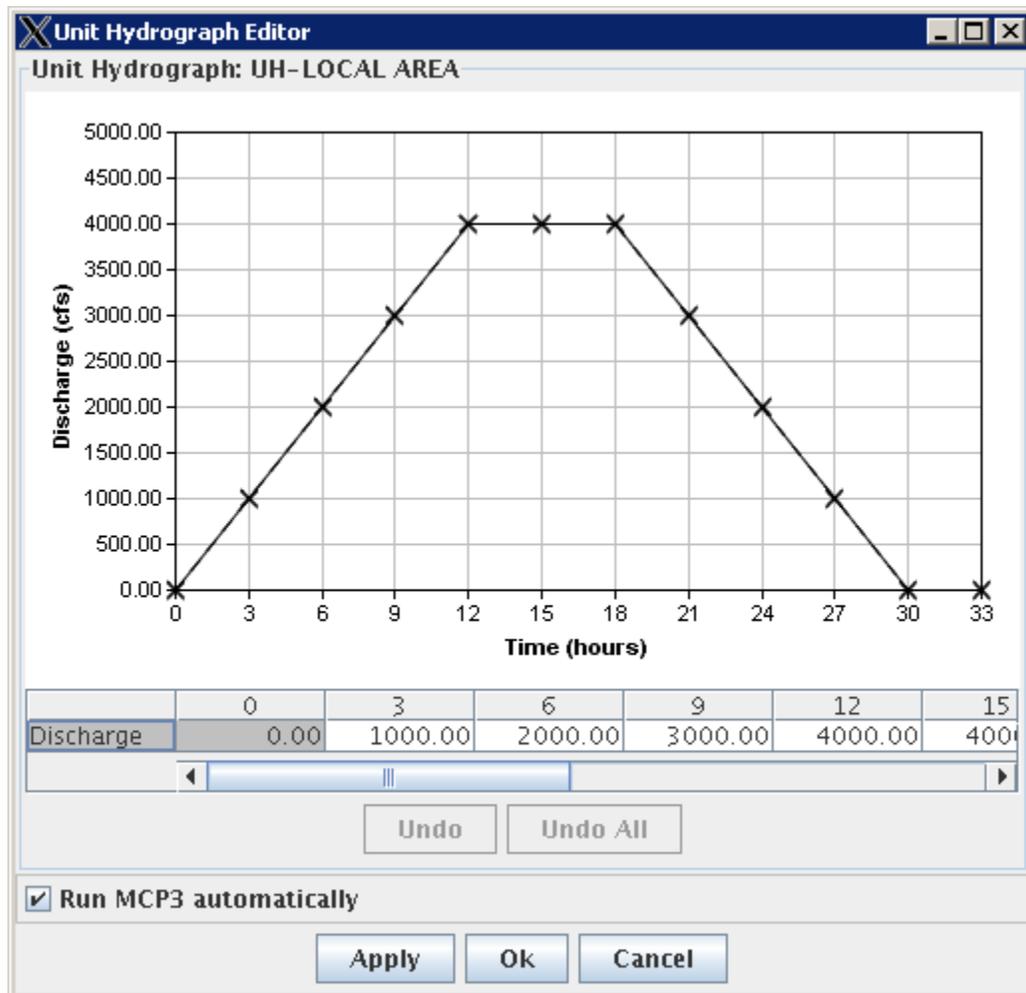
- a. Select the deck AFGIX.curr (TESTICP → PETE → AFGIX → AFGIX.curr)
- b. Open the parameter window with Edit → UNIT-HG...

**Expected Results:** The UNIT-HG parameter window will be shown similar to below. Note that all fields are disabled because editing occurs through the curve.



UNIT-HG\_Editor0

- c. Open the UNIT-HG curve window by pressing the Curve button in the UNIT-HG parameter editor window
- d. Expected Results: The UNIG-HG curve editor window will be shown similar to below. Verify that the first and last cells are grayed out indicating they are not editable. Using the deck editor, review the UNIT-HG operation definition and verify that the ordinates agree with the deck.



UNIT-HG\_Editor

- B. Edit a coordinate in the table & verify that the data point on the curve updates.
- Continue from previous test.
  - Edit values in the table. Press Enter after each value. Note that the entire curve will adjust, not just the single point.  
**Expected Result:** The graph will update to display the updated values.
  - Press Apply to save changes.  
**Expected Result:** MCP3 will run and the plot output will be updated to reflect results.
- C. Edit a parameter by dragging symbols up or down & verify that the corresponding table cell updates after the drag is completed.
- Continue previous test (the UNIT-HG Curve window should be open).
  - Drag a point vertically to change the curve shape.  
**Expected results:** The curve will adjust to respond to the new data.
  - Press Apply to save results.  
**Expected Results:** MCP3 will rerun and display output corresponding to the new values.
- D. Verify that Undo reverts a data cell to the original value and reverts the curve data point.
- Continue the previous test.
  - Press Undo Cell Edit. **Expected results:** The curve should revert to its values prior to the previous edit.
- E. Verify that Undo All reverts all data cells and curve data points to the original values.
- Continue the previous test.
  - Press Undo All . **Expected results:** The curve should return to its original shape.
- F. Verify that all columns of the table can be displayed by scrolling.
- Use the scrollbar handle to scroll through all the unit hydrograph data. **Expected results:** The number of ordinates in the unit hydrograph table + 2 should be visible, with the zero endpoints being non-editable.
- G. Verify the functionality of automatic slope calculation.
- Edit any point to the left of the last editable point.
  - Edit any point to the right of that point.  
**Expected Result:** Any intervening points between the edited points will be adjusted to lie on a straight line between the edited points.

## B.2. Regression Tests

**Note that this type of testing was not originally scoped but some work was done to investigate regression testing, in order to automate testing. However, project resources have not been sufficient to fully implement this approach. The following documentation is provided to allow for possible implementation in future enhancements to ICP.**

A list of regression tests will be provided once GUI features become static, and will be made available for final acceptance and integration testing. It is envisioned that key test cases as described in the previous section will be automated by using the Abbot/Costello software and will therefore allow NWSRFS developers/maintainers to verify ICP functionality without depending on interactive tests.

## B.3. Unit Tests

Unit tests are implemented within the ICP developer sandbox during each software release iteration. Because ICP is being developed in a test-driven fashion, unit tests are an integral part of development. Unit tests are not listed here but are visible in the Eclipse project and can be run using the Ant “test” target. Developers should define unit tests consistent with Eclipse and JUnit standards.

A list of unit tests and output can be provided for final delivery. Performing a clean compile of the ICP software will clearly indicate when unit tests fail because targets to run the software and build installations is dependent on unit test targets.