

# ***HEFS Test Manual***

***HEFS Release 0.3.2***

***April 3, 2013***

***National Weather Service***

***Office of Hydrologic Development***



1	Test Objective .....	4
1.1	Directories of Note .....	4
2	Test Summary: .....	4
3	List of Tests.....	5
3.2	MEFP Data Ingest .....	5
3.3	MEFP PE .....	12
3.4	EnsPost PE .....	20
3.5	MEFP Forecast .....	25
3.6	EnsPost .....	32
3.7	GraphGen .....	33

# 1 Test Objective

Testers will test on a Standalone that is already configured with HEFS. Testers will verify whether the HEFS components are working as intended. The components to be tested are Data Ingest, MEFP & EnsPost Parameter Estimation (PE), MEFP forecast, EnsPost, and GraphGen. After testing each of the components please provide your feedback in the *HEFS Feedback Form*.

A prerequisite of this test is installing and configuring CHPS 3.0.1 and HEFS 0.3.2 (see associated install notes), updating or re-estimating the MEFP parameters, and converting or re-estimating the EnsPost parameters.

## 1.1 Directories of Note

The following directories will be referred to in the instructions provided below:

- *<region\_dir>*: The *installation stand-alone* region home directory, typically “##rfc\_sa”.
- *<configuration\_dir>*: The stand-alone Config directory, typically *<region\_dir>/Config*.
- *<tar\_root\_dir>*: The directory where the release package was untarred.
- *<mefp\_root\_dir>*: The directory selected to hold CFSv2 location time series files and MEFP parameter files; see the *MEFP Configuration Guide: Data Ingest Components*.

## 2 Test Summary:

Each test consists of two sections: Test Prerequisites and a Test Procedure.

### 1. MEFP Data Ingest

Data ingest workflows prepare gridded forecast inputs to MEFP. This test will run the workflow for execution of the data ingest components and verify the result using the FEWS GUI.

### 2. MEFP PE

The MEFP Parameter Estimator (MEFPPE) is a FEWS explorer plug-in designed to guide the user through the process of estimating parameters for use with MEFP. This test will run the MEFPPE workflow using the FEWS GUI to estimate parameters and verify the results.

### 3. EnsPost PE

The EnsPost Parameter Estimator (EnsPostPE) is a FEWS explorer plug-in designed to guide the user through the process of estimating parameters for use with EnsPost. This test will run the EnsPostPE workflow using the FEWS GUI to estimate parameters and verify the results.

#### 4. MEFP Forecast

The MEFP forecast workflow generates the forecast ensembles. This test will execute the workflow using the FEWS GUI to generate the forecast ensembles and verify the results.

#### 5. EnsPost

The execution of the EnsPost workflow post processes stream flow ensembles. This test will run the workflow using the FEWS GUI to verify the installation was successful.

#### 6. GraphGen

Delivered with the HEFS release of the MEFP and HEFS, EnsPost software is pre-configured Graphics Generator products designed to display MEFP Results for HEFS EnsPost Input and HEFS EnsPost Output. Using the FEWS GUI, this test will verify the installation was successful.

### 3 List of Tests

#### 3.2 MEFP Data Ingest

##### 3.2.2 Test Prerequisites

CHPS is configured with the data ingest components as described in the document *MEFP Configuration Guide: Data Ingest Components*. Below is the same information from the confirmation section of the configuration guide.

This test is designed to replicate exactly how the grid files will be imported when configured to run as an automated workflow. The data represents that which is available for an MEFP run on Jan 31, 2013 at 12Z. The grids are imported by system times (T0) as follows:

- GFS: 1/31/13 00Z
- GEFS: 1/31/13 00Z
- CFSv2: 1/31/13 12Z (the data is 24-hours old: 1/30/13 12Z)

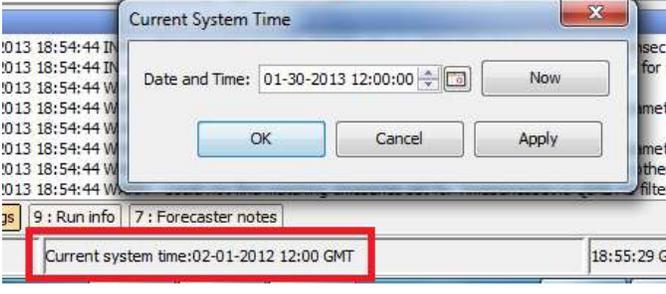
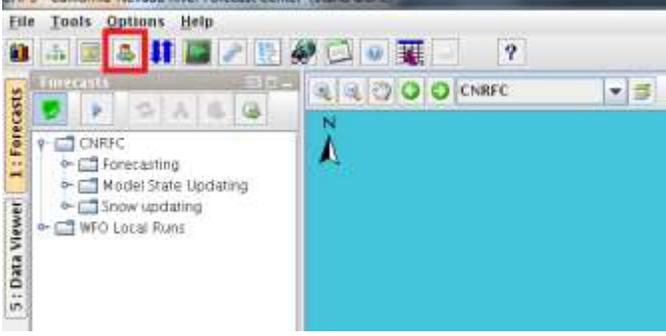
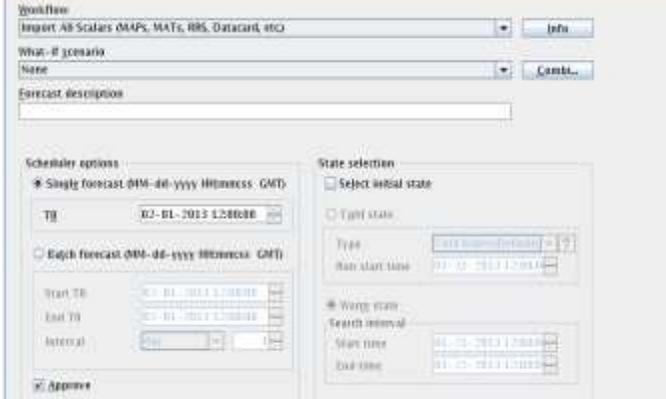
The test steps below describe how to view the gridded forecasts through the **Spatial Display Panel** of the CHPS interface.

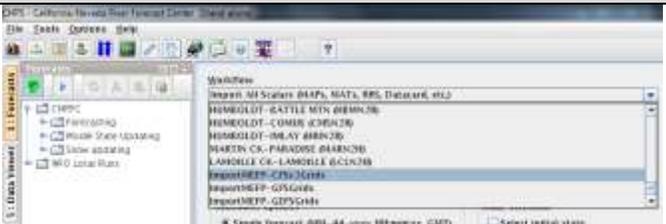
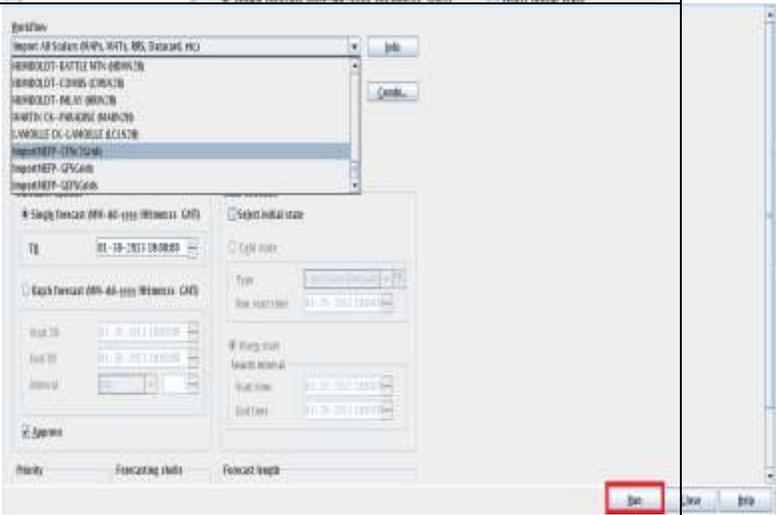
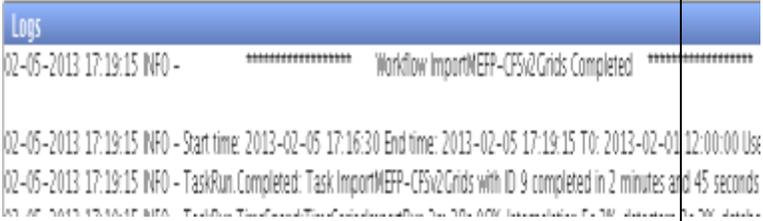
Prior to running the test, prepare the data for import as follows:

**Action:** Populate the `<tar_root_dir>/dataIngest/Import` directory with grid data for testing. Do the following:

```
cd <region_dir>
tar -zxvf <tar_root_dir>/dataIngest/importTestData.tgz
```

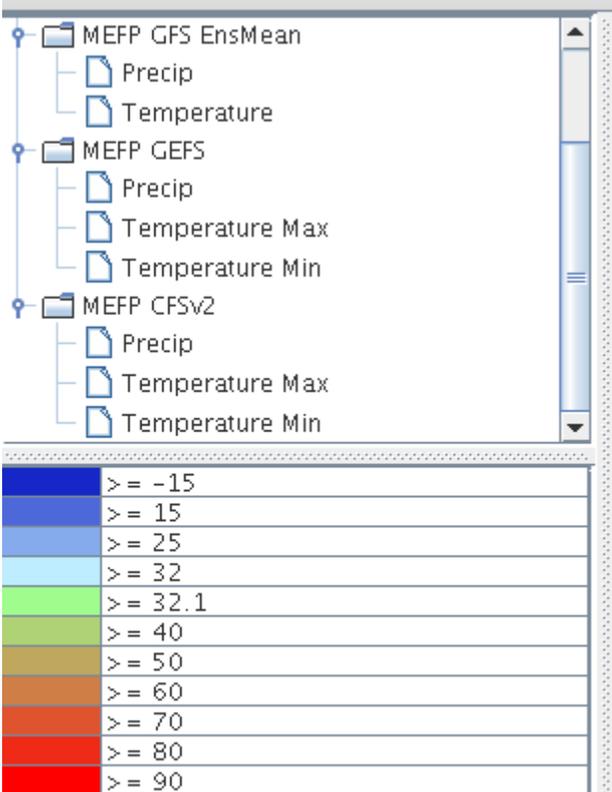
### 3.2.3 Test Procedure

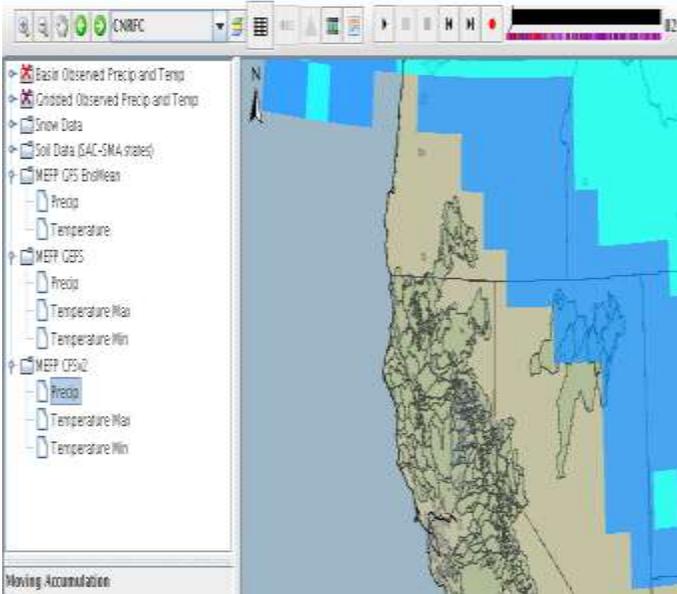
#	Action	Expected Results
1	Start FEWS using the installation standalone:  <pre>cd &lt;region_dir&gt; cd .. ./hefsPlugins/fews_hefsPlugins.sh ##rfc_sa &amp;</pre>	FEWS will be started. The splash screen displayed will vary by RFC. The default splash screen is:    After a short time, the CHPS interface will open.
2	Click on the <b>Current System Time Label</b> at the bottom of the CHPS interface so that the <b>Current System Time</b> dialog opens. Set the system time to 01-30-2013 12:00:00.	
3	Click on <b>Manual Forecast Button</b> .	
4	The <b>Manual Forecast Panel</b> will open allowing you to select the workflow to run.	

#	Action	Expected Results
5	In the <b>Workflow List</b> , select the ImportMEFP-CFSv2Grids workflow.	
6	Click <b>Run</b> .	
7	Wait for run to complete (up to 5 minutes)	<p>We can see this in the Logs once run is complete:</p>  <pre> 02-05-2013 17:19:15 INFO - ***** Workflow ImportMEFP-CFSv2Grids Completed ***** 02-05-2013 17:19:15 INFO - Start time: 2013-02-05 17:16:30 End time: 2013-02-05 17:19:15 TO: 2013-02-05 12:00:00 Use 02-05-2013 17:19:15 INFO - TaskRun.Completed: Task ImportMEFP-CFSv2Grids with ID 9 completed in 2 minutes and 45 seconds </pre>
8	Verify that appropriate directories and files for each <i>installation catchment</i> were created under the directory <code>&lt;mefp_root_dir&gt;/cfsv2Interpolated/archive</code> .	If they were not created, then the module that exports the location-specific CFSv2 forecast time series file, or one of the preceding modules, failed to execute.
8	Perform Step 2, again, but set the system time to be 01-31-2013 00:00:00.	
9	In the <b>Workflow List</b> , select the ImportMEFP-GFSGrids workflow.	
10	Click <b>Run</b> .	

#	Action	Expected Results
11	Wait for run to complete (< 1 minute).	<p>We can see this in Logs once run is complete:</p> <pre> 17:03:39 INFO - ***** Workflow ImportMEFP-GEFSGrids Completed *****  17:03:39 INFO - Start time: 2013-02-05 17:03:25 End time: 2013-02-05 17:03:39 TO: 2013-01-30 18:00:00 User Id:s 17:03:39 INFO - TaskRun.Completed: Task ImportMEFP-GEFSGrids with ID 5 completed in 0 minutes and 13 seconds. 17:03:39 INFO - TaskRun.TimeSpent:TimeSeriesImportRun 12: 92% TransformationModule 0s 2% datastore 0s 4% database 0 B 17:03:39 INFO - Workflow.ActivityCompleted: 'Workflow ImportMEFP-GEFSGrids' completed in 0 minutes and 12 seconds </pre>
12	In the <b>Workflow List</b> , select the ImportMEFP-GEFSGrids workflow.	
13	Click <b>Run</b> .	
14	Wait for run to complete (< 1 minute)	<p>We can see this in Logs once run is complete:</p>  <pre> INFO - ***** Workflow ImportMEFP-GEFSGrids Completed *****  INFO - Start time: 2013-02-05 17:06:01 End time: 2013-02-05 17:06:14 TO: 2013-01-30 18:00:00 User Id:s INFO - TaskRun.Completed: Task ImportMEFP-GEFSGrids with ID 6 completed in 0 minutes and 13 seconds. INFO - TaskRun.TimeSpent:TimeSeriesImportRun 12: 100% datastore 0s 10% database 0 B cache file 0 B </pre>

#	Action	Expected Results																																
15	Click on the <b>Logs Panel</b> (to make it active) and press the F12 key.	<p>A menu will appear:</p>																																
16	Select “ <b>open database viewer</b> ” (shortcut key: <b>J</b> ).																																	
17	In the <b>Database Viewer Panel</b> that opens, select each workflow to verify there is data in the database.																																	
18	You should be able to see the EnsMean has been calculated for the GFS Workflow.	<table border="1"> <tbody> <tr> <td>MEFP_GFS_Interpolate_USA</td> <td>Temperat...</td> <td>FMAT</td> </tr> <tr> <td>MEFP_GFS_Interpolate_USA</td> <td>Precip</td> <td>FMAP</td> </tr> <tr> <td>MEFP_GFS_Grid_EnsMean</td> <td>Precip</td> <td>FMAP</td> </tr> <tr> <td>MEFP_GFS_Grid_EnsMean</td> <td>Temperat...</td> <td>FMAT</td> </tr> </tbody> </table>	MEFP_GFS_Interpolate_USA	Temperat...	FMAT	MEFP_GFS_Interpolate_USA	Precip	FMAP	MEFP_GFS_Grid_EnsMean	Precip	FMAP	MEFP_GFS_Grid_EnsMean	Temperat...	FMAT																				
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19	This is what you should see in the GEFS workflow.	<table border="1"> <thead> <tr> <th>moduleInstance</th> <th>group</th> <th>parameterId</th> <th>locationId</th> </tr> </thead> <tbody> <tr> <td>2</td> <td>2</td> <td>3</td> <td>2</td> </tr> <tr> <td>ImportMEFP_GEFS</td> <td>Precip</td> <td>FMAP</td> <td>HEFS_GEFS</td> </tr> <tr> <td>ImportMEFP_GEFS</td> <td>Temperat...</td> <td>TFMN</td> <td>HEFS_GEFS</td> </tr> <tr> <td>ImportMEFP_GEFS</td> <td>Temperat...</td> <td>TFMX</td> <td>HEFS_GEFS</td> </tr> <tr> <td>MEFP_GEFS_Interpolate_USA</td> <td>Precip</td> <td>FMAP</td> <td>HEFS_GEFS_USA</td> </tr> <tr> <td>MEFP_GEFS_Interpolate_USA</td> <td>Temperat...</td> <td>TFMX</td> <td>HEFS_GEFS_USA</td> </tr> <tr> <td>MEFP_GEFS_Interpolate_USA</td> <td>Temperat...</td> <td>TFMN</td> <td>HEFS_GEFS_USA</td> </tr> </tbody> </table>	moduleInstance	group	parameterId	locationId	2	2	3	2	ImportMEFP_GEFS	Precip	FMAP	HEFS_GEFS	ImportMEFP_GEFS	Temperat...	TFMN	HEFS_GEFS	ImportMEFP_GEFS	Temperat...	TFMX	HEFS_GEFS	MEFP_GEFS_Interpolate_USA	Precip	FMAP	HEFS_GEFS_USA	MEFP_GEFS_Interpolate_USA	Temperat...	TFMX	HEFS_GEFS_USA	MEFP_GEFS_Interpolate_USA	Temperat...	TFMN	HEFS_GEFS_USA
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#	Action	Expected Results																																																
20	This is what you should see in the CFSv2 workflow.	<table border="1"> <thead> <tr> <th>moduleInstance</th> <th>group</th> <th>parameterId</th> <th>qualifiers</th> </tr> </thead> <tbody> <tr> <td>4</td> <td>2</td> <td>3</td> <td>1</td> </tr> <tr> <td>MEFP_CFSv2_Interpolate_USA</td> <td>Precip</td> <td>FMAP</td> <td></td> </tr> <tr> <td>MEFP_CFSv2_Interpolate_USA</td> <td>Temperat...</td> <td>TFMX</td> <td></td> </tr> <tr> <td>MEFP_CFSv2_Interpolate_USA</td> <td>Temperat...</td> <td>TFMN</td> <td></td> </tr> <tr> <td>MEFP_CFSv2_Interpolate_Location_FMAP</td> <td>Precip</td> <td>FMAP</td> <td>CFSv2</td> </tr> <tr> <td>MEFP_CFSv2_Interpolate_Location_FMAP</td> <td>Precip</td> <td>FMAP</td> <td>CFSv2</td> </tr> <tr> <td>MEFP_CFSv2_Interpolate_Location_FMAP</td> <td>Precip</td> <td>FMAP</td> <td>CFSv2</td> </tr> <tr> <td>MEFP_CFSv2_Interpolate_Location_TFMX</td> <td>Temperat...</td> <td>TFMX</td> <td>CFSv2</td> </tr> <tr> <td>MEFP_CFSv2_Interpolate_Location_TFMX</td> <td>Temperat...</td> <td>TFMX</td> <td>CFSv2</td> </tr> <tr> <td>MEFP_CFSv2_Interpolate_Location_TFMX</td> <td>Temperat...</td> <td>TFMX</td> <td>CFSv2</td> </tr> <tr> <td>MEFP_CFSv2_Interpolate_Location_TFMN</td> <td>Temperat...</td> <td>TFMN</td> <td>CFSv2</td> </tr> </tbody> </table>	moduleInstance	group	parameterId	qualifiers	4	2	3	1	MEFP_CFSv2_Interpolate_USA	Precip	FMAP		MEFP_CFSv2_Interpolate_USA	Temperat...	TFMX		MEFP_CFSv2_Interpolate_USA	Temperat...	TFMN		MEFP_CFSv2_Interpolate_Location_FMAP	Precip	FMAP	CFSv2	MEFP_CFSv2_Interpolate_Location_FMAP	Precip	FMAP	CFSv2	MEFP_CFSv2_Interpolate_Location_FMAP	Precip	FMAP	CFSv2	MEFP_CFSv2_Interpolate_Location_TFMX	Temperat...	TFMX	CFSv2	MEFP_CFSv2_Interpolate_Location_TFMX	Temperat...	TFMX	CFSv2	MEFP_CFSv2_Interpolate_Location_TFMX	Temperat...	TFMX	CFSv2	MEFP_CFSv2_Interpolate_Location_TFMN	Temperat...	TFMN	CFSv2
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21	Click <b>Spatial Button</b> in the toolbar of the CHPS interface.																																																	
22	When the <b>Spatial Display Panel</b> opens, on the left, expand all three of the following: "MEFP GFS EnsMean", "MEFP GEFS", and "MEFP CFSv2".	<p>There should not be any red X's on any of the expanded nodes (a red X indicates missing data) and the tree should appear similar to the screen shot below:</p> 																																																

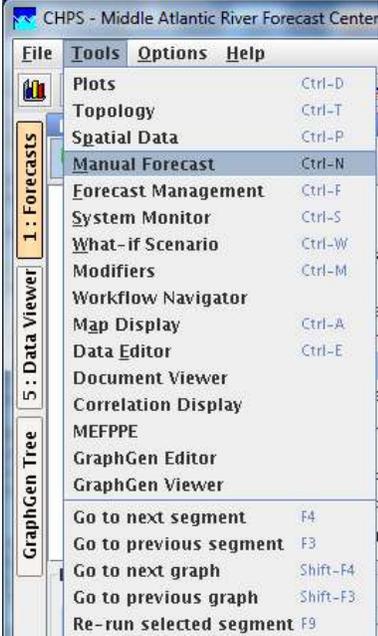
#	Action	Expected Results
23	Select each of the “Precip”, “Temperature”, and “Temperature Max/Min” nodes made visible in the last step and confirm that gridded data is displayed on the map to the right.	
24	From the <b>File Menu</b> , select “Exit” to close the standalone.	

# MEFP PE

## 3.2.1 Test Prerequisites

CHPS is configured with the MEFPPE components as described in the document *MEFPPE Configuration Guide*. Below is the same information from the confirmation section of the configuration guide. The directory `<configuration_dir>/Import/mefppe_cardfiles` should already be populated with MAP and MAT datacard files.

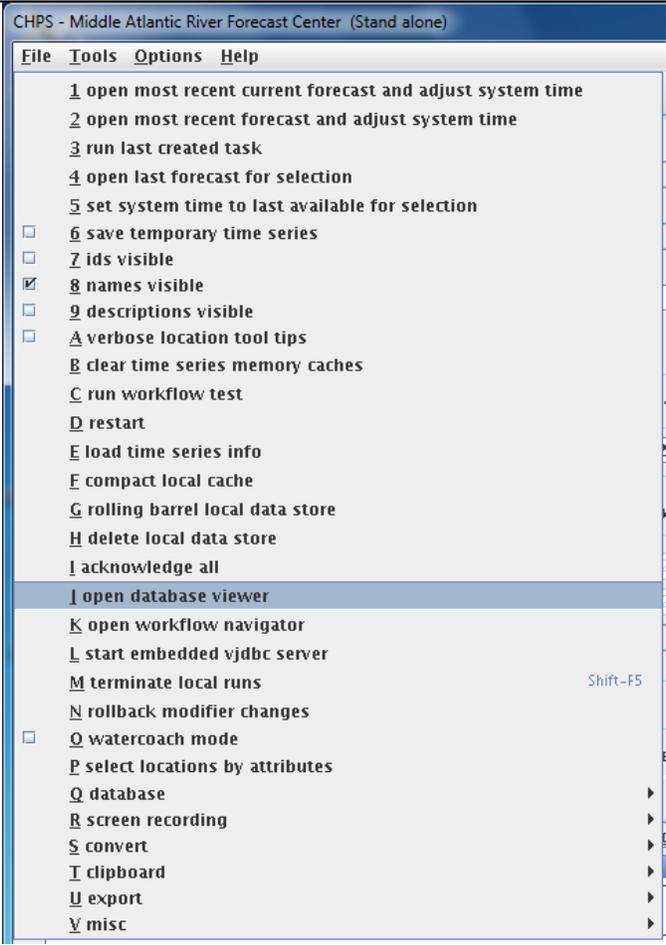
## 3.2.2 Test Procedure

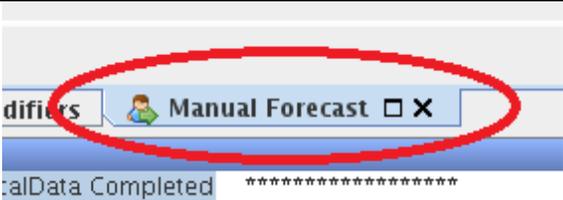
#	Action	Expected Results
1	<p>Start FEWS using the installation standalone:</p> <pre>cd &lt;region_dir&gt; cd .. ./hefsPlugins/fews_hefsPlugins.sh ##rfc_sa &amp;</pre>	<p>FEWS will be started. The splash screen displayed will vary by RFC. The default splash screen is:</p>  <p>After a short time, the CHPS interface will open.</p>
2	<p>In CHPS, run the “<b>ImportMEFPPEHistoricalData</b>” workflow. Choose Tools (menu), Manual Forecast (menu option).</p>	
3	<p>Under Workflow (pull down menu), choose <b>ImportMEFPPEHistoricalData</b>. It may be the last Workflow.</p>	

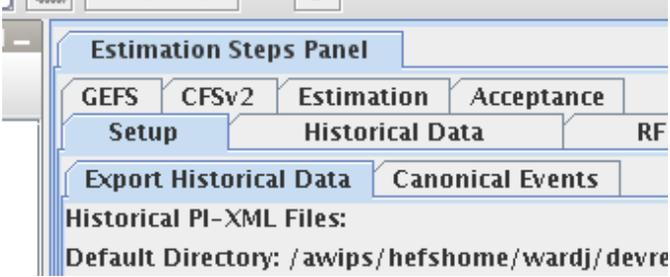
#	Action	Expected Results
4	Click <b>Run</b> (button). 	Output (in the CHPS log area) will have “Workflow ImportMEFPPEHistoricalData Completed”, as shown in Figure 1 below. The historical MAP/MAT datacards have been imported.

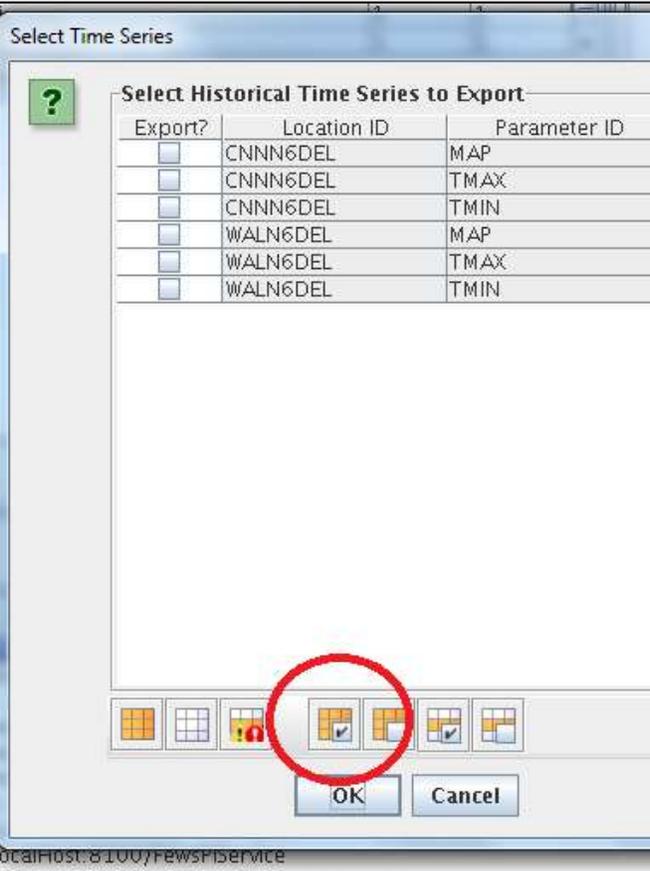


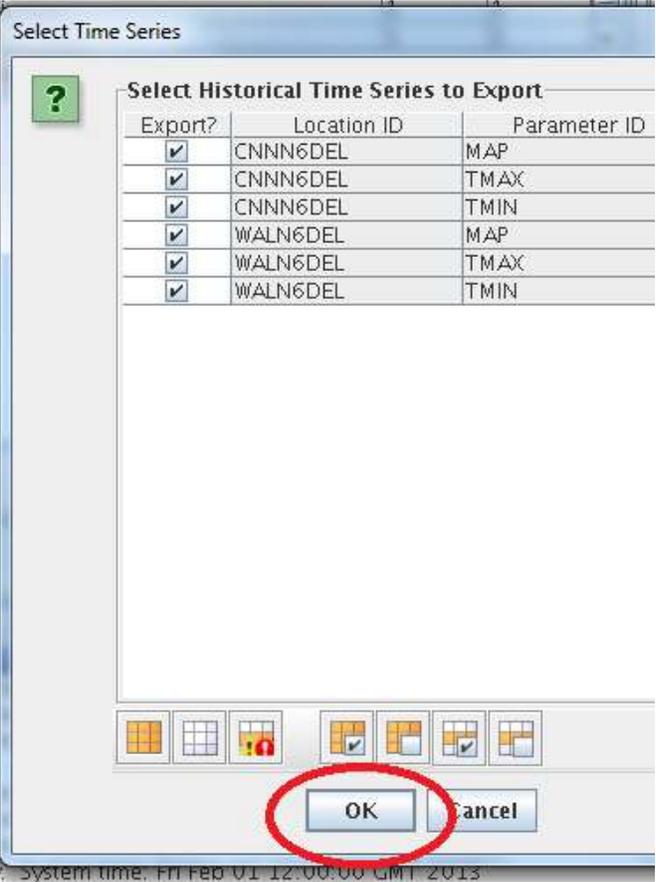
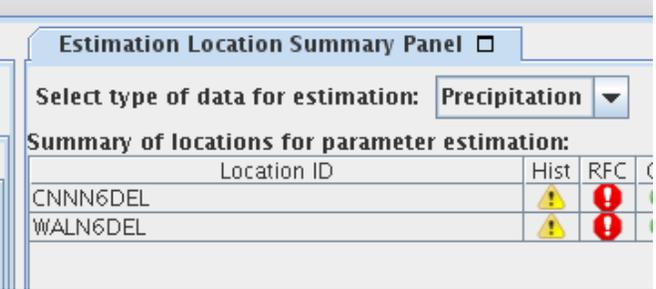
Figure 1

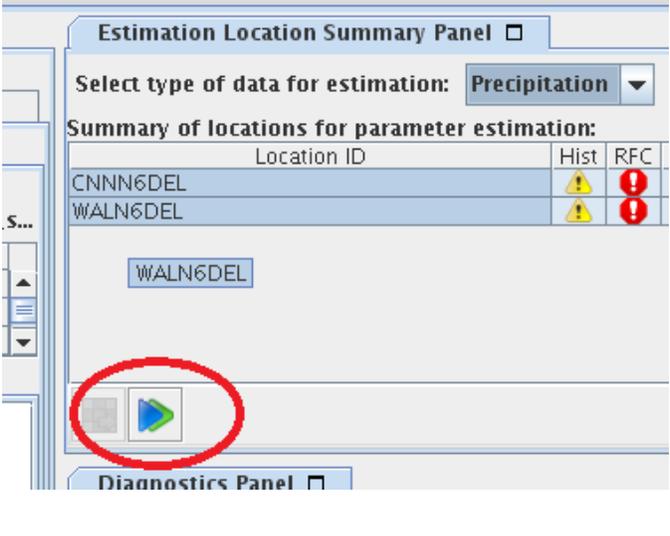
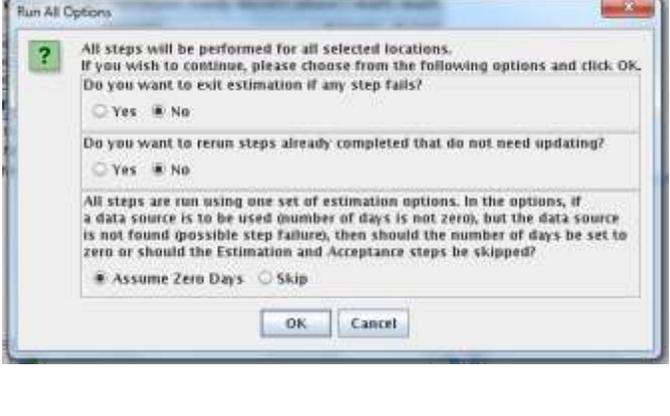
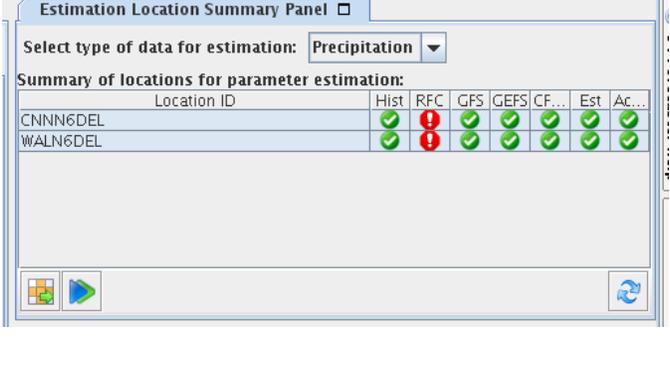
#	Action	Expected Results
5	Click in the CHPS <b>Logs Panel</b> , press the <F12 key>, and press the <J> key to open the <b>Database Viewer</b> .	 <p>CHPS - Middle Atlantic River Forecast Center (Stand alone)</p> <p>File Tools Options Help</p> <ul style="list-style-type: none"> <li>1 open most recent current forecast and adjust system time</li> <li>2 open most recent forecast and adjust system time</li> <li>3 run last created task</li> <li>4 open last forecast for selection</li> <li>5 set system time to last available for selection</li> <li><input type="checkbox"/> 6 save temporary time series</li> <li><input type="checkbox"/> 7 ids visible</li> <li><input checked="" type="checkbox"/> 8 names visible</li> <li><input type="checkbox"/> 9 descriptions visible</li> <li><input type="checkbox"/> A verbose location tool tips</li> <li>B clear time series memory caches</li> <li>C run workflow test</li> <li>D restart</li> <li>E load time series info</li> <li>F compact local cache</li> <li>G rolling barrel local data store</li> <li>H delete local data store</li> <li>I acknowledge all</li> <li><b>J open database viewer</b></li> <li>K open workflow navigator</li> <li>L start embedded vjdbc server</li> <li>M terminate local runs <span style="float: right;">Shift-F5</span></li> <li>N rollback modifier changes</li> <li><input type="checkbox"/> O watercoach mode</li> <li>P select locations by attributes</li> <li>Q database <span style="float: right;">▶</span></li> <li>R screen recording <span style="float: right;">▶</span></li> <li>S convert <span style="float: right;">▶</span></li> <li>T clipboard <span style="float: right;">▶</span></li> <li>U export <span style="float: right;">▶</span></li> <li>V misc <span style="float: right;">▶</span></li> </ul>

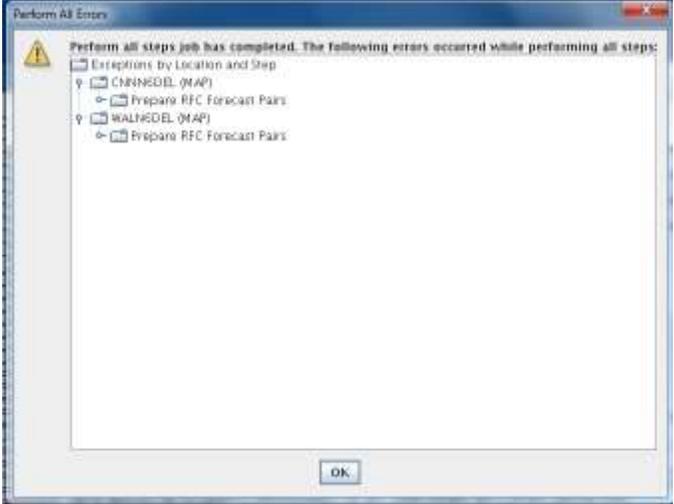
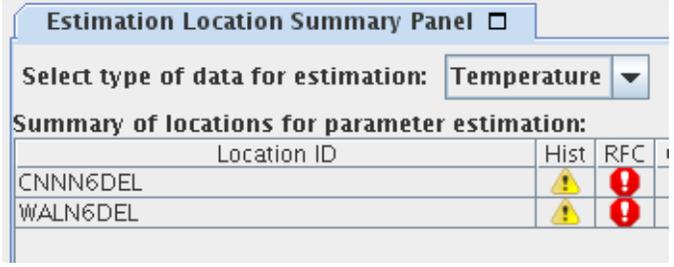
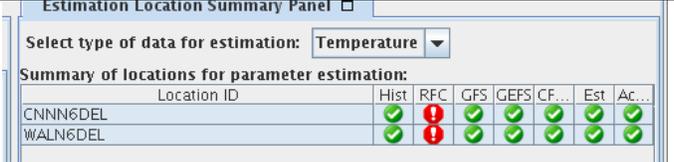
#	Action	Expected Results
6	Confirm that the imported datacard time series are present and that the imported data appears reasonable. To do so, use the standard <b>Database Viewer</b> tool to select the imported time series and view them.	
7	Close the <b>Database Viewer</b> by clicking on the X at the bottom of the panel.	
8	Close the <b>Manual Forecast Dialog</b> by clicking on the X at the bottom of the window.	
9	Start the MEFPPE by clicking on the <b>MEFPPE</b> Button in the toolbar of the CHPS interface.	
10	Unless Graphics Generator was installed in the <i>installation standalone</i> , MEFPPE will not be connected to the PI-service (see the screen capture to the right). If the MEFPPE is connected to the PI-service, skip to Step 6. The Picture on right shows the PI-service is not connected.	
11	Scroll the <b>Logs Panel</b> to find your PI-service port number, looking for a log message that starts with “Started FewspServiceImpl on localhost...”.	

#	Action	Expected Results
12	Click on the <b>Reconnect to CHPS PI-service Button</b> , enter your PI-service port number (in this example 8100), and click OK.	 <p>The screenshot shows a dialog box titled "Enter Port Number". It contains a question mark icon and the text: "Enter the port number to use to connect to the PI-service. To identify the number, check the log panel at start-up for a line similar to this: 10-14-2010 15:01:02 INFO - Started FewSPServiceImpl on localhost: 8100". Below this, it says "The number at the end of the line is the port number to enter here:" followed by a text input field containing "8100". There are "OK" and "Cancel" buttons at the bottom.</p>
13	When successfully connected, the <b>Reconnect to CHPS PI-service Button</b> (highlighted in the red box) will show a green checkmark and the <b>Export Time Series from CHPS DB Button</b> (highlighted in the red box) will be enabled.	 <p>The screenshot shows two buttons side-by-side. The left button has a green checkmark icon and is circled in red. The right button has a database icon with a green arrow pointing right and is also circled in red.</p>
14	Select <b>Export Historical Data Tab</b> in the <b>Setup Subpanel</b> of the <b>Estimation Steps Panel</b> .	 <p>The screenshot shows the "Estimation Steps Panel" with several tabs. The "Setup" tab is selected, and within it, the "Historical Data" sub-tab is active. Other visible tabs include "GEFS", "CFSv2", "Estimation", "Acceptance", and "RF". Below the tabs, there are options for "Export Historical Data" and "Canonical Events". At the bottom, it says "Historical PI-XML Files: Default Directory: /awips/hefshome/wardj/devre".</p>
15	Click on the <b>Export Time Series from CHPS DB Button</b> .	 <p>The screenshot shows the same two buttons as in row 13. The right button, which has a database icon with a green arrow, is circled in red.</p>

#	Action	Expected Results																					
16	Click on the <b>Check All Rows for Export</b> Button to check all rows in the table.	 <p>The screenshot shows a 'Select Time Series' dialog box. It contains a table with the following data:</p> <table border="1"> <thead> <tr> <th>Export?</th> <th>Location ID</th> <th>Parameter ID</th> </tr> </thead> <tbody> <tr> <td><input type="checkbox"/></td> <td>CNNN6DEL</td> <td>MAP</td> </tr> <tr> <td><input type="checkbox"/></td> <td>CNNN6DEL</td> <td>TMAX</td> </tr> <tr> <td><input type="checkbox"/></td> <td>CNNN6DEL</td> <td>TMIN</td> </tr> <tr> <td><input type="checkbox"/></td> <td>WALN6DEL</td> <td>MAP</td> </tr> <tr> <td><input type="checkbox"/></td> <td>WALN6DEL</td> <td>TMAX</td> </tr> <tr> <td><input type="checkbox"/></td> <td>WALN6DEL</td> <td>TMIN</td> </tr> </tbody> </table> <p>The 'Check All Rows for Export' icon in the toolbar is circled in red.</p>	Export?	Location ID	Parameter ID	<input type="checkbox"/>	CNNN6DEL	MAP	<input type="checkbox"/>	CNNN6DEL	TMAX	<input type="checkbox"/>	CNNN6DEL	TMIN	<input type="checkbox"/>	WALN6DEL	MAP	<input type="checkbox"/>	WALN6DEL	TMAX	<input type="checkbox"/>	WALN6DEL	TMIN
Export?	Location ID	Parameter ID																					
<input type="checkbox"/>	CNNN6DEL	MAP																					
<input type="checkbox"/>	CNNN6DEL	TMAX																					
<input type="checkbox"/>	CNNN6DEL	TMIN																					
<input type="checkbox"/>	WALN6DEL	MAP																					
<input type="checkbox"/>	WALN6DEL	TMAX																					
<input type="checkbox"/>	WALN6DEL	TMIN																					

#	Action	Expected Results																					
17	When all of the time series are selected, click <b>OK</b> .	 <p>The screenshot shows a dialog box titled "Select Time Series". It contains a table with the following data:</p> <table border="1"> <thead> <tr> <th>Export?</th> <th>Location ID</th> <th>Parameter ID</th> </tr> </thead> <tbody> <tr> <td><input checked="" type="checkbox"/></td> <td>CNNN6DEL</td> <td>MAP</td> </tr> <tr> <td><input checked="" type="checkbox"/></td> <td>CNNN6DEL</td> <td>TMAX</td> </tr> <tr> <td><input checked="" type="checkbox"/></td> <td>CNNN6DEL</td> <td>TMIN</td> </tr> <tr> <td><input checked="" type="checkbox"/></td> <td>WALN6DEL</td> <td>MAP</td> </tr> <tr> <td><input checked="" type="checkbox"/></td> <td>WALN6DEL</td> <td>TMAX</td> </tr> <tr> <td><input checked="" type="checkbox"/></td> <td>WALN6DEL</td> <td>TMIN</td> </tr> </tbody> </table> <p>The "OK" button at the bottom of the dialog is circled in red.</p>	Export?	Location ID	Parameter ID	<input checked="" type="checkbox"/>	CNNN6DEL	MAP	<input checked="" type="checkbox"/>	CNNN6DEL	TMAX	<input checked="" type="checkbox"/>	CNNN6DEL	TMIN	<input checked="" type="checkbox"/>	WALN6DEL	MAP	<input checked="" type="checkbox"/>	WALN6DEL	TMAX	<input checked="" type="checkbox"/>	WALN6DEL	TMIN
Export?	Location ID	Parameter ID																					
<input checked="" type="checkbox"/>	CNNN6DEL	MAP																					
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<input checked="" type="checkbox"/>	CNNN6DEL	TMIN																					
<input checked="" type="checkbox"/>	WALN6DEL	MAP																					
<input checked="" type="checkbox"/>	WALN6DEL	TMAX																					
<input checked="" type="checkbox"/>	WALN6DEL	TMIN																					
18	Select "Precipitation" in the <b>Select type of data for estimation</b> Drop down menu in the <b>Location Summary Panel</b> .	 <p>The screenshot shows the "Estimation Location Summary Panel". The "Select type of data for estimation" dropdown menu is set to "Precipitation". Below it is a table showing a summary of locations for parameter estimation:</p> <table border="1"> <thead> <tr> <th>Location ID</th> <th>Hist</th> <th>RFC</th> </tr> </thead> <tbody> <tr> <td>CNNN6DEL</td> <td></td> <td></td> </tr> <tr> <td>WALN6DEL</td> <td></td> <td></td> </tr> </tbody> </table>	Location ID	Hist	RFC	CNNN6DEL			WALN6DEL														
Location ID	Hist	RFC																					
CNNN6DEL																							
WALN6DEL																							

#	Action	Expected Results
19	Shift + Click to select all rows and click on the <b>Run All</b> Button.	 <p>The screenshot shows the 'Estimation Location Summary Panel' with a dropdown menu set to 'Precipitation'. Below it is a table titled 'Summary of locations for parameter estimation:' with columns for Location ID, Hist, and RFC. Two rows are listed: CINN6DEL and WALN6DEL. Both rows have a yellow warning icon in the Hist column and a red error icon in the RFC column. Below the table, the 'WALN6DEL' location is selected. At the bottom, a 'Run All' button (a blue play icon) is circled in red.</p>
20	<p>Select <b>OK</b> in the <b>Run All Options</b> window. The parameters will be estimated from the Historical, GFS, GEFS, and the CFSv2 data sources. The RFC data source is not available.</p> <p>(If you wish to add RFC data, see Appendix B and Appendix C below.)</p> <p>A progress dialog will open to display parameter estimation progress.</p> <p>Parameter estimation may take a few minutes.</p>	 <p>The screenshot shows the 'Run All Options' dialog box. It contains two questions: 'Do you want to exit estimation if any step fails?' and 'Do you want to rerun steps already completed that do not need updating?'. Both questions have 'No' selected. At the bottom, there are 'OK' and 'Cancel' buttons.</p>
21	When finished, all the boxes except RFC should be checked green in the <b>Summary of location for parameter estimation</b> Table.	 <p>The screenshot shows the 'Estimation Location Summary Panel' after completion. The 'Summary of locations for parameter estimation:' table now has columns for Hist, RFC, GFS, GEFS, CF..., Est, and Ac... (partially visible). The rows are CINN6DEL and WALN6DEL. The Hist, GFS, GEFS, CF..., Est, and Ac... columns for both rows contain green checkmarks. The RFC column for both rows contains a red error icon.</p>

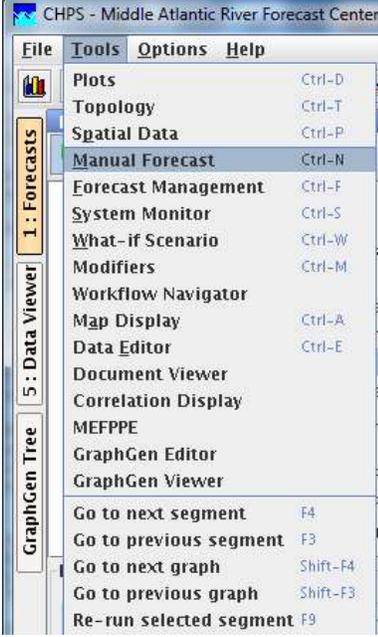
#	Action	Expected Results																								
22	You may see a <b>Perform All Errors Dialog</b> alerting you to missing RFC data. Click <b>OK</b> .	 <p>The dialog box titled "Perform All Errors" contains a tree view under "Exceptions By Location and Step". It shows two locations: C&gt;NN6DEL and WALN6DEL. For each location, the step "Prepare RFC Forecast Pairs" is listed with a yellow warning icon next to it. An "OK" button is at the bottom.</p>																								
23	As an additional check, the directory <i>&lt;mefp_root_dir&gt;/mefpParameters</i> should contain the generated and accepted *.parameter.tgz files.	<p>C&gt;NN6DEL.precipitation.mefp.parameters.tgz</p> <p>WALN6DEL.precipitation.mefp.parameters.tgz</p>																								
24	Select "Temperature" in the <b>Select type of data for estimation</b> drop down menu in the <b>Estimation Location Summary Panel</b> and perform steps 19 & 20 again.	 <p>The "Estimation Location Summary Panel" has a dropdown menu set to "Temperature". Below it is a table titled "Summary of locations for parameter estimation:".</p> <table border="1" data-bbox="787 1144 1442 1249"> <thead> <tr> <th>Location ID</th> <th>Hist</th> <th>RFC</th> </tr> </thead> <tbody> <tr> <td>C&gt;NN6DEL</td> <td></td> <td></td> </tr> <tr> <td>WALN6DEL</td> <td></td> <td></td> </tr> </tbody> </table>	Location ID	Hist	RFC	C>NN6DEL			WALN6DEL																	
Location ID	Hist	RFC																								
C>NN6DEL																										
WALN6DEL																										
25	All the check boxes, except RFC, should be green.	 <p>The "Estimation Location Summary Panel" has the dropdown menu still set to "Temperature". The table below it shows the status of various parameters for both locations.</p> <table border="1" data-bbox="787 1396 1442 1480"> <thead> <tr> <th>Location ID</th> <th>Hist</th> <th>RFC</th> <th>GFS</th> <th>GEFS</th> <th>CF...</th> <th>Est</th> <th>Ac...</th> </tr> </thead> <tbody> <tr> <td>C&gt;NN6DEL</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>WALN6DEL</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>	Location ID	Hist	RFC	GFS	GEFS	CF...	Est	Ac...	C>NN6DEL								WALN6DEL							
Location ID	Hist	RFC	GFS	GEFS	CF...	Est	Ac...																			
C>NN6DEL																										
WALN6DEL																										
26	As an additional check, the directory <i>&lt;mefp_root_dir&gt;/mefpParameters</i> should contain the generated and accepted *.parameter.tgz files.	<p>C&gt;NN6DEL.temperature.mefp.parameters.tgz</p> <p>WALN6DEL.temperature.mefp.parameters.tgz</p>																								

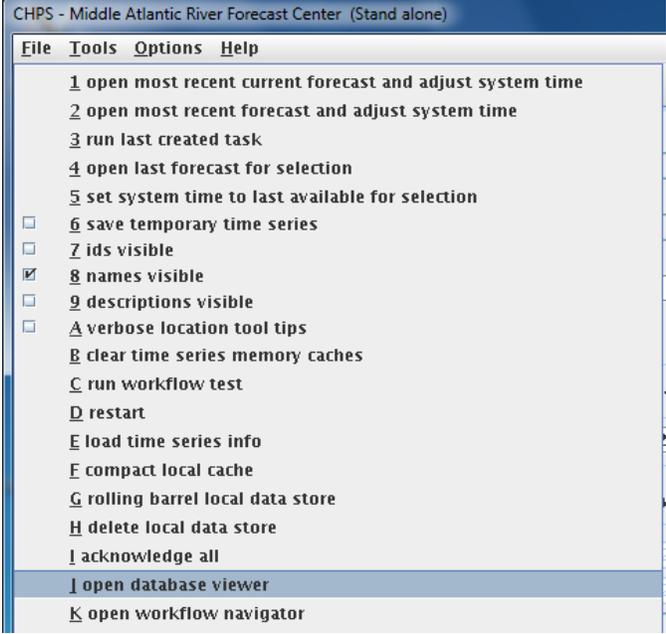
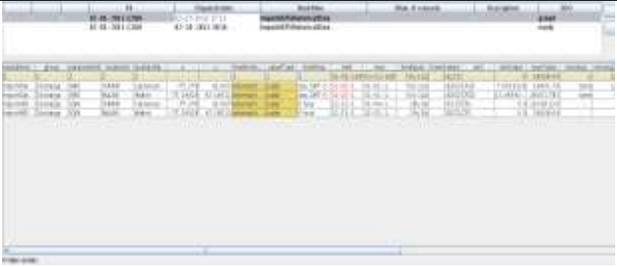
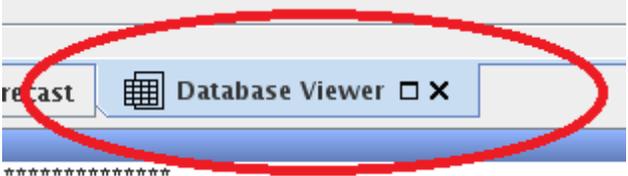
### 3.3 EnsPost PE

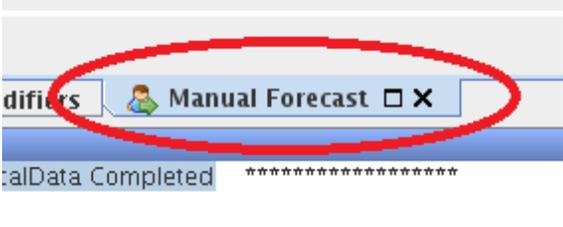
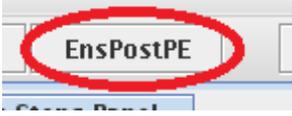
#### 3.3.2 Test Prerequisite

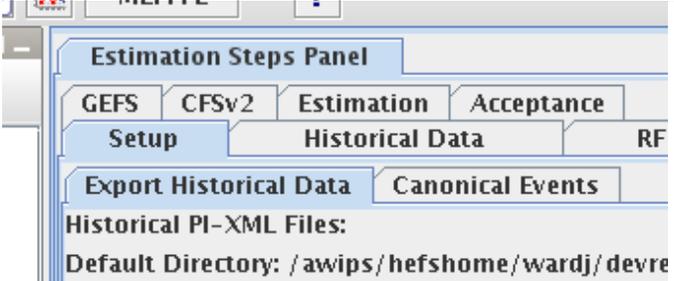
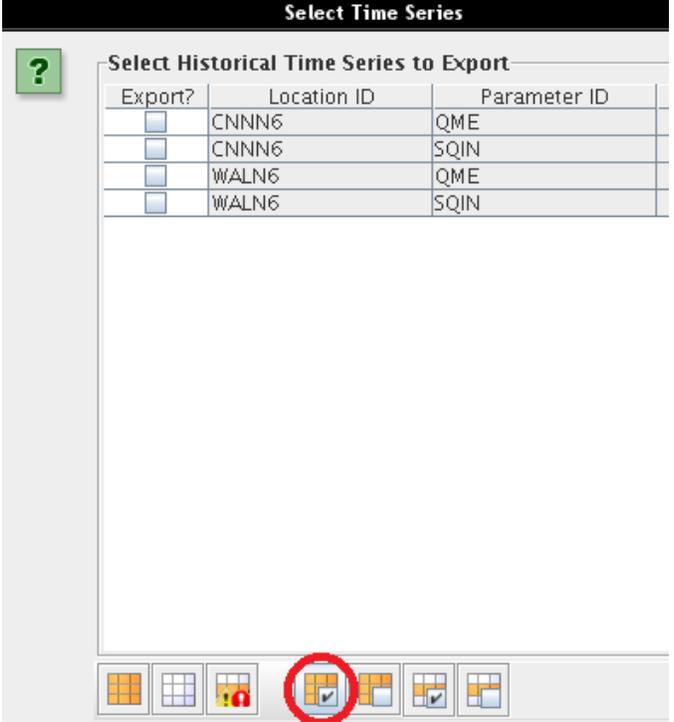
CHPS is configured with the EnsPostPE components as described in the document *EnsPostPE Configuration Guide*. Below is the same information from the confirmation section of the configuration guide. The directories should be populated with datacard files and pixml files.

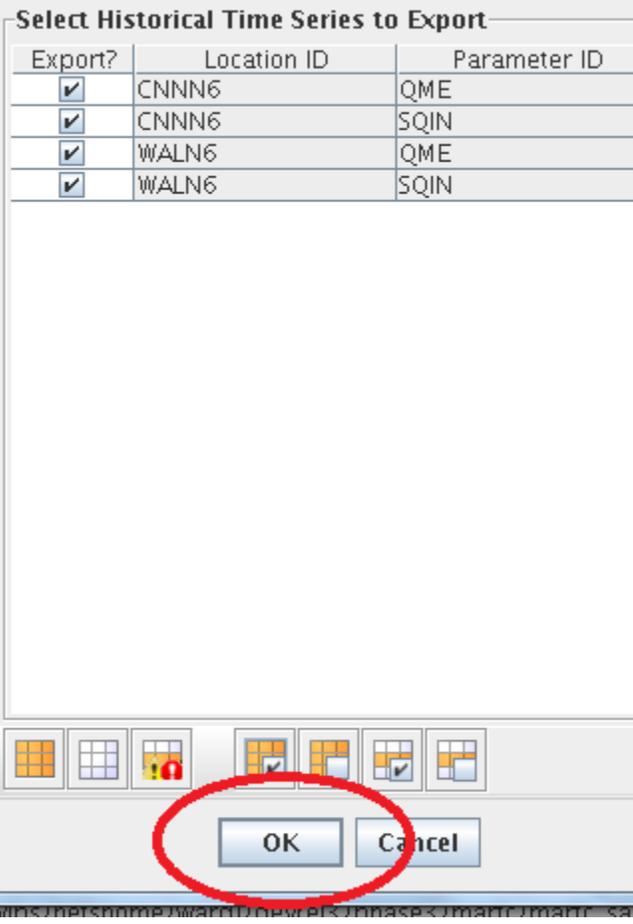
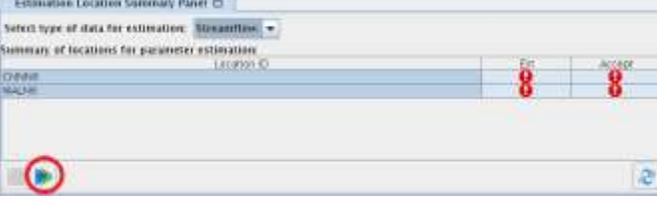
#### 3.3.3 Test Procedure

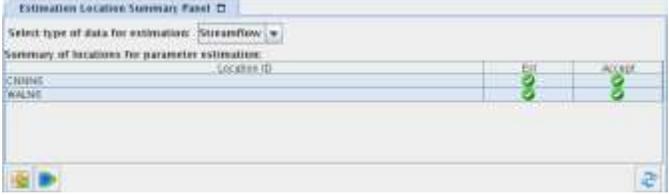
#	Action	Expected Results
1	Start FEWS using the installation standalone:  <pre>cd &lt;region_dir&gt;</pre> <pre>cd ..</pre> <pre>./hefsPlugins/fews_hefsPlugins.sh ##rfc_sa</pre> &	FEWS will be started. The splash screen displayed will vary by RFC. The default splash screen is:   After a short time, the CHPS interface will open.
2	In CHPS run the “ <b>ImportEnsPostPEHistoricalData</b> ” workflow.  Choose <b>Tools</b> (menu), <b>Manual Forecast</b> (menu option).	
3	Under Workflow (pull down menu), choose <b>ImportEnsPostPEHistoricalData</b> . It may be the last Workflow.	

#	Action	Expected Results
4	Click Run (button).  	Output (in the CHPS log area) will have “Workflow ImportEnsPostPEHistoricalData Completed”. The historical datacards and simulated pixml files have been imported.
5	Click in the <b>Logs panel</b> , hit the F12 key, and hit the <b>J</b> key to open the <b>database viewer</b> .	
6	The imported data should be present.	
7	Close the <b>Database Viewer</b> by clicking on the <b>X</b> at the bottom of the window.	

#	Action	Expected Results
8	Close the <b>Manual Forecast</b> by clicking on the X at the bottom of the window.	
9	Start the EnsPostPE by clicking on the in the toolbar of the CHPS interface.	
10	The PI-service will be disconnected.	
11	Scroll the Logs panel to find your PI-service port number (here <b>8100</b> ).	
12	Click on the PI-service icon, enter your PI-service port number (8100 in this example), and click OK.	
13	When successfully connected, two database icons should be green.	

#	Action	Expected Results															
14	Select <b>Export Historical Data</b> in the <b>Setup</b> subpanel of the <b>Estimation Steps Panel</b> .	 <p>The screenshot shows the 'Estimation Steps Panel' with subpanels for 'GEFS', 'CFSv2', 'Estimation', and 'Acceptance'. The 'Setup' subpanel is active, showing 'Export Historical Data' and 'Canonical Events' options. Below these, it displays 'Historical PI-XML Files:' and 'Default Directory: /awips/hefshome/wardj/devre'.</p>															
15	Click on the Export Time Series icon.	 <p>The screenshot shows a toolbar with several icons. The icon representing 'Export Time Series' (a document with a green arrow) is circled in red.</p>															
16	Select All time series to export by pressing the “Select All” button?.	 <p>The screenshot shows the 'Select Time Series' dialog box. It contains a table with the following data:</p> <table border="1" data-bbox="878 953 1442 1087"> <thead> <tr> <th>Export?</th> <th>Location ID</th> <th>Parameter ID</th> </tr> </thead> <tbody> <tr> <td><input type="checkbox"/></td> <td>CNN6</td> <td>QME</td> </tr> <tr> <td><input type="checkbox"/></td> <td>CNN6</td> <td>SQIN</td> </tr> <tr> <td><input type="checkbox"/></td> <td>WALN6</td> <td>QME</td> </tr> <tr> <td><input type="checkbox"/></td> <td>WALN6</td> <td>SQIN</td> </tr> </tbody> </table> <p>At the bottom of the dialog, there are several buttons. The 'Select All' button, which has a checkmark icon, is circled in red.</p>	Export?	Location ID	Parameter ID	<input type="checkbox"/>	CNN6	QME	<input type="checkbox"/>	CNN6	SQIN	<input type="checkbox"/>	WALN6	QME	<input type="checkbox"/>	WALN6	SQIN
Export?	Location ID	Parameter ID															
<input type="checkbox"/>	CNN6	QME															
<input type="checkbox"/>	CNN6	SQIN															
<input type="checkbox"/>	WALN6	QME															
<input type="checkbox"/>	WALN6	SQIN															

#	Action	Expected Results															
17	When all of the time series are selected, click OK.	 <p><b>Select Historical Time Series to Export</b></p> <table border="1"> <thead> <tr> <th>Export?</th> <th>Location ID</th> <th>Parameter ID</th> </tr> </thead> <tbody> <tr> <td><input checked="" type="checkbox"/></td> <td>CNN6</td> <td>QME</td> </tr> <tr> <td><input checked="" type="checkbox"/></td> <td>CNN6</td> <td>SQIN</td> </tr> <tr> <td><input checked="" type="checkbox"/></td> <td>WALN6</td> <td>QME</td> </tr> <tr> <td><input checked="" type="checkbox"/></td> <td>WALN6</td> <td>SQIN</td> </tr> </tbody> </table> <p>OK Cancel</p>	Export?	Location ID	Parameter ID	<input checked="" type="checkbox"/>	CNN6	QME	<input checked="" type="checkbox"/>	CNN6	SQIN	<input checked="" type="checkbox"/>	WALN6	QME	<input checked="" type="checkbox"/>	WALN6	SQIN
Export?	Location ID	Parameter ID															
<input checked="" type="checkbox"/>	CNN6	QME															
<input checked="" type="checkbox"/>	CNN6	SQIN															
<input checked="" type="checkbox"/>	WALN6	QME															
<input checked="" type="checkbox"/>	WALN6	SQIN															
18	Shift + Click to select all Location ID rows, and then click on the Run All double arrow.	 <p>Estimation Location Summary Panel</p> <p>Select type of data for estimation: Streamflow</p> <p>Summary of locations for parameter estimation</p> <table border="1"> <thead> <tr> <th>Location ID</th> <th>Fit</th> <th>Accept</th> </tr> </thead> <tbody> <tr> <td>CNN6</td> <td>8</td> <td>8</td> </tr> <tr> <td>WALN6</td> <td>8</td> <td>8</td> </tr> </tbody> </table> <p>Run All</p>	Location ID	Fit	Accept	CNN6	8	8	WALN6	8	8						
Location ID	Fit	Accept															
CNN6	8	8															
WALN6	8	8															
19	Select <b>OK</b> in the <b>Run All Options</b> window.	 <p><b>Run All Options</b></p> <p>All steps will be performed for all selected locations. If you wish to continue, please choose from the following options and click OK. Do you want to exit estimation if any step fails?</p> <p><input type="radio"/> Yes <input checked="" type="radio"/> No</p> <p>Do you want to rerun steps already completed that do not need updating?</p> <p><input type="radio"/> Yes <input checked="" type="radio"/> No</p> <p>OK Cancel</p>															

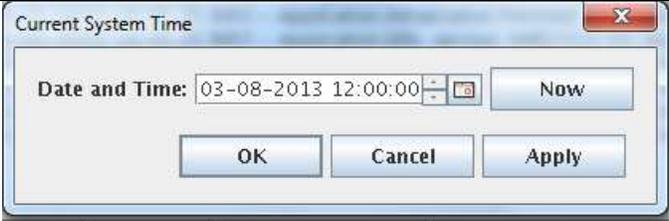
#	Action	Expected Results
20	When finished, all the boxes should be checked green.	
21	As an additional check, the directory <ens_post_root_dir>/ensPostParameters should contain the *.parameter.tgz files.	CNN6.SQIN.enspost.parameters.tgz WALN6.SQIN.enspost.parameters.tgz

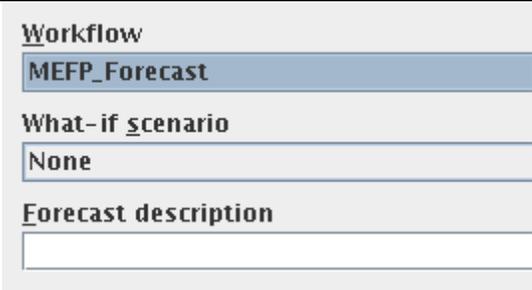
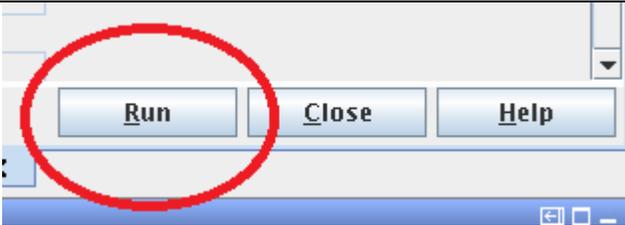
### 3.4 MEFP Forecast

#### 3.4.1 Test prerequisite

CHPS is configured with the MEFP components as described in the document *MEFP Configuration Guide: Forecast*. Below is the same information from the confirmation section of the configuration guide. The data ingest components have been installed, and for a given forecast time (T0, system time), the GEFS and CFSv2 gridded forecasts must be present.

#### 3.4.2 Test Procedure

#	Action	Expected Results
1	Start FEWS using the installation standalone:  <code>cd &lt;region_dir&gt;</code>  <code>cd ..</code>  <code>./hefsPlugins/fews_hefsPlugins.sh ##rfc_sa</code> <code>&amp;</code>	FEWS will be started. The splash screen displayed will vary by RFC. The default splash screen is:    After a short time, the CHPS interface will open.
2	Only perform this step if the current system time is not correct for testing.  Click on the <b>Current System Time</b> label at the bottom of the CHPS interface so that the <b>Current System Time</b> dialog opens. Set the system time appropriately and click <b>OK</b> .	

#	Action	Expected Results
3	Click on the <b>Manual Forecast Button</b> .	
4	The <b>Manual Forecast Panel</b> will open, allowing you to select a workflow to run. In the Workflow List, select the MEFP_Forecast workflow and press the F12 key.	
5	In the <b>Manual Forecast Panel</b> , click Run.	
6	When MEFP Forecast is done, you should see “Workflow MEFP_Forecast Completed” in the logs panel: (see Figure 2 below)	

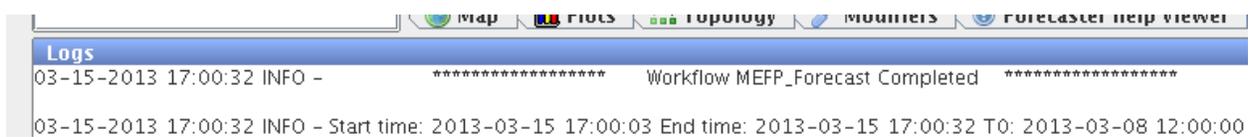


Figure 2

#	Action	Expected Results
7	To verify that ensembles were generated, click in the <b>Logs Panel</b> , hit the <F12> key, and hit the <J> key to open the <b>Database Viewer</b> .	<ul style="list-style-type: none"> <li><u>1</u> open most recent current forecast</li> <li><u>2</u> open most recent forecast and adj</li> <li><u>3</u> run last created task</li> <li><u>4</u> open last forecast for selection</li> <li><u>5</u> set system time to last available fo</li> <li><u>6</u> save temporary time series</li> <li><u>7</u> ids visible</li> <li><u>8</u> names visible</li> <li><u>9</u> descriptions visible</li> <li><u>A</u> verbose location tool tips</li> <li><u>B</u> clear time series memory caches</li> <li><u>C</u> run workflow test</li> <li><u>D</u> restart</li> <li><u>E</u> load time series info</li> <li><u>F</u> compact local cache</li> <li><u>G</u> rolling barrel local data store</li> <li><u>H</u> delete local data store</li> <li><u>I</u> acknowledge all</li> <li><u>J</u> open database viewer</li> <li><u>K</u> open workflow navigator</li> </ul>
8	MEFP_Forecast should be the last workflow you ran. Double click to open it. See Figure 3 below	

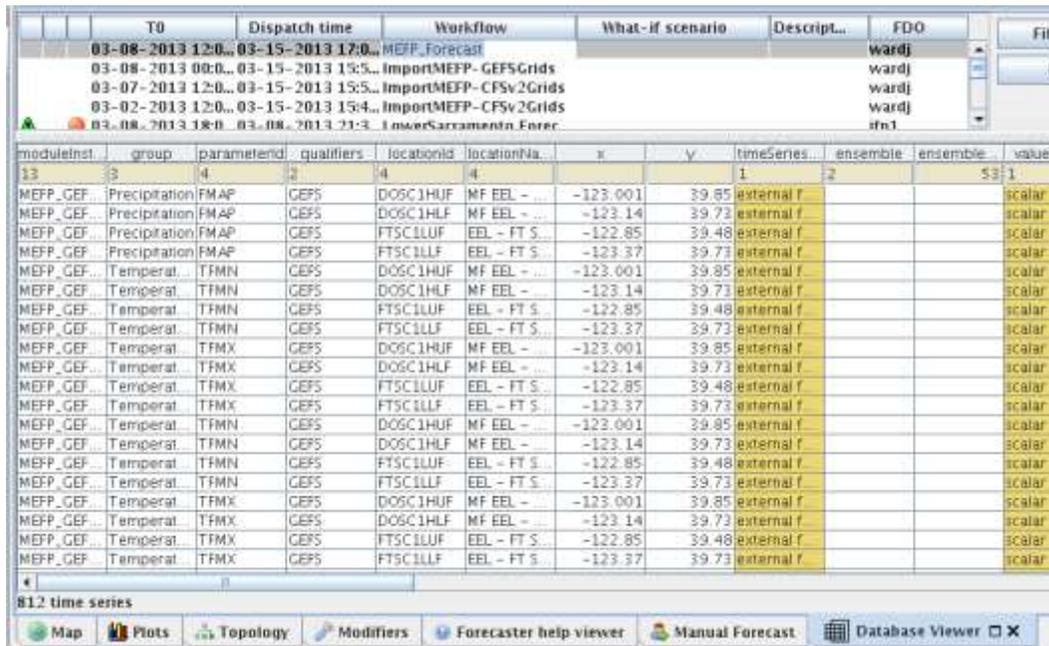
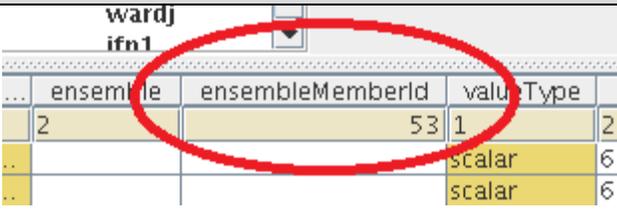
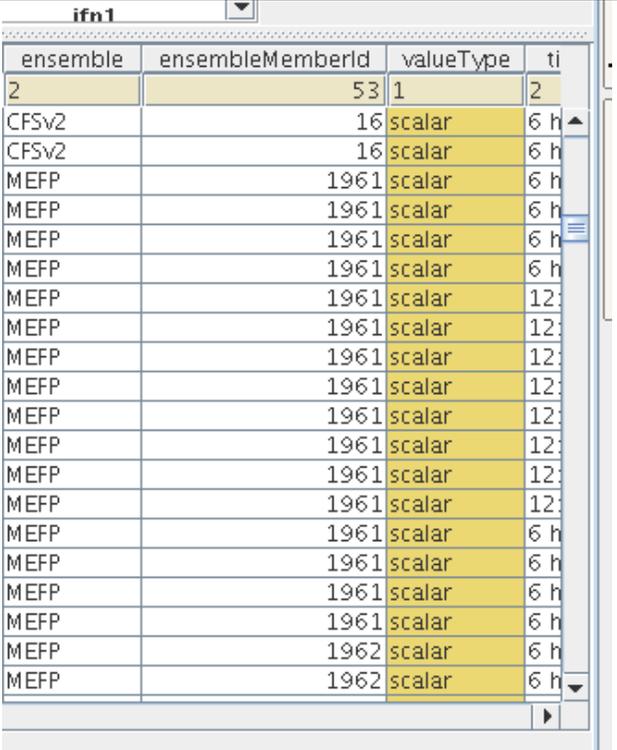


Figure 3

#	Action	Expected Results																																																																																								
9	Click on the “ensembleMemberId” column to sort by it. You may have to expand the column to see the full name.	 <p>The screenshot shows a data table with columns: ensemble, ensembleMemberId, valueType, and ti. The 'ensembleMemberId' column is highlighted in red. The table contains the following data:</p> <table border="1"> <thead> <tr> <th>ensemble</th> <th>ensembleMemberId</th> <th>valueType</th> <th>ti</th> </tr> </thead> <tbody> <tr> <td>2</td> <td>53</td> <td>1</td> <td>2</td> </tr> <tr> <td>..</td> <td></td> <td>scalar</td> <td>6</td> </tr> <tr> <td>..</td> <td></td> <td>scalar</td> <td>6</td> </tr> </tbody> </table>	ensemble	ensembleMemberId	valueType	ti	2	53	1	2	..		scalar	6	..		scalar	6																																																																								
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..		scalar	6																																																																																							
10	Scroll down to ensembleMemberId (year) 1961.	 <p>The screenshot shows a data table with columns: ensemble, ensembleMemberId, valueType, and ti. The table is sorted by ensembleMemberId. The following rows are visible:</p> <table border="1"> <thead> <tr> <th>ensemble</th> <th>ensembleMemberId</th> <th>valueType</th> <th>ti</th> </tr> </thead> <tbody> <tr> <td>2</td> <td>53</td> <td>1</td> <td>2</td> </tr> <tr> <td>CFSv2</td> <td>16</td> <td>scalar</td> <td>6 h</td> </tr> <tr> <td>CFSv2</td> <td>16</td> <td>scalar</td> <td>6 h</td> </tr> <tr> <td>MEFP</td> <td>1961</td> <td>scalar</td> <td>12:</td> </tr> <tr> <td>MEFP</td> <td>1961</td> <td>scalar</td> <td>6 h</td> </tr> <tr> <td>MEFP</td> <td>1962</td> <td>scalar</td> <td>6 h</td> </tr> <tr> <td>MEFP</td> <td>1962</td> <td>scalar</td> <td>6 h</td> </tr> </tbody> </table>	ensemble	ensembleMemberId	valueType	ti	2	53	1	2	CFSv2	16	scalar	6 h	CFSv2	16	scalar	6 h	MEFP	1961	scalar	6 h	MEFP	1961	scalar	6 h	MEFP	1961	scalar	6 h	MEFP	1961	scalar	6 h	MEFP	1961	scalar	12:	MEFP	1961	scalar	6 h	MEFP	1961	scalar	6 h	MEFP	1961	scalar	6 h	MEFP	1961	scalar	6 h	MEFP	1962	scalar	6 h	MEFP	1962	scalar	6 h																												
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MEFP	1962	scalar	6 h																																																																																							
11	Pick a locationId. This will vary between RFCs. In our example, locationId DOSCIHUF was chosen. <Shift> + left click to select the TFMN, TFMX, and FMAT for that location, and for one ensemble member index (1961, in Figure 4 below).																																																																																									

moduleInst	group	parameterId	qualifiers	locationId	locationNa	x	y	timeSeries	ensemble	ensembleMemberId	valueType	ti	
13	3	4	2	4	4			1	2	53	1	2	
NorthCoas	Temperat.	TFMX	CFSv2	FTSC1LUF	EEL - FT S	-122.85	39.48	external f	CFSv2		16	scalar	6 h
NorthCoas	Temperat.	TFMX	CFSv2	FTSC1LLF	EEL - FT S	-123.37	39.73	external f	CFSv2		16	scalar	6 h
NorthCoas	Precipitation	FMAP		DOSC1HUF	MF EEL -	-123.001	39.85	external f	MEFP		1961	scalar	6 h
NorthCoas	Precipitation	FMAP		DOSC1HLF	MF EEL -	-123.14	39.73	external f	MEFP		1961	scalar	6 h
NorthCoas	Precipitation	FMAP		FTSC1LUF	EEL - FT S	-122.85	39.48	external f	MEFP		1961	scalar	6 h
NorthCoas	Precipitation	FMAP		FTSC1LLF	EEL - FT S	-123.37	39.73	external f	MEFP		1961	scalar	6 h
NorthCoas	Temperat.	TFMN		DOSC1HUF	MF EEL -	-123.001	39.85	external f	MEFP		1961	scalar	12
NorthCoas	Temperat.	TFMX		DOSC1HUF	MF EEL -	-123.001	39.85	external f	MEFP		1961	scalar	12
NorthCoas	Temperat.	TFMN		DOSC1HLF	MF EEL -	-123.14	39.73	external f	MEFP		1961	scalar	12
NorthCoas	Temperat.	TFMX		DOSC1HLF	MF EEL -	-123.14	39.73	external f	MEFP		1961	scalar	12
NorthCoas	Temperat.	TFMN		FTSC1LUF	EEL - FT S	-122.85	39.48	external f	MEFP		1961	scalar	12
NorthCoas	Temperat.	TFMX		FTSC1LUF	EEL - FT S	-122.85	39.48	external f	MEFP		1961	scalar	12
NorthCoas	Temperat.	TFMN		FTSC1LLF	EEL - FT S	-123.37	39.73	external f	MEFP		1961	scalar	12
NorthCoas	Temperat.	TFMX		FTSC1LLF	EEL - FT S	-123.37	39.73	external f	MEFP		1961	scalar	12
MEFP_FMA	Temperat.	FMAT		DOSC1HUF	MF EEL -	-123.001	39.85	external f	MEFP		1961	scalar	6 h
MEFP_FMA	Temperat.	FMAT		DOSC1HLF	MF EEL -	-123.14	39.73	external f	MEFP		1961	scalar	6 h
MEFP_FMA	Temperat.	FMAT		FTSC1LUF	EEL - FT S	-122.85	39.48	external f	MEFP		1961	scalar	6 h
MEFP_FMA	Temperat.	FMAT		FTSC1LLF	EEL - FT S	-123.37	39.73	external f	MEFP		1961	scalar	6 h
NorthCoas	Precipitation	FMAP		DOSC1HUF	MF EEL -	-123.001	39.85	external f	MEFP		1962	scalar	6 h
NorthCoas	Precipitation	FMAP		DOSC1HLF	MF EEL -	-123.14	39.73	external f	MEFP		1962	scalar	6 h

Figure 4

#	Action	Expected Results
12	Right click and select “ <b>Show time series dialog</b> ”. The <b>Database Viewer</b> will appear. TFMX is shown in red at top, TFMN is shown in blue at top, and generated FMAT is shown on the bottom. See Figure 5 below.	

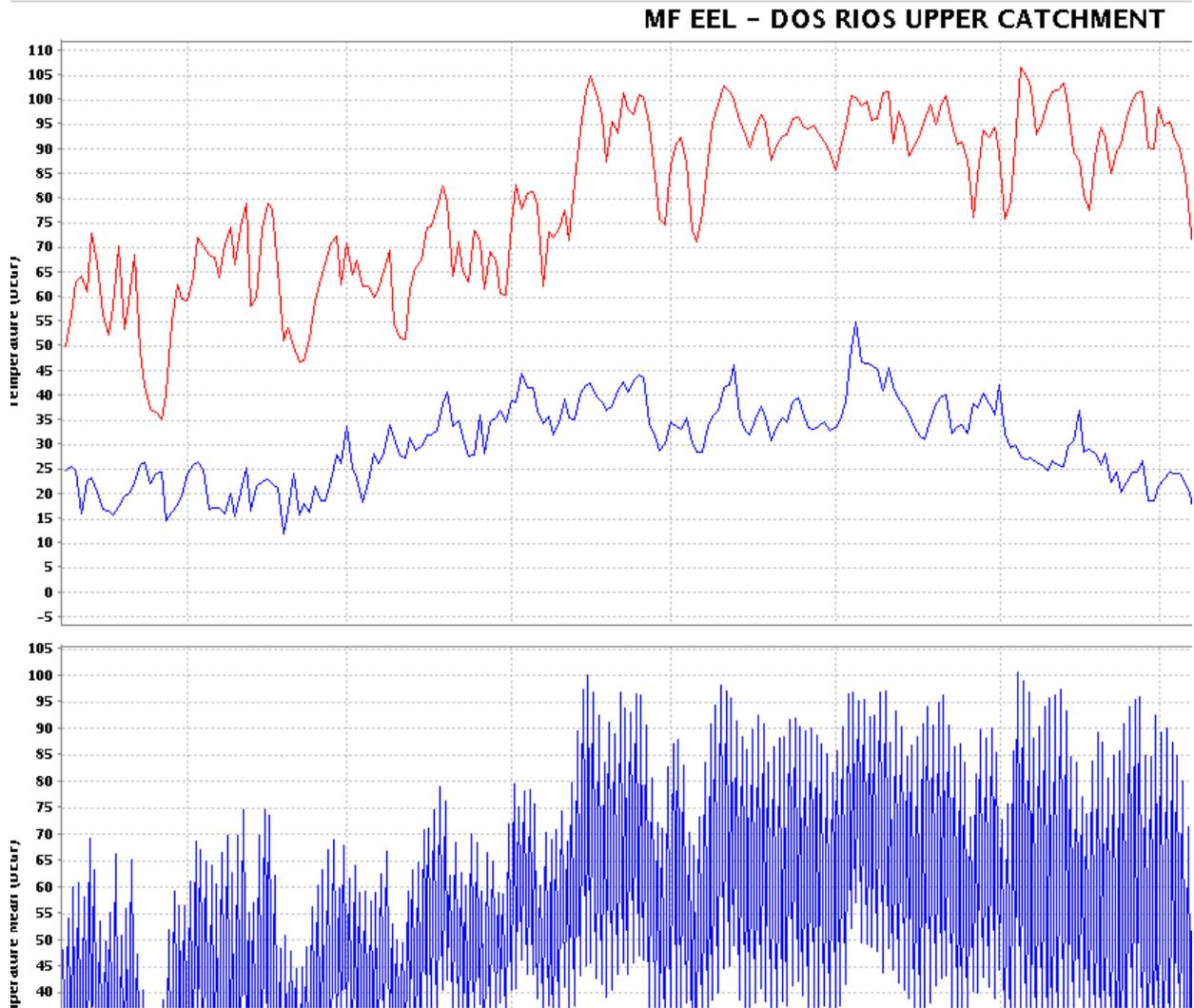


Figure 5

#	Action	Expected Results
13	For a better view, select a region of the <b>Database Viewer</b> by clicking and dragging a small rectangle from upper left to lower right. The generated FMAT should lie between the max and min temps. See Figure 6 below.	

MF EEL - DOS RIOS UPPER CATCHMEI

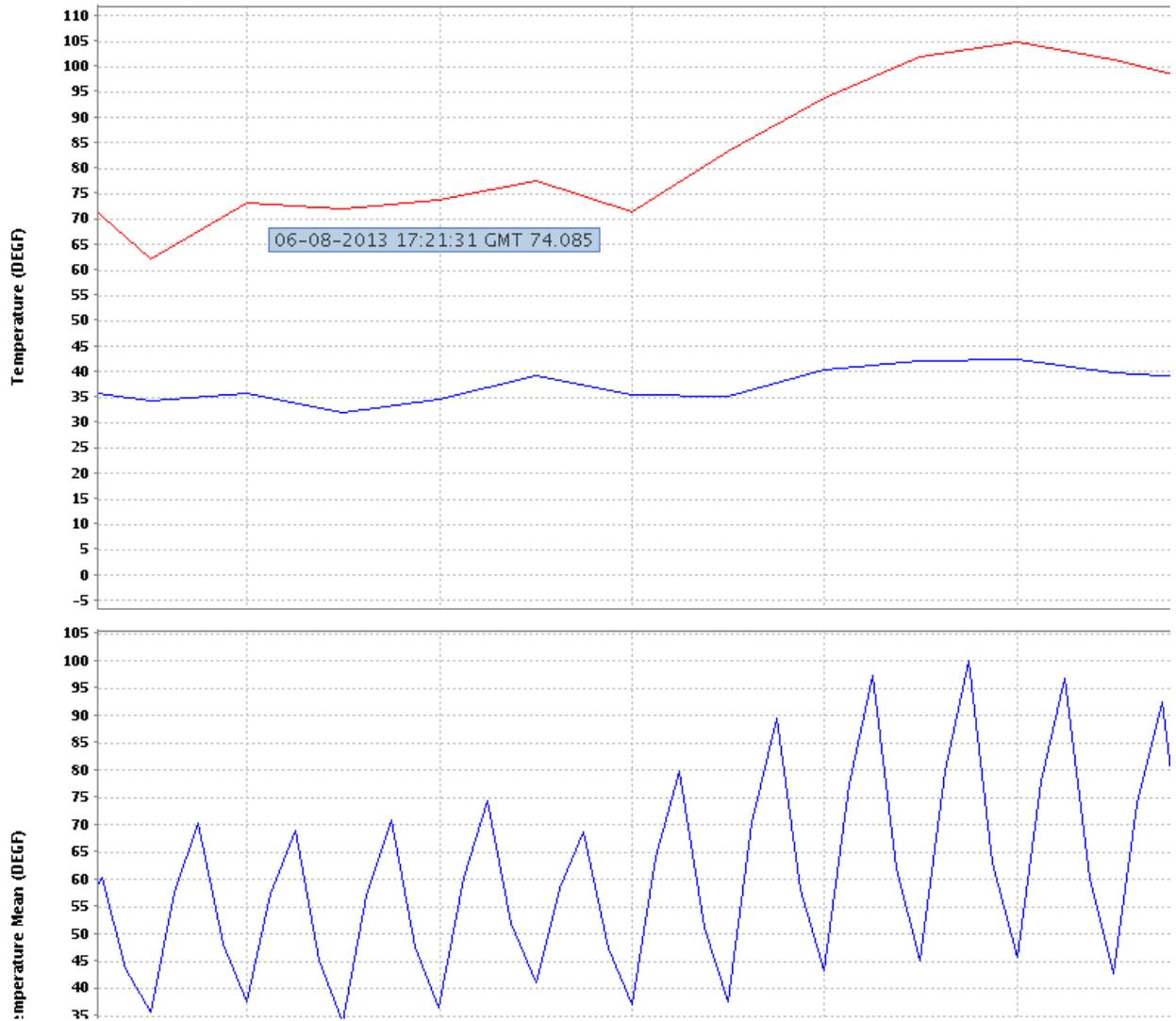


Figure 6

## 3.5 EnsPost

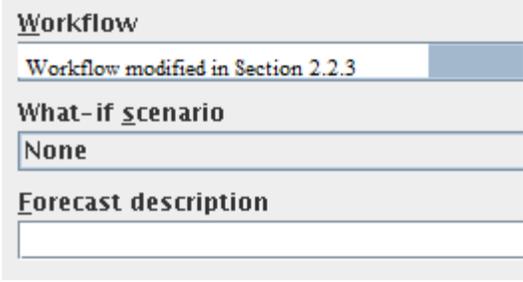
### 3.5.1 Test Prerequisite

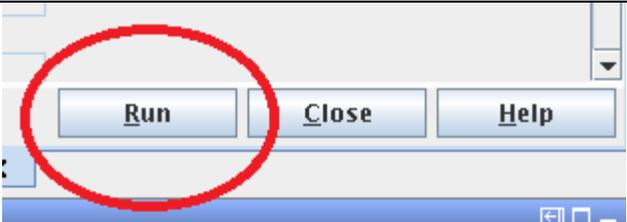
CHPS is configured with the EnsPost components as described in the document *EnsPost Configuration Guide*. Below is the same information from the confirmation section of the configuration guide. EnsPostPE is installed as described in the *EnsPostPE Configuration Guide*. The parameters .tgz file must be in the following format:

<LocationID>.<ParameterID>.enspost.parameters.tgz

Identify a workflow that generates an ensemble of stream flow forecasts. It can be an MEFP-based ensemble (see the *MEFP Configuration Guide: Forecast Components*) or an existing ESP workflow.

### 3.5.2 Test Procedure

#	Action	Expected Results
1	Start FEWS using the installation standalone:  <pre>cd &lt;region_dir&gt; cd .. ./hefsPlugins/fews_hefsPlugins.sh ##rfc_sa &amp;</pre>	FEWS will be started. The splash screen displayed will vary by RFC. The default splash screen is:    After a short time, the CHPS interface will open.
2	Click on the <b>Manual Forecast Button</b> .	
3	The <b>Manual Forecast Panel</b> will open, allowing you to select a workflow to run. In the Workflow List, select the workflow modified in the <i>EnsPostPE Configuration Guide</i> .	

#	Action	Expected Results
4	In the <b>Manual Forecast Panel</b> , click Run.	
5	Once the workflow is done.	You should see “Workflow Completed” in the logs panel. For example, “Workflow HEFS Forecast Completed”
6	Open the Database viewer in order to confirm that EnsPost successfully ran.	Select the workflow that was just completed in the database viewer, and find entries with the EnsembleID of HEFSENSPOST.

## 3.6 GraphGen

### 3.6.1 Test Prerequisite

CHPS is configured with the GraphGen components as described in the document *HEFS Graphics Generator Products Installation Guide*. Below is the same information from the confirmation section of the configuration guide. A localDataStore containing MEFP generated forecast ensembles, MEFP-based generated streamflow ensembles, and/or EnsPost post-processed streamflow ensembles.

### 3.6.2 Test Procedure

#	Action	Expected Results
1	Execute the workflow GraphGen_Create_HEFS_Products created in the <i>HEFS Graphics Generator Products Installation Guide</i> via the CHPS interface <b>Manual Forecast Panel</b> as normal (start CHPS, set the PI-service port number, open the panel, show all workflows, select the workflow, and click <b>Run</b> ).	The HEFS product files will be created in the standard location (i.e., <products_dir>) specified by the baseOutputDir run file property (see <i>HEFS Graphics Generator Products Installation Guide</i> ). The images will appear similar to Figures 7 - 9 shown below:

- *MEFP Results*: MEFP generated forecast ensembles of 6-hour FMAP and FMAT time series.

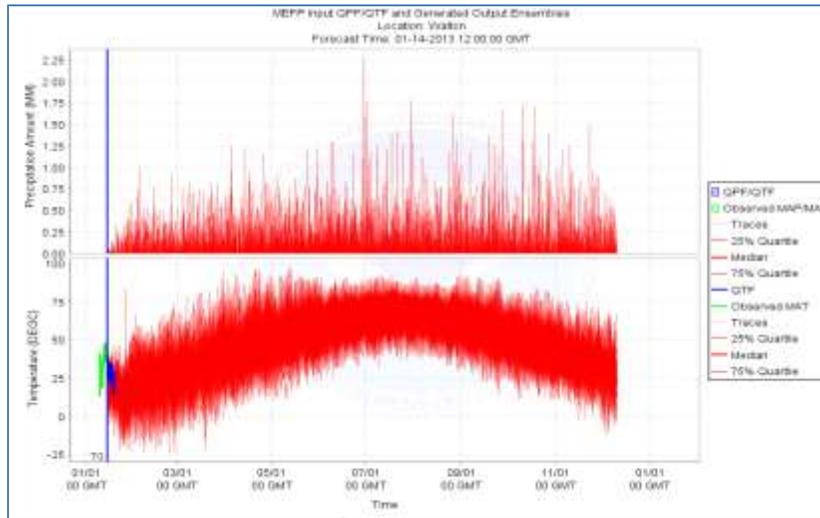


Figure 7

- *HEFS EnsPost Input*: Streamflow ensembles that are input to the HEFS EnsPost. If HEFS EnsPost is not used, the products can be used to display any streamflow ensemble.

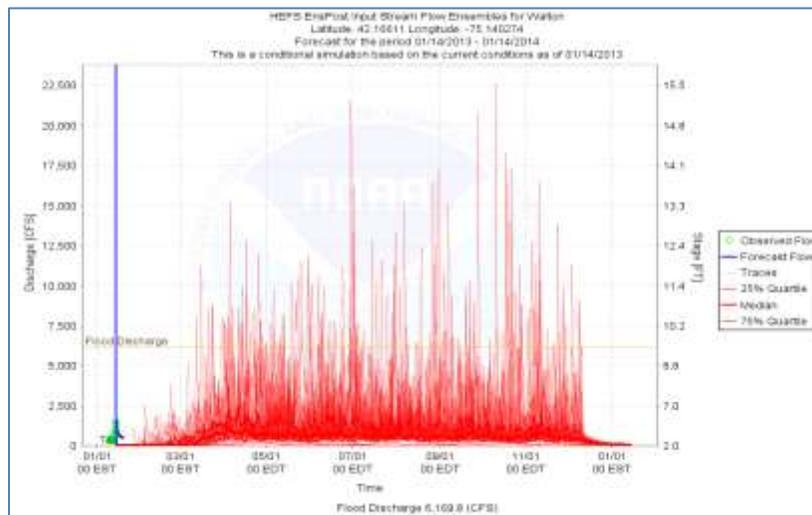


Figure 8

- *HEFS EnsPost Output*: Streamflow ensembles that are post-processed and output by the HEFS EnsPost.

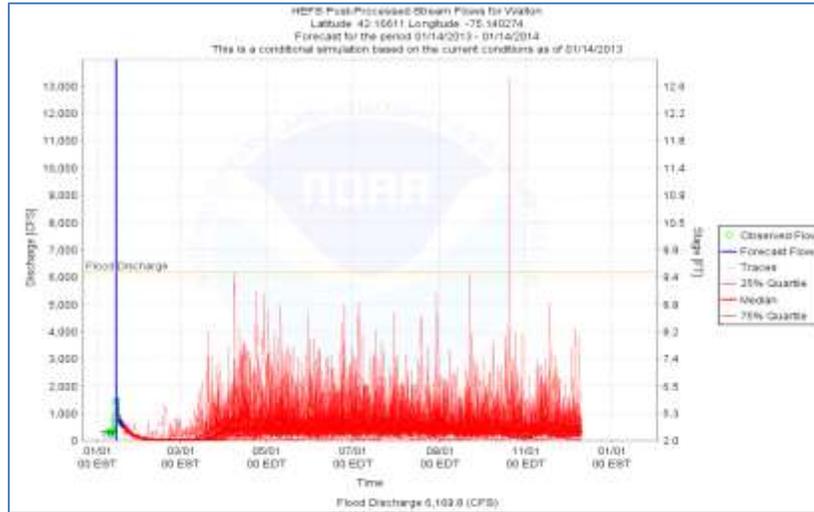


Figure 9