EnsPostPE Configuration Guide

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1 Overview

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 guide provides instructions for configuring CHPS to include the EnsPostPE plug-in and basic instructions for using EnsPostPE to estimate parameters.

1.1 *Notation*

Within this document, the following notation is used:

- All graphical interface components are **Capitalized and in Bold**.
- All XML snippets are in this font or this font.
- All command line entries are in this font.
- All important terms are *italicized* when first mentioned.

1.2 *Terminology*

- *parameter estimation stand-alone*: The stand-alone in which the EnsPost parameter estimation components will be installed, setup in Section 1.4.
- *installation segment*: The id of the first segment for which HEFS is to execute.

1.3 *Directories of Note*

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

- <*region_dir*>: The parameter estimation stand-alone region home directory, typically "##rfc_sa".
- <*configuration_dir*>: The parameter estimation stand-alone Config directory, typically <*region_dir*>/Config.
- <*tar_root_dir*>: The directory where the release package was untarred.
- <*ens_post_root_dir*>: The directory in which a subdirectory, ensPostParameters, stores the parameter files generated by the EnsPostPE.
- <*enspostpe_run_area*>: The directory in which EnsPostPE stores files as it gathers data and estimates parameters. It is <*region_dir*>/Models/hefs/hefsEnsPostPERunArea and is setup during the installation process (Section 2.1). You should not need to interact with this area directly except when debugging problems.

1.4 *Pre-installation Steps*

1. Install the HEFS release as described in the *HEFS Install Notes*. This puts the needed jar files in place for execution of EnsPostPE.

2. Create the *parameter estimation stand-alone* using an operational configuration as the basis with an empty localDataStore. This stand-alone will be used for parameter estimation of both the MEFP and EnsPost. This stand-alone must not be deleted, as it will be used indefinitely into the future, so place it on the file system accordingly. However, it may be necessary to rebuild the stand-alone if your operational configurations change significantly. As such instructions for porting the EnsPostPE to another stand-alone are provided in Section 5.1.1. Furthermore, it may be necessary to update the stand-alone as new versions of the software are released. Instructions for that will be provided with each release.

1.5 *Release Package*

As part of installing the HEFS release, the release package was acquired and untarred in a directory referred to in the *HEFS Install Notes* as <*tar_root_dir*>. Within this document, only the contents of the subdirectory enspostpe are referred to. The enspostpe subdirectory contents are as follows, with a description of each subdirectory:

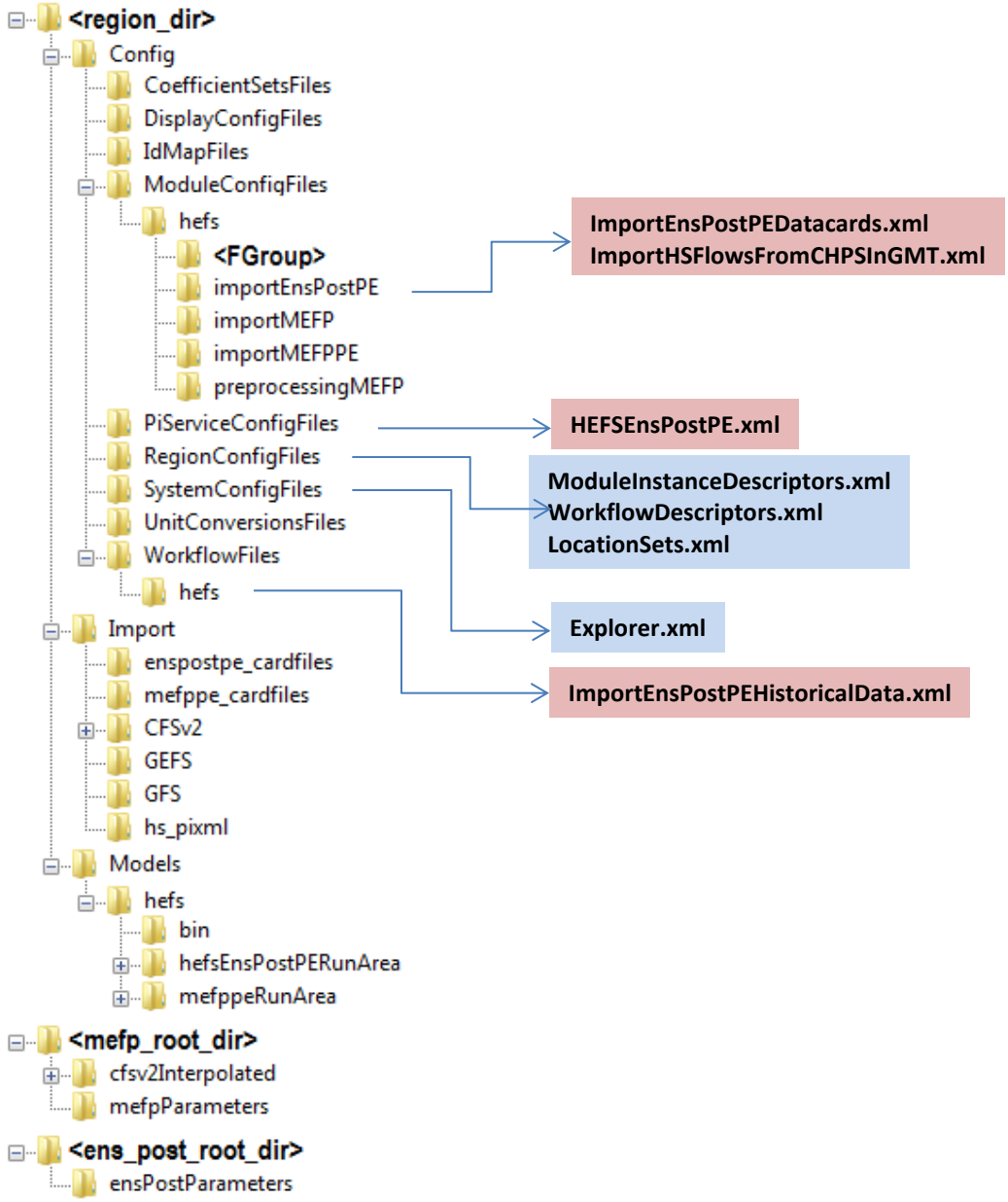
<*tar_root_dir*>/enspostpe/…
- Config – Configuration files to be copied to the parameter estimation stand-alone.
- Import – Import directory structure to be copied to the parameter estimation stand-alone.
- Models – Models directory structure to be put in place in the parameter estimation stand-alone.
- samples – Sample files referred to in the instructions below as needed.

1.6 *Affected Configuration Files*

The diagram in Figure 1 summarizes all configuration files created or modified by the installation steps provided in this document. The directory structure shown includes all directories affected by any HEFS component. Files with a light red background are new files and should be safe enough to copy over, while those with a light blue background should already exist and require editing. Note the following:

- The directories **<region_dir>**/Import/cardfiles and Import/pixml are needed for EnsPostPE.
- The directories shown under **<region_dir>**/Models will be created during installation.
- The directory corresponding to **<mefp_root_dir>** is used by MEFP and MEFPPE and will not be used herein.

Figure 1: Configuration files created or modified during installation.



2 Installing EnsPostPE

This section provides instructions for the following:

- Making needed additions and changes to configuration files in the parameter estimation stand-alone.
- Confirming the installation.

By the end of this section, the EnsPostPE will be installed and usable in the parameter estimation stand-alone.

2.1 *Copy New Files and Directories (All Steps Required)*

Execute the following command to copy *all* new files and directories that are necessary for running the EnsPost data ingest components into the installation stand-alone directory structure (replace *<region_dir>* and *<tar_root_dir>* appropriately):

```
cd <tar_root_dir>/enspostpe
cp –r Config <region_dir>/.
cp –r Models <region_dir>/.
cp –r Import <region_dir>/.
```

Most of the files and directories just copied will not be modified further.

2.2 *Create <ens_post_root_dir> (Required)*

Action: Select a directory to host the EnsPost root directory. This directory will store the following files:

- Tar/Gzipped EnsPost location-specific and data type specific parameter files

The directory must not be specific to the installation standalone. Rather, it must be a central shared directory as it will be referenced by all standalones and other instances of CHPS (e.g. Forecast Shell Servers – fss) that execute the EnsPostPE for parameter estimation or EnsPost for operational forecasting. For example, the directory referenced by $EXPORT_FOLDER in the fss global properties file is a commonly used central directory for storing data generated by executing CHPS. This directory is denoted <*ens_post_root_dir*> throughout this document.

Action: Do the following:

```
mkdir <ens_post_root_dir>
cd <ens_post_root_dir>
cp  -r <tar_root_dir>/enspostpe/ensPostRootDir/* .
```

2.3 *Modify Global Properties*

Action: Modify the global properties file:

<*region_dir*>/sa_global.properties

Add the following properties if they do not already exist:

ENS_POST_ROOT_DIR=<*ens_post_root_dir*>

i.e. ENS_POST_ROOT_DIR=$EXPORT_FOLDER$/ensPostRootDir

2.4 *Configuration File Changes*

Described in the following sections are changes that must be made to the configuration files to setup the EnsPost data ingest.

2.4.1 Modify File Added in Step 2.1: HEFSEnsPostPE.xml (Optional)

This step should only be performed if an alternative source of historical simulated stream flow time series and observed stream flow time series is available for your RFC. By default, it is assumed that pixml files will be imported; see below for more details.

Action: Modify the file

<*configuration_dir*>/PiServiceConfigFiles/HEFSEnsPostPE.xml

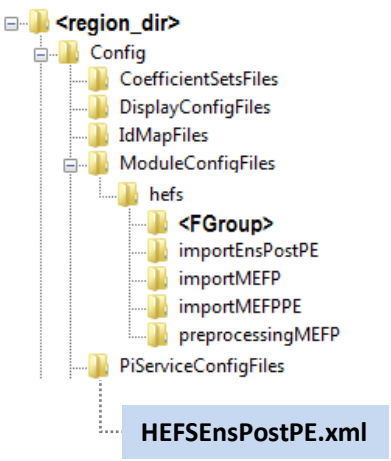
as needed in order to specify the historical simulated stream flow time series and observed stream flow timeseries that will be used to estimate EnsPost parameters. See the example below which shows the default configuration.

Description: By default, the file makes use of the output from the ImportEnsPostPEHistoricalData workflow and associated modules put in place in Section 2.1. However, if your RFC has a source of historical time series already appropriately defined with data in the localDataStore, then, in the HEFSEnsPostPE.xml file, modify the timeSeriesSet elements defined for the timeSeries element with id "All Historical Data".

The requirements for the time series specified by the timeSeriesSet elements are as follows:

- *Historical simulated stream flow time series:* Can be hourly, 6 hourly, or daily time steps and use parameterId SQIN or QINE.

- *Observed stream flow time series*: Can be hourly, 6 hourly, or daily. The time zone must match between the imported data and the entry in the PiServiceConfig file.

Standard Location: <*configuration_dir*>**/PiServiceConfigFiles**	**Contents:** ***HEFSEnsPostPE.xml***
	<?xml version="1.0" encoding="UTF-8"?> <!-- edited with XMLSpy v2007 sp2 (http://www.altova.com) by WL | Delft Hydraulics (WL | Delft Hydraulics) --> <fewsPiServiceConfig xmlns="http://www.wldelft.nl/fews" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation="http://www.wldelft.nl/fews http://fews.wldelft.nl/schemas/version1.0/fewsPiServiceConfig.xsd"> <general> <!-- Define id-mappings here only if needed to force observed and simulated streamflow to have matching locationIds. Add the appropriate new id-mapping file to Config/IdMapFiles. --> <!--<importIdMap>IdImportPiService</importIdMap> <exportIdMap>IdExportPiService</exportIdMap> --> </general> <!-- This one query is used to extract all needed time series from the localDataStore and export them to files under Models/hefs/hefsEnsPostPERunArea/piXMLFiles It should be configured to include ALL historical simulated and observed streamflows that will be used to estimate parameters for EnsPost. Within the software, the time series will be extracted one at a time, so don't worry about the size of the query results. The examples below can be considered as a template; modify as needed.--> <timeSeries> <id>All Time Series</id> <!-- Make the historical simulation time series available to the EnsPostPE. By default, this assumes the HS data was imported using the ImportHSFlowsFromCHPSInGMT module. --> <timeSeriesSet> <moduleInstanceId>ImportHSFlowsFromCHPSInGMT</moduleInstanceId> <valueType>scalar</valueType> <parameterId>SQIN</parameterId> <locationSetId>Gages_HEFS</locationSetId> <timeSeriesType>external historical</timeSeriesType> <timeStep unit="hour" multiplier="6"/> <readWriteMode>read only</readWriteMode> </timeSeriesSet> <!-- This is, typically, a 24h observed QME time series imported from a datacard file. --> <timeSeriesSet> <moduleInstanceId> ImportEnsPostPEDatacards</moduleInstanceId> <valueType>scalar</valueType> <parameterId>QME</parameterId> <locationSetId>Gages_HEFS</locationSetId> <timeSeriesType>external historical</timeSeriesType> <timeStep unit="hour" multiplier="24" timeZone="GMT-6"/> <readWriteMode>read only</readWriteMode> </timeSeriesSet> </timeSeries> </fewsPiServiceConfig>

2.4.2 Modify Existing File: ModuleInstanceDescriptors.xml (Required)

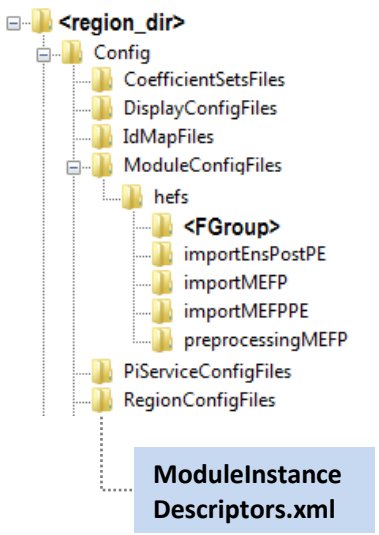
Action: Define new module instance descriptors in the file

<configuration_dir>/RegionConfigFiles/ModuleInstanceDescriptors.xml

See the example below for text to add immediately before the closing "**</moduleInstanceDescriptors>**" at the end of the file. A sample is provided in the following file:

<tar_root_dir>/enspostpe/samples/Config/RegionConfigFiles/ModuleInstanceDescriptors.xml

Description: The added modules are used to import datacard data in the RFC local time zone,

Standard Location: *<configuration_dir>*/**RegionConfigFiles/**	**Contents:** ***ModuleInstanceDescriptors.xml***
	<?xml version="1.0" encoding="UTF-8"?> <moduleInstanceDescriptors xmlns="http://www.wldelft.nl/fews" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation="http://www.wldelft.nl/fews http://chps1/schemas/moduleInstanceDescriptors.xsd" version="1.0"> … **<!-- ADDED FOR HEFS EnsPostPE ========== -->** … **<!-- HEFS Parameter Estimator Modules: Import datacard file in appropriate local time, import HS PI-xml files -->** **<moduleInstanceGroup id="HEFSPEs">** **<moduleInstanceDescriptor id="ImportEnsPostPEDatacards">** **<description>Imports Datacards in Local Time</description>** **<moduleId>TimeSeriesImportRun</moduleId>** **</moduleInstanceDescriptor>** **<moduleInstanceDescriptor id="ImportHSFlowsFromCHPSInGMT">** **<description>Imports PI-XML Historical Simulations in GMT</description>** **<moduleId>TimeSeriesImportRun</moduleId>** **</moduleInstanceDescriptor>** **</moduleInstanceGroup>** **<!-- END HEFS EnsPostPE ========== -->** </moduleInstanceDescriptors>

2.4.3 Modify Existing File: WorkflowDescriptors.xml (Required)

Action: Define a new workflow descriptor in the file

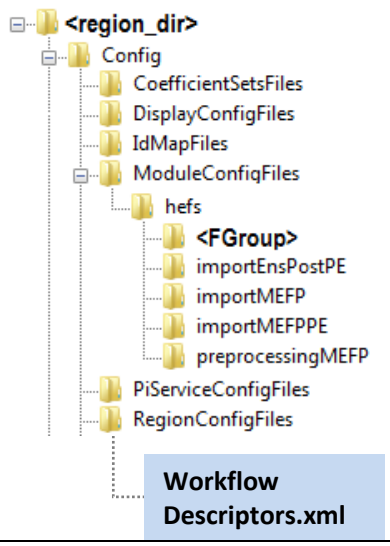
<configuration_dir>/RegionConfigFiles/WorkflowDescriptors.xml

See the example below for text to add immediately before the closing "</workflowDescriptors>" at the end of the file. A sample is provided in the following file:

<tar_root_dir>/enspostpe/samples/Config/RegionConfigFiles/WorkflowDescriptors.xml

Description: The added workflow executes the import modules.

NOTE: In the example below, the description element is a single line element, but is displayed on two lines in the example only because it is too long to fit on one line.

Standard Location: *<configuration_dir>*/**RegionConfigFiles/**	**Contents:** ***WorkflowDescriptors.xml***
	<?xml version="1.0" encoding="UTF-8"?> <workflowDescriptors xmlns="http://www.wldelft.nl/fews" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation="http://www.wldelft.nl/fews http://chps1/schemas/workflowDescriptors.xsd" version="1.0"> … **<!-- ADDED FOR HEFS EnsPostPE ========== -->** … **<!-- General import for all HEFS components: historical data for parameter estimation. -->** **<workflowDescriptor id="ImportEnsPostPEHistoricalData" forecast="true" visible="true" name="ImportEnsPostPEHistoricalData" allowApprove="false">** **<description>Import QME Historical Datacard Files and HS PI-timeseries xml files for HEFS EnsPostPE</description>** **</workflowDescriptor>** **<!-- END HEFS EnsPostPE ========== -->** </workflowDescriptors>

2.4.4 Modify Existing File: LocationSets.xml (Required)

Action: Define the following location set:

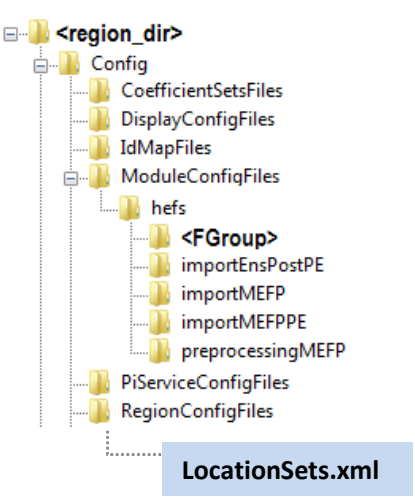
- Gages_HEFS: The locationIds of all gages for which EnsPost must execute over the entire RFC. These are the locationIds of the streamflow ensemble time series to be post-processed by EnsPost.

Add it to this file:

<*configuration_dir*>/RegionConfigFiles/LocationSets.xml

See the example below for text to add before the closing "</locationSets>" at the end of the file. Replace *gageLocationId* with the appropriate locationId for the *installation segment* (one line must be added per catchment).

NOTE: All locationsIds provided in the location sets must be included in the file <*configuration_dir*>/RegionConfigFiles/Locations.xml. See Section 5.2.1 for troubleshooting tips.

Standard Location: <*configuration_dir*>/**RegionConfigFiles/**	**Contents:** ***LocationSets.xml***
	<?xml version="1.0" encoding="UTF-8"?> <locationSets version="1.1" xmlns="http://www.wldelft.nl/fews" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation="http://www.wldelft.nl/fews http://chps1/schemas/locationSets.xsd"> … **<!-- ADDED FOR HEFS EnsPostPE ========== -->** … **<locationSet id="Gages_HEFS">** **<locationId>*gageLocationId1*</locationId>** **<locationId>*gageLocationId2*</locationId>** **</locationSet>** **<!-- END HEFS EnsPostPE ========== -->** </locationSets>

2.4.5 Modify Existing File: Explorer.xml (Required)

Action: Add a new explorer task for EnsPostPE to the following file:

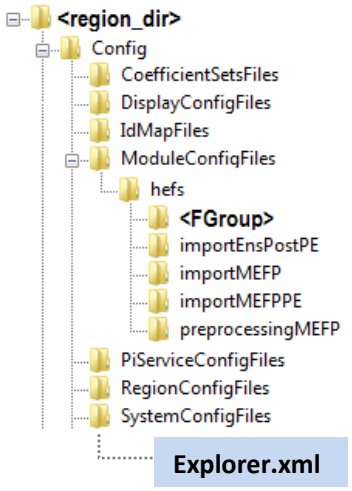
<*configuration_dir*>/SystemConfigFiles/Explorer.xml

See the example below for the exact text to add immediately before the closing "</explorerTasks>" and after the last already defined explorerTask XML element. A sample is provided in the following file (search for "HEFS" to find added workflow descriptors):

<*tar_root_dir*>/enspostpe/samples/Config/SystemConfigFiles/Explorer.xml

If XML has already been added for HEFS (i.e., if the "ADDED FOR HEFS EnsPostPE" line already exists in the file), insert the new XML just before the current "END HEFS EnsPostPE" line.

Description: The added explorer task allows EnsPostPE to be accessed as a plug-in to the CHPS interface. By installing it as the last explorerTask defined within the explorerTasks XML element, it will show up as the last button in the CHPS interface toolbar.

Standard Location: <*configuration_dir*>/**RegionConfigFiles/**	**Contents:** ***Explorer.xml***
	<?xml version="1.0" encoding="UTF-8"?> <explorer version="1.1" xmlns="http://www.wldelft.nl/fews" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation="http://www.wldelft.nl/fews http://chps1/schemas/explorer.xsd"> … <explorerTasks> … **<!-- ADDED FOR HEFS EnsPostPE** **========== -->** **<explorerTask name="EnsPostPE">** **<taskClass>ohd.hseb.hefs.enspost.pe.HEFSEnsPostPEExplorerPlugIn</taskClass>** **<toolbarTask>true</toolbarTask>** **<menubarTask>true</menubarTask>** **</explorerTask>** **<!-- END HEFS EnsPostPE ========== -->** </explorerTasks> … </explorer >

2.5 *Confirm Installation*

To confirm the installation, follow the instructions in Section 3 for estimating parameters for the *installation segments*. Once completed, confirm that appropriate parameter files were created under the directory:

< *ens_post_root_dir*>/ensPostRootDir/.

3 Estimating Parameters

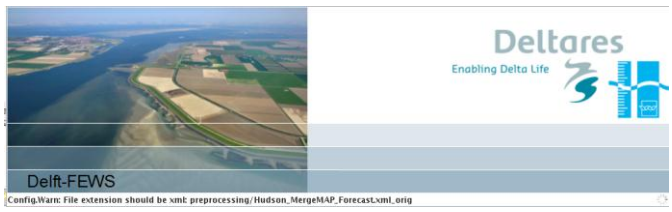
This section presents very basic instructions for estimating parameters for the installation catchments. The general steps are as follows:

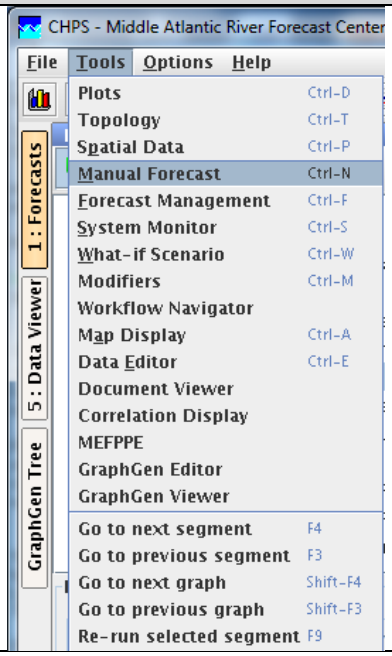
1. Start CHPS.
2. Import datacard files that contain the observed stream flow time series data and the pixml historical simulated stream flow time series to be used for parameter estimation.
3. Start the EnsPostPE.
4. Define the appropriate connection to the PI-service.
5. Use the **Export Historical Data Subpanel** of the **Setup Panel** to extract the time series from the localDataStore via the FEWS PI-service and make it available to EnsPostPE.
6. Perform all steps necessary for the installation Gages by clicking on the **Run All Button** in the **Location Summary Panel** of the EnsPostPE.
7. Close EnsPostPE and shutdown CHPS.

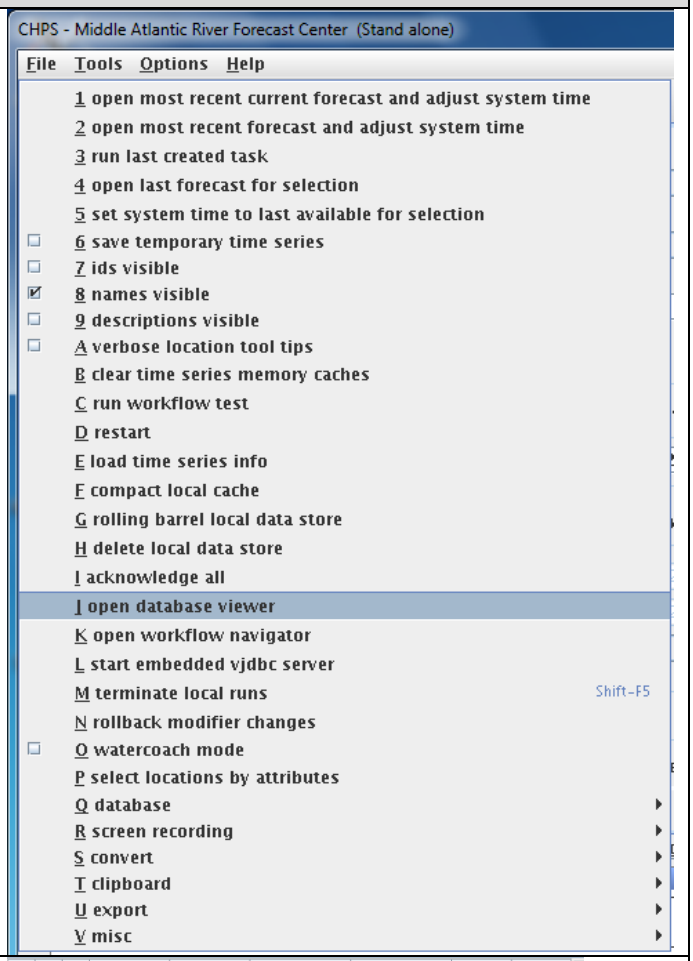
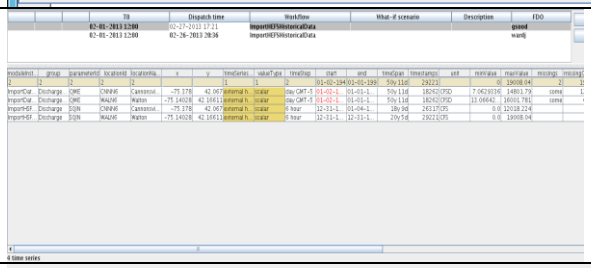
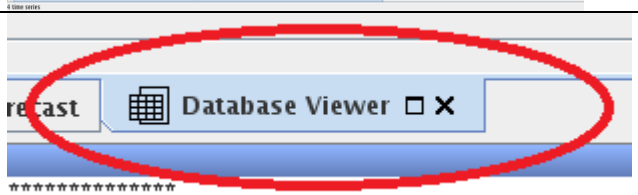
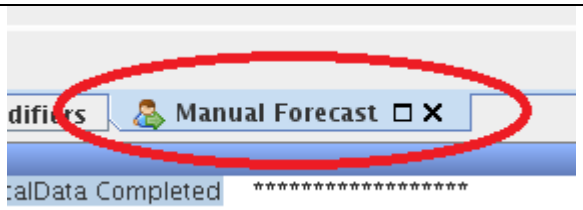
The following steps are not described here, but are described in the *EnsPostPE User's Manual*:

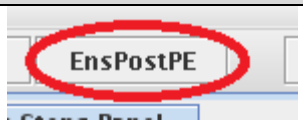
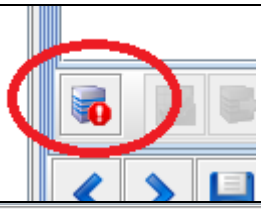
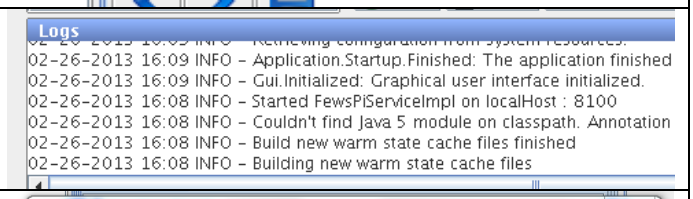
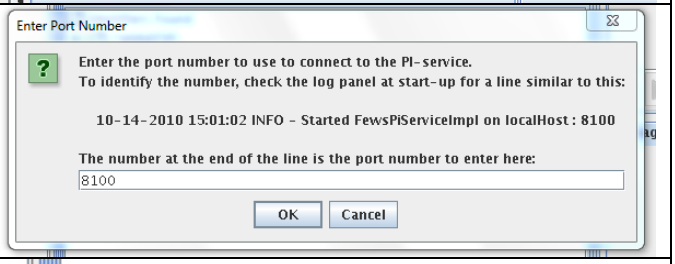
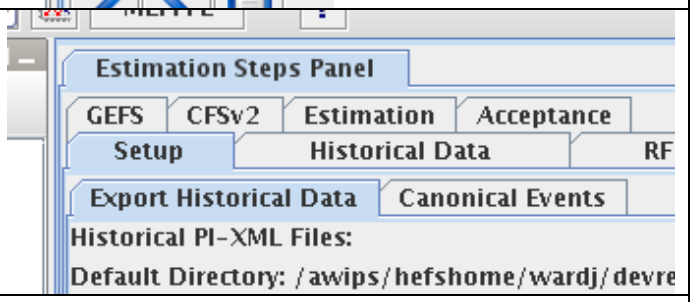
- Setting estimation options and estimating the parameters via the **Estimation Panel**.
- Accepting the parameters, which zips up the parameter files from the EnsPostPE run area to the <*ens_post_root_dir*>/parameters directory.
- Using the **Diagnostics Panel** to view data and parameters.

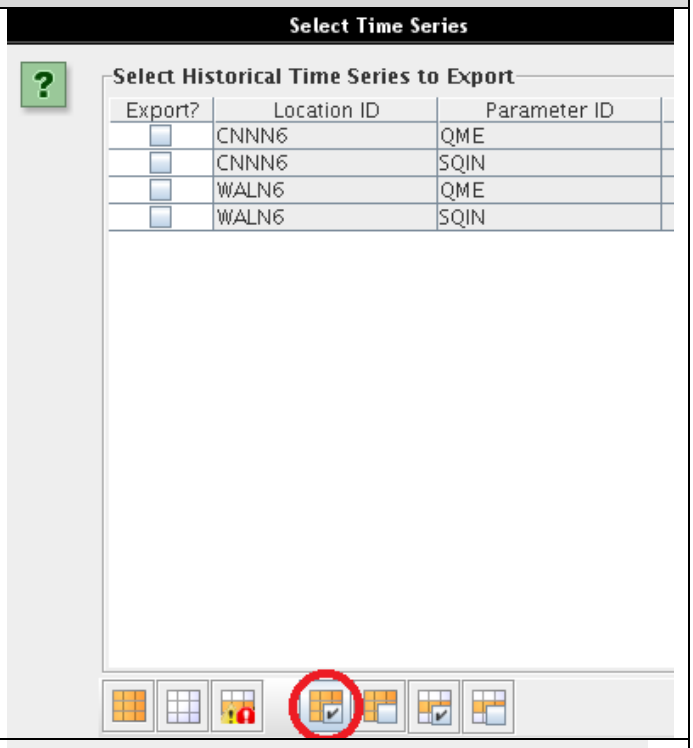
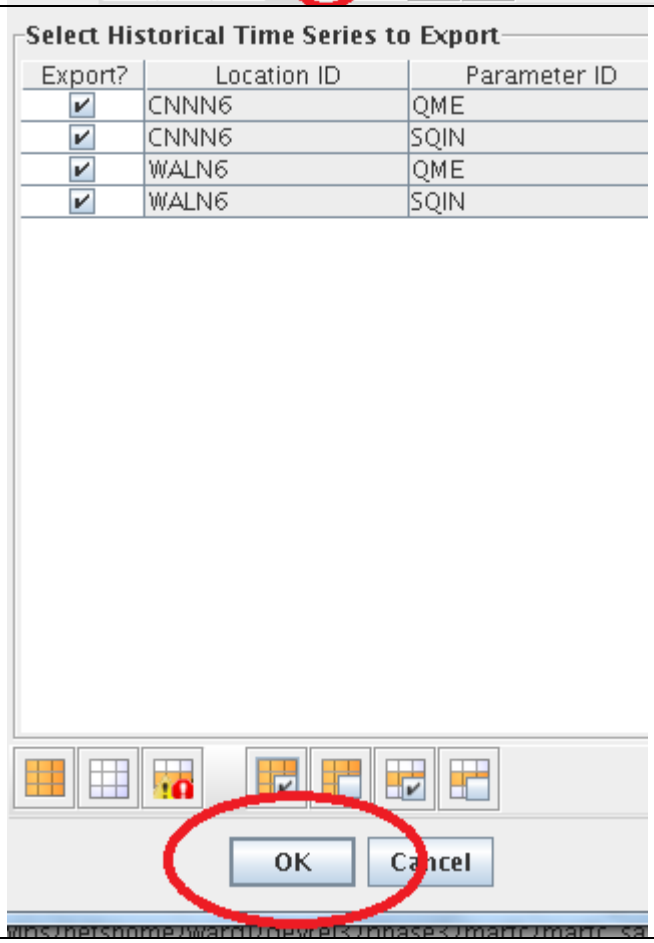
The first two steps above are performed non-interactively using default settings when the **Run All Button** is clicked. The last step can be applied after the fact or step-by-step to quality control data and examine parameter estimation results.

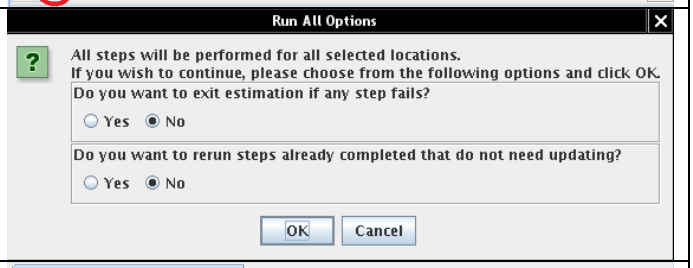
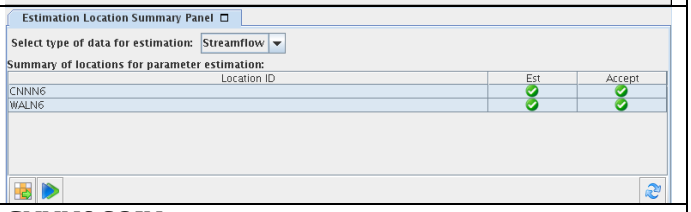
#	Action	Expected Results
1	Start FEWS using the installation standalone: ***cd*** *<region_dir>* ***cd ..*** ***./hefsPlugins/fews_hefsPlugins.sh ##rfc_sa &***	FEWS will be started. The splash screen displayed will vary by RFC. The default splash screen is:  After a short time, the CHPS interface will open.

#	Action	Expected Results
2	In CHPS run the "**ImportEnsPostPEHistoricalData**" workflow. Choose Tools (menu), Manual Forecast (menu option).	
3	Under Workflow (pull down menu), choose **ImportEnsPostPEHistoricalData.** It may be the last Workflow.	
4	Click Run (button). 	Output (in the CHPS log area) will have "Workflow ImportEnsPostPEHistoricalData Completed", as shown in the following figure. The historical datacards and simulated pixml files have been imported.

#	Action	Expected Results
5	Click in the Logs panel, hit the F12 key, and hit the J key to open the database viewer.	
6	The imported data should be present.	
7	Close the Database Viewer by clicking on the X at the bottom of the window.	
8	Close the Manual Forecast by clicking on the X at the bottom of the window.	

#	Action	Expected Results
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 8100).	
12	Click on the PI-service icon, enter your PI-service port number (here 8100), and click OK.	
13	When successfully connected, two database icons should be green.	
14	Select Export Historical Data in the Setup subpanel of the Estimation Steps Panel.	
15	Click on the Export Time Series icon.	

#	Action	Expected Results
16	Select All time series to export.	
17	When all of the time series are selected, click OK.	

#	Action	Expected Results
18	Shift + Click to select all Location ID rows, then click on the Run All double arrow.	
19	Select OK in the Run All Options window.	
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.	CNNN6.SQIN.enspost.parameters.tgz WALN6.SQIN.enspost.parameters.tgz

4 Adding Segments and Forecast Groups

When adding a new segment, the only change required to allow for the EnsPostPE to estimate parameters is to add the appropriate gage locationId to the location set Gages_HEFS. See step 2.4.4. With that change, the import modules should be able to import the appropriate historical observed stream flows and historical simulated stream flows and the EnsPostPE should be able to extract the time series from the CHPS localDataStore so that parameters can be estimated.

5 Tips and Trouble Shooting

This section provides basic tips and troubleshooting related to the installation and use of EnsPostPE.

5.1 *Tips*

5.1.1 Moving the EnsPostPE to Another Stand-alone

To move the EnsPostPE to another stand-alone, first perform the installation step presented above. After installing, copy the EnsPost run area from the current stand-alone to the new stand-alone:

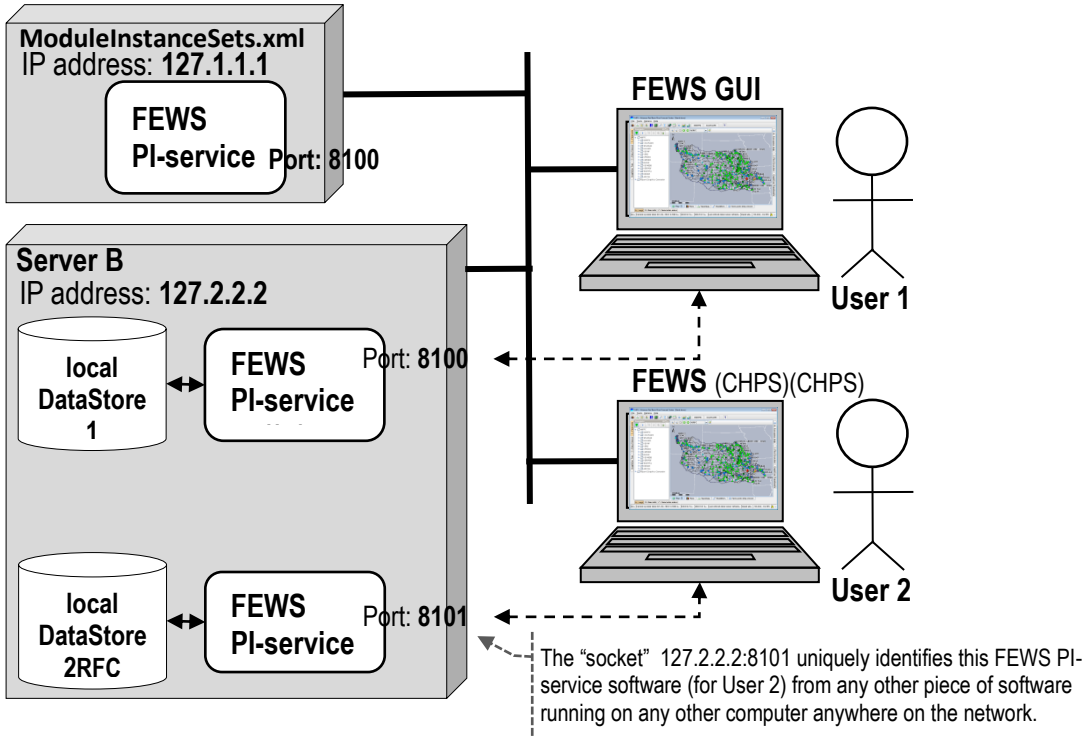
cp –r <*enspostpe_run_area*> <new *region_dir*>/Models/hefs/.

After doing this copy, when the EnsPostPE is started in the new stand-alone, it will have access to all files used in the current stand-alone, including binary historical data files, archived forecast and reforecast data files, and parameters already estimated.

5.1.2 Setting the FEWS PI-Service Port Number for Interactive Use

EnsPostPE makes use of the FEWS Published Interface (PI)-service. However, before EnsPostPE can make use of the FEWS PI-service, it must be configured correctly. The below describes the problem of identifying the correct connection and how to direct EnsPostPE to use the correct connection.

IP addresses enable computers to be uniquely addressed. Since each computer has its own unique IP address; messages can be correctly delivered (from one computer to the next) as long as the message contains the destination's IP address. However, with **multiple pieces of software on a single computer**, ports are also required:



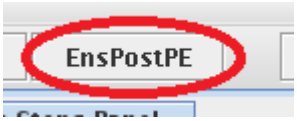
In the above figure, the FEWS interface for User 2 needs to send a message to the FEWS PI-service software on Server B. However, there are two copies of the PI-service running on Server B. Which copy of the PI-service will receive the message? Using only the IP address for Server B (127.2.2.2) will not indicate which of the two PI-services will receive the message. Moreover, we do not want User 2 changing data in the localDataStore that belongs to User 1. Consequently, we need an addressing mechanism that uniquely identifies both computers **and** FEWS instances running on those computers. Port numbers supply the additional piece of information that uniquely identifies a single FEWS instance on a computer. (The combination of an IP address and a port number is often referred to as a "socket".)

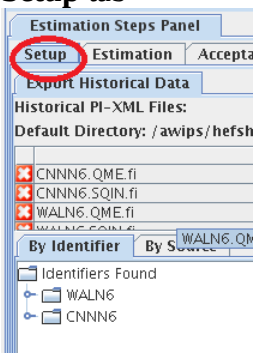
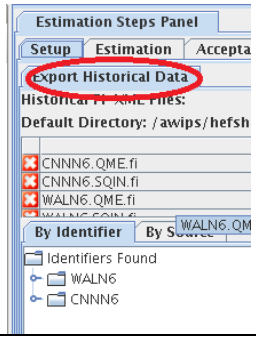
When the first user (on a particular computer) starts FEWS, it automatically starts a FEWS PI-service for that user and assigns the PI-service software a port number of 8100. However, when a second user on the same computer attempts to run FEWS, FEWS recognizes that another user

is already "using" port number 8100 and automatically assigns the next user PI-service port number 8101. The third user will get 8102, and so on.

Unfortunately, EnsPostPE has no way of knowing which PI-service port number was assigned to an instance of FEWS. The FEWS software does not currently provide a mechanism for FEWS explorer plug-in to ask what the current user's FEWS instance port number is. Consequently, **the FEWS PI-service connection must be manually configured by HEFS users**.

To ensure a proper connection to the PI-service, the following should be executed immediately after starting the CHPS interface that has Graphics Generator installed:

#	Action
1	To find your PI-service port number, check the **Logs Panel** for lines similar to the following: 11-04-2010 11:16:08 INFO - OHD FEWS explorer plug-in software establishing connection to CHPS FewsPiServiceImpl on localHost : 8100... 11-04-2010 11:16:01 INFO - Started FewsPiServiceImpl on localHost : 8101 11-04-2010 11:16:01 WARN - Failed to start: SocketListener0@0.0.0.0:8100 In the above example, note the yellow highlighted number 8100. 8100 was the port number that the Graphics Generator attempted to connect to in order to access the PI-service. Note also the above warning: "WARN – Failed to start: SocketListener0@0.0.0.0:8100". This is an indicator that port 8100 was not available because another user is already using it. Look for the text "Started FewsPiServiceImpl" which indicates the automatically assigned port number, shown highlighted in green above. In this case, 8101 is the port number of the PI-service started for **your FEWS session** and 8101 is the port number Graphics Generator should use. (Note that in this case the new port number was 8101. This may not always be true since it is not always obvious how many FEWS users are using the same computer.) **You should always check to see which port number was assigned to your FEWS PI-service**. If your assigned port number is not the default (8100), as is the case above, the HEFS GUI components will fail to connect to the PI-service or will connect to the *wrong* PI-service. **If your port number is not 8100, then continue to Step 2. Otherwise, if your port number is 8100 there is no need to make a correction and the steps below can be skipped.**
2	Click on the **EnsPostPE Button** in the toolbar of the CHPS interface, 

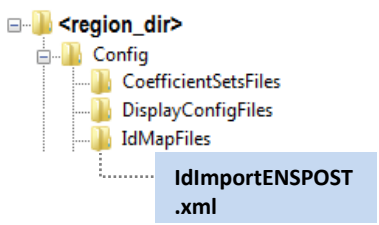
#	Action
3	Make the **Export Historical Data SubPanel** of the **Setup Panel** active by, clicking on **Setup** tab  in the EnsPostPE and clicking on the **Export Historical Data** tab 
4	Click on the **Reconnect to CHPS PI-service Button** , , to set the port number.
5	In the **Enter Port Number Dialog** that opens, enter the correct port number (green highlighted number in Step 1 above.) and click **OK**. After a brief delay, a connection will be established (button will display) or an error message will be displayed if a problem occurred (button will display).

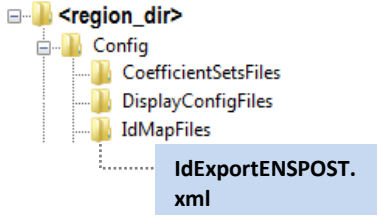
5.2 *Troubleshooting*

5.2.1 Location IDs

When adding LocationSets to the LocationSets.xml file, the location IDs should match the location ID element of the pi-xml file and/or the location ID in the datacard file. If they do not match, an idMapping will be needed for importing the data.

For example:

Standard Location: <*configuration_dir*>**/IdMapFiles/**	**Contents:** ***IdImportENSPOST.xml***
	<?xml version="1.0" encoding="UTF-8"?> <idMap version="1.1" xmlns="http://www.wldelft.nl/fews" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation="http://www.wldelft.nl/fews http://fews.wldelft.nl/schemas/version1.0/idMap.xsd"> <map internalParameter="SQIN" internalLocation="MTRN6HUD" externalParameter="SQIN" externalLocation="MTRN6"/> <enableOneToOneMapping/> </idMap>

Standard Location: <*configuration_dir*>**/IdMapFiles/**	**Contents:** ***IdExportENSPOST.xml***
	<?xml version="1.0" encoding="UTF-8"?> <idMap version="1.1" xmlns="http://www.wldelft.nl/fews" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation="http://www.wldelft.nl/fews http://fews.wldelft.nl/schemas/version1.0/idMap.xsd"> <map internalParameter="SQIN" internalLocation="MTRN6HUD" externalParameter="SQIN" externalLocation="MTRN6"/> <enableOneToOneMapping/> </idMap>

Appendix A: Formatting Datacard Files for Import

To estimate parameters, EnsPostPE requires historical simulated stream flow time series (SQIN/QINE) and observed stream flow timeseries (QIN/QME). The recommended mechanism for making this data available to EnsPostPE is via the FEWS PI-service. However, in order for EnsPostPE to acquire that data, it must first be imported into the parameter estimation stand-alone localDataStore.

With this release is provided a workflow, ImportHEFSHistoricalData, designed to import MAP, MAT, and historical streamflow (QME) data from a datacard file in local time. For that workflow to successfully import a datacard file, however, the datacard file must be properly formatted.

This appendix describes errors commonly found in datacard files to be imported and how best to correct those errors prior to importing the files.

A.1 Location identifier in the datacard file is a number, does not match the expected locationId, or is missing

The locationId assumed by CHPS when it imports a datacard file is specified in the header of that file. The position of the locationId is highlighted in the following datacard file examples:

Example 1: Numerical/Invalid locationId

```
...
              QME  L3   CFSD 24   01431500      Lackawaxen River At
10  1948 09   1999  6   F9.3
01431500    1048   0   55.000   52.000   48.000   43.000   41.000   45.000
01431500    1048   0   42.000   40.000   43.000   45.000   48.000   63.000
01431500    1048   0   57.000   48.000   42.000   38.000   36.000   74.000
01431500    1048   0  128.000   84.000   66.000   55.000   50.000   46.000
...
```

Example 2: Missing locationId

```
...
DATACARD      QME  L3   CFSD 24
 1  1951  9   2006  4   F14.5
DOLC2        151   1      42.00000      39.00000      37.00000      39.00000
DOLC2        151   2      41.00000      37.00000      33.00000      36.00000
DOLC2        151   3      39.00000      37.00000      38.00000      40.00000
...
```

In either case, edit the file manually in order to modify or insert an appropriate locationId in the file. Optionally, for the first case where a numerical or invalid locationId is used, an import id-mapping can be applied to the module ImportDatacardsInLocaltime,

A.2 A '0' is used in front of single digit months within lines of the datacard file

The following is an example of a datacard file that will not import successfully because of a zero preceding single digit months:

```
...
01431500    1248   0  150.000  140.000  130.000  135.000  160.000 4100.000
01431500    1248   0 5300.000
01431500    0149   0 2060.000 1350.000  950.000  687.000 1450.000 6030.000
01431500    0149   0 3090.000 1930.000 1360.000 1100.000  980.000  766.000
01431500    0149   0  652.000  574.000  440.000  455.000  480.000  495.000
01431500    0149   0  538.000  624.000  465.000  465.000  450.000  506.000
01431500    0149   0  822.000  673.000  556.000  708.000  893.000  600.000
01431500    0149   0  500.000
01431500    0249   0  520.000  460.000  350.000  435.000  420.000  370.000
01431500    0249   0  382.000  350.000  340.000  320.000  290.000  270.000
...
```

To fix the problem, the problematic zeros must be removed:

```
...
01431500    1248   0  150.000  140.000  130.000  135.000  160.000 4100.000
01431500    1248   0 5300.000
01431500     149   0 2060.000 1350.000  950.000  687.000 1450.000 6030.000
01431500     149   0 3090.000 1930.000 1360.000 1100.000  980.000  766.000
01431500     149   0  652.000  574.000  440.000  455.000  480.000  495.000
01431500     149   0  538.000  624.000  465.000  465.000  450.000  506.000
01431500     149   0  822.000  673.000  556.000  708.000  893.000  600.000
01431500     149   0  500.000
01431500     249   0  520.000  460.000  350.000  435.000  420.000  370.000
01431500     249   0  382.000  350.000  340.000  320.000  290.000  270.000
...
```

Appendix B: Repackaging existing EnsPost Parameters

EnsPostPE now places the generated parameters onto the file system instead of within the localDataStore. In addition, the parameter estimator tars/gzips the parameter files instead of zipping them (as it used to previously).

The name of the new tar/gzip parameter file must be:

<locationId>.<parameterId>.enspost.parameters.tgz

It must be located in the directory

<*ens_post_root_dir*>/ensPostParameters/.

In order to use the previously generated parameters, the parameters have to be repackaged via a tar command and moved to the appropriate location. First, find the appropriate old parameter file under the directory Config/ModuleDataSetFiles within the old parameter estimation stand-alone. Then, do the following (the tar command should be on one line; replace <*ens_post_root_dir*> with the appropriate directory):

```
unzip <old_parameter_file>.zip
tar –zcvf <locationId>.<parameterId>.enspost.parameters.tgz <locationId>.<parameterId>.param
    <locationId>.<parameterId>.xml <locationId>.<parameterId>/*
mv <locationId>.<parameterId>.enspost.parameters.tgz <ens_post_root_dir>/ensPostParameters/.
```

For example, the tar command to executing for locationId CNNN6 and parameterId SQIN is:

```
tar –zcvf CNNN6.SQIN.enspost.parameters.tgz CNNN6.SQIN.param CNNN6.SQIN.xml
    CNNN6.SQIN/*
```

Appendix C: Data Analysis to determine seasons and threshold flow

The EnsPostPE estimates the parameters to account for hydrologic uncertainty and bias in the model simulation. These vary according to season and the magnitude of flow. Therefore, for better quantification of hydrologic uncertainty and bias, the data is stratified according to season and magnitude of simulated flow, and parameters are estimated separately for each category. The stratification requires (a) identification of seasons and (b) defining a threshold flow.

Described in the following sections are changes that must be made to the configuration files to setup the EnsPost data ingest.

C.1 Copy New Files and Directories (All Steps Required)

Execute the following command to copy *all* new files and directories that are necessary for running the Data Analysis workflow into the installation stand-alone directory structure (replace *<region_dir>* and *<tar_root_dir>* appropriately):

```
cd <tar_root_dir>/enspostpe/FlowStats
cp –r Config <region_dir>/.
```

Most of the files and directories just copied will not be modified further.

C.2 Modify Existing ModuleInstanceDescriptors.xml (Required)

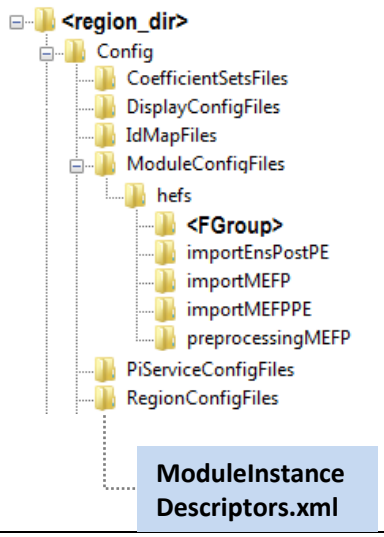
Action: Define new module instance descriptor in the file

<configuration_dir>/RegionConfigFiles/ModuleInstanceDescriptors.xml

See the example below for text to add immediately before the closing "**</moduleInstanceDescriptors>**" at the end of the file. Look for the moduleInstanceGroup called HEFSPEs and add the new ModuleInstanceDescriptor within that group. A sample is provided in the following file:

<tar_root_dir>/enspostpe/FlowStats/samples/Config/RegionConfigFiles/ModuleInstanceDescriptors.xml

Description: The added modules are used to import datacard data in the RFC local time zone,

Standard Location: *<configuration_dir>*/**RegionConfigFiles/**	**Contents:** ***ModuleInstanceDescriptors.xml***
	<?xml version="1.0" encoding="UTF-8"?> <moduleInstanceDescriptors xmlns="http://www.wldelft.nl/fews" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation="http://www.wldelft.nl/fews http://chps1/schemas/moduleInstanceDescriptors.xsd" version="1.0"> … **<!-- ADDED FOR HEFS EnsPostPE ========== -->** … **<moduleInstanceGroup id="HEFSPEs">** **<moduleInstanceDescriptor id="STATQME_HEFS_BASE_Calibration">** **<description>Calculates Statistics for Historical Observed and Simulated Flows</description>** **<moduleId>TransformationModule</moduleId>** **</moduleInstanceDescriptor>** **</moduleInstanceGroup>** **<!-- END HEFS EnsPostPE ========== -->** </moduleInstanceDescriptors>

C.3 Modify Existing File: WorkflowDescriptors.xml (Required)

Action: Define a new workflow descriptor in the file

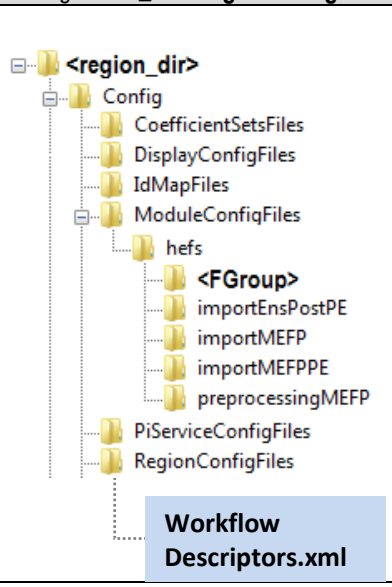
<configuration_dir>/RegionConfigFiles/WorkflowDescriptors.xml

See the example below for text to add immediately before the closing "</workflowDescriptors>" at the end of the file. A sample is provided in the following file:

<tar_root_dir>/FlowStats/enspostpe/FlowStats/samples/Config/RegionConfigFiles/WorkflowDescriptors.xml

Description: The added workflow executes the import modules.

NOTE: In the example below, the description element is a single line element, but is displayed on two lines in the example only because it is too long to fit on one line.

Standard Location: *<configuration_dir>*/**RegionConfigFiles/**	**Contents:** ***WorkflowDescriptors.xml***
	<?xml version="1.0" encoding="UTF-8"?> <workflowDescriptors xmlns="http://www.wldelft.nl/fews" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation="http://www.wldelft.nl/fews http://chps1/schemas/workflowDescriptors.xsd" version="1.0"> ... **<!-- ADDED FOR HEFS EnsPostPE ========== -->** ... **<workflowDescriptor id="HEFSFlowStats" name="Flow Stats - Observed vs Simulated - (Daily)" forecast="true" visible="true">** **<description>Calculates Statistics for Historical Observed and Simulated Flows</description>** **<timeZone>GMT-6</timeZone>** **</workflowDescriptor>** **<!-- END HEFS EnsPostPE ========== -->** </workflowDescriptors>

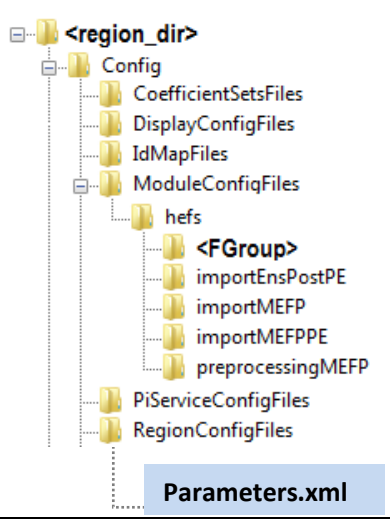
C.4 Modify Existing File: Parameters.xml (Required)

Action: Define a new parameter in the file

<configuration_dir>/RegionConfigFiles/Parameters.xml

See the example below for text to add within the Discharge Mean parameterGroup. A sample is provided in the following file:

<tar_root_dir>/FlowStats/enspostpe/FlowStats/samples/Config/RegionConfigFiles/Parameters.xml

Standard Location: *<configuration_dir>*/**RegionConfigFiles/**	**Contents:** ***Parameters.xml***
	<?xml version="1.0" encoding="UTF-8"?> <parameterGroups version="1.0" xmlns="http://www.wldelft.nl/fews" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation="http://www.wldelft.nl/fews http://chps1/schemas/parameters.xsd">… ..... **<parameterGroup id="Discharge Mean">** **<parameterType>accumulative</parameterType>** **<unit>CMSD</unit>** **<displayUnit>CFSD</displayUnit>** **<valueResolution>0.01</valueResolution>** .... **<!-- Added for HEFS EnsPostPE Flow Stats -->** **<parameter id="ESQME" name="Error DISCHARGE SIMULATED MEAN">** **<shortName>ESQME</shortName>** **</parameter>** **<!-- END HEFS EnsPostPE Flow Stats -->**

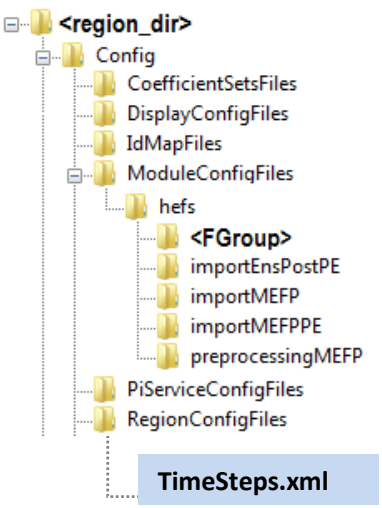
C.5 Modify Existing File: TimeSteps.xml (Required)

Action: Define a new set of timesteps in the file

<configuration_dir>/RegionConfigFiles/TimeSteps.xml

See the example below for text to add immediately before the closing "**</timeSteps>**" at the end of the file. Make sure there are no duplicates. A sample is provided in the following file:

<tar_root_dir>/FlowStats/enspostpe/FlowStats/samples/Config/RegionConfigFiles/TimeSteps.xml

Standard Location: *<configuration_dir>*/**RegionConfigFiles/**	**Contents:** ***TimeSteps.xml***
	<?xml version="1.0" encoding="UTF-8"?> <timeSteps xmlns="http://www.wldelft.nl/fews" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation="http://www.wldelft.nl/fews http://chps1/schemas/timeSteps.xsd"> .... **<!-- ADDED For HEFSEnsPostPE Flow Stats -->** **<timeStep id="monthly" monthDays="--01-01 --02-01 --03-01 --04-01 --05-01 --06-01 --07-01 --08-01 --09-01 --10-01 --11-01 --12-01"/>** **<timeStep id="jan1" monthDays="--01-01 --01-02 --01-03 --01-04 --01-05 --01-06 --01-07 --01-08 --01-09 --01-10"/>** **<timeStep id="jan2" monthDays="--01-11 --01-12 --01-13 --01-14 --01-15 --01-16 --01-17 --01-18 --01-19 --01-20"/>** **<timeStep id="jan3" monthDays="--01-21 --01-22 --01-23 --01-24 --01-25 --01-26 --01-27 --01-28 --01-29 --01-30 --01-31"/>** **<timeStep id="feb1" monthDays="--02-01 --02-02 --02-03 --02-04 --02-05 --02-06 --02-07 --02-08 --02-09 --02-10"/>** **<timeStep id="feb2" monthDays="--02-11 --02-12 --02-13 --02-14 --02-15 --02-16 --02-17 --02-18 --02-19 --02-20"/>** **<timeStep id="feb3" monthDays="--02-21 --02-22 --02-23 --02-24 --02-25 --02-26 --02-27 --02-28"/>** **<timeStep id="mar1" monthDays="--03-01 --03-02 --03-03 --03-04 --03-05 --03-06 --03-07 --03-08 --03-09 --03-10"/>** **<timeStep id="mar2" monthDays="--03-11 --03-12 --03-13 --03-14 --03-15 --03-16 --03-17 --03-18 --03-19 --03-20"/>** **<timeStep id="mar3" monthDays="--03-21 --03-22 --03-23 --03-24 --03-25 --03-26 --03-27 --03-28 --03-29 --03-30 --03-31"/>** **<timeStep id="apr1" monthDays="--04-01 --04-02 --04-03 --04-04 --04-05 --04-06 --04-07 --04-08 --04-09 --04-10"/>** **<timeStep id="apr2" monthDays="--04-11 --04-12 --04-13 --04-14 --04-15 --04-16 --04-17 --04-18 --04-19 --04-20"/>** **<timeStep id="apr3" monthDays="--04-21 --04-22 --04-23 --04-24 --04-25 --04-26 --04-27 --04-28 --04-29 --04-30"/>** **<timeStep id="may1" monthDays="--05-01 --05-02 --05-03 --05-04 --05-05 --05-06 --05-07 --05-08 --05-09 --05-10"/>** **<timeStep id="may2" monthDays="--05-11 --05-12 --05-13 --05-14 --05-15 --05-16 --05-17 --05-18 --05-19 --05-20"/>** **<timeStep id="may3" monthDays="--05-21 --05-22 --05-23 --05-24 --05-25 --05-26 --05-27 --05-28 --05-29 --05-30 --05-31"/>** **<timeStep id="jun1" monthDays="--06-01 --06-02 --06-03 --06-04 --06-05 --06-06 --06-07 --06-08 --06-09 --06-10"/>** **<timeStep id="jun2" monthDays="--06-11 --06-12 --06-13 --06-14 --06-15 --06-16 --06-17 --06-18 --06-19 --06-20"/>** **<timeStep id="jun3" monthDays="--06-21 --06-22 --06-23 --06-24 --06-25 --06-26 --06-27 --06-28 --06-29 --06-30"/>** **<timeStep id="jul1" monthDays="--07-01 --07-02 --07-03 --07-04 --07-05 --07-06 --07-07 --07-08 --07-09 --07-10"/>** **<timeStep id="jul2" monthDays="--07-11 --07-12 --07-13 --07-14 --07-15 --07-16 --07-17 --07-18 --07-19 --07-20"/>** **<timeStep id="jul3" monthDays="--07-21 --07-22 --07-23 --07-24 --07-25 --07-26 --07-27 --07-28 --07-29 --07-30 --07-31"/>** **<timeStep id="aug1" monthDays="--08-01 --08-02 --08-03 --08-04 --08-05 --08-06 --08-07 --08-08 --08-09 --08-10"/>** **<timeStep id="aug2" monthDays="--08-11 --08-12 --08-13 --08-14 --08-15 --08-16 --08-17 --08-18 --08-19 --08-20"/>** **<timeStep id="aug3" monthDays="--08-21 --08-22 --08-23 --08-24 --08-25 --08-26 --08-27 --08-28 --08-29 --08-30 --08-31"/>** **<timeStep id="sep1" monthDays="--09-01 --09-02 --09-03 --09-04 --09-05 --09-06 --09-07 --09-08 --09-09 --09-10"/>** **<timeStep id="sep2" monthDays="--09-11 --09-12 --09-13 --09-14 --09-15 --09-16 --09-17 --09-18 --09-19 --09-20"/>** **<timeStep id="sep3" monthDays="--09-21 --09-22 --09-23 --09-24 --09-25 --09-26 --09-27 --09-28 --09-29 --09-30"/>** **<timeStep id="oct1" monthDays="--10-01 --10-02 --10-03 --10-04 --10-05 --10-06 --10-07 --10-08 --10-09 --10-10"/>** **<timeStep id="oct2" monthDays="--10-11 --10-12 --10-13 --10-14 --10-15 --10-16 --10-17 --10-18 --10-19 --10-20"/>** **<timeStep id="oct3" monthDays="--10-21 --10-22 --10-23 --10-24 --10-25 --10-26 --10-27 --10-28 --10-29 --10-30 --10-31"/>** **<timeStep id="nov1" monthDays="--11-01 --11-02 --11-03 --11-04 --11-05 --11-06 --11-07 --11-08 --11-09 --11-10"/>** **<timeStep id="nov2" monthDays="--11-11 --11-12 --11-13 --11-14 --11-15 --11-16 --11-17 --11-18 --11-19 --11-20"/>** **<timeStep id="nov3" monthDays="--11-21 --11-22 --11-23 --11-24 --11-25 --11-26 --11-27 --11-28 --11-29 --11-30"/>** **<timeStep id="dec1" monthDays="--12-01 --12-02 --12-03 --12-04 --12-05 --12-06 --12-07 --12-08 --12-09 --12-10"/>** **<timeStep id="dec2" monthDays="--12-11 --12-12 --12-13 --12-14 --12-15 --12-16 --12-17 --12-18 --12-19 --12-20"/>** **<timeStep id="dec3" monthDays="--12-21 --12-22 --12-23 --12-24 --12-25 --12-26 --12-27 --12-28 --12-29 --12-30 --12-31"/>** **<!-- END For HEFSEnsPostPE Flow Stats -->**

C.6 Modify Existing File: TimeSeriesDisplayConfig.xml (Required)

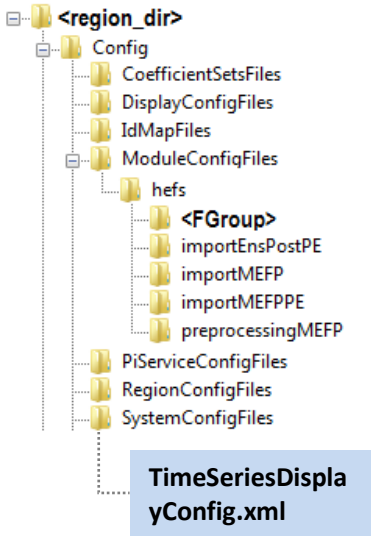
Action: Add new display options in the file

<configuration_dir>/SystemConfigFiles/TimeSeriesDisplayConfig.xml

See the example below for text to add immediately before the opening "<tickUnitsConfig>" at the end of the file. A sample is provided in the following file:

<tar_root_dir>/FlowStats/enspostpe/FlowStats/samples/Config/SystemConfigFiles/ TimeSeriesDisplayConfig.xml

NOTE: In the example below, the description element is a single line element, but is displayed on two lines in the example only because it is too long to fit on one line. The text highlighted in green is to be inserted before the existing </parametersDisplayConfig>

Standard Location: *<configuration_dir>*/**SystemConfigFiles/**	**Contents:** ***TimeSeriesDisplayConfig.xml***
	<?xml version="1.0" encoding="UTF-8"?> <timeSeriesDisplay xmlns="http://www.wldelft.nl/fews" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation="http://www.wldelft.nl/fews http://chps1/schemas/timeSeriesDisplay.xsd" version="1.0"> ... **<!-- ADDED FOR HEFS EnsPostPE Flow Stats** **========== -->** **<parameterDisplayOptions id="SQME">** **<qualifierId>monthly</qualifierId>** **<preferredColor>orange</preferredColor>** **<lineStyle>bar</lineStyle>** **</parameterDisplayOptions>** **<parameterDisplayOptions id="QME">** **<qualifierId>monthly</qualifierId>** **<preferredColor>green</preferredColor>** **<lineStyle>bar</lineStyle>** **</parameterDisplayOptions>** **<parameterDisplayOptions id="SQME">** **<qualifierId>accu</qualifierId>** **<qualifierId>error</qualifierId>** **<preferredColor>yellow</preferredColor>** **<lineStyle>bar</lineStyle>** **</parameterDisplayOptions>** **</parametersDisplayConfig>** **<statisticalFunctions>** **<statisticalFunction function="showPeaksAbove"></statisticalFunction>** **<statisticalFunction function="showLowsBelow"></statisticalFunction>** **<statisticalFunction function="principalcomponentanalysis">** **<observedParameterId>QME</observedParameterId>** **<simulatedParameterId>SQME</simulatedParameterId>** **</statisticalFunction>** **<statisticalFunction function="boxPlot">** **<statisticalFunction function="scatterPlot">** **<statisticalFunction function="durationExceedence">** **<statisticalFunction function="movingAverage">** **<movingAccumulationTimeSpan unit="day" multiplier="1"/>** **<movingAccumulationTimeSpan unit="day" multiplier="30"/>** **<movingAccumulationTimeSpan unit="day" multiplier="90"/>** **<movingAccumulationTimeSpan unit="day" multiplier="365"/>** **</statisticalFunction>**

Standard Location: <*configuration_dir*>**/SystemConfigFiles/**	**Contents:** ***TimeSeriesDisplayConfig.xml***
	<statisticalFunction function="accumulationInterval"> <movingAccumulationTimeSpan unit="day" multiplier="1"/> <movingAccumulationTimeSpan unit="day" multiplier="30"/> <movingAccumulationTimeSpan unit="day" multiplier="90"/> <movingAccumulationTimeSpan unit="day" multiplier="365"/> </statisticalFunction> <statisticalFunction function="calendarAggregation"> <movingAccumulationTimeSpan unit="day" multiplier="1"/> <movingAccumulationTimeSpan unit="day" multiplier="30"/> <movingAccumulationTimeSpan unit="day" multiplier="90"/> <movingAccumulationTimeSpan unit="day" multiplier="365"/> </statisticalFunction> <statisticalFunction function="centralMovingAverage"> <movingAccumulationTimeSpan unit="day" multiplier="1"/> <movingAccumulationTimeSpan unit="day" multiplier="30"/> <movingAccumulationTimeSpan unit="day" multiplier="90"/> <movingAccumulationTimeSpan unit="day" multiplier="365"/> </statisticalFunction> <statisticalFunction function="cumulative"> <movingAccumulationTimeSpan unit="day" multiplier="1"/> <movingAccumulationTimeSpan unit="day" multiplier="30"/> <movingAccumulationTimeSpan unit="day" multiplier="90"/> <movingAccumulationTimeSpan unit="day" multiplier="365"/> </statisticalFunction> </statisticalFunctions> <descriptiveFunctionGroups> <descriptiveFunctionGroup name="Stats"> <descriptiveFunction function="infoParameterId"/> <descriptiveFunction function="startTime"/> <descriptiveFunction function="endTime"/> <descriptiveFunction function="standardDeviation"/> <descriptiveFunction function="min"/> <descriptiveFunction function="max"/> <descriptiveFunction function="mean"/> </descriptiveFunctionGroup> </descriptiveFunctionGroups> <!-- ADDED FOR HEFS EnsPostPE Flow Stats ========== --> …. <tickUnitsConfig> <dateTickMarkPosition> <dateTickUnit>hour</dateTickUnit> <tickMarkPosition>12</tickMarkPosition> </dateTickMarkPosition> </tickUnitsConfig> </timeSeriesDisplay>

C.7 Modify New File: STATQME_HEFS_BASE_Calibration.xml (Required)

Action: Open the file

<*configuration_dir*>/ModuleConfigFiles/stats/STATQME_HEFS_BASE_Calibration.xml

in your editor of choice. The line that might have to be modified is line 26.

Line 26:

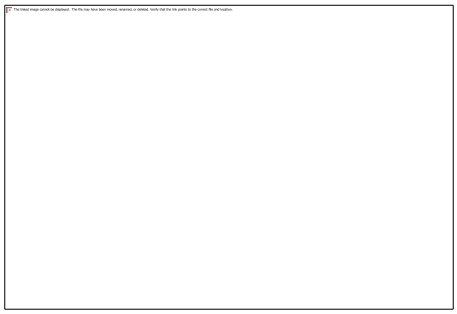
```
<timeStep unit="hour" multiplier="6"/>
```

Change the multiplier to the timestep used in the SQIN data that was imported.

C.8 Running the HEFS Flow Stats workflow

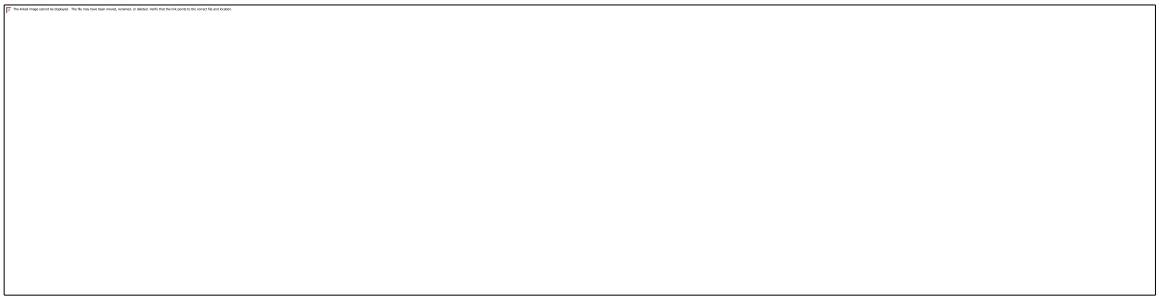
This is assuming the Import workflow has already been run using the instructions in Section 3

In FEWS, bring up the Manual Forecast Display

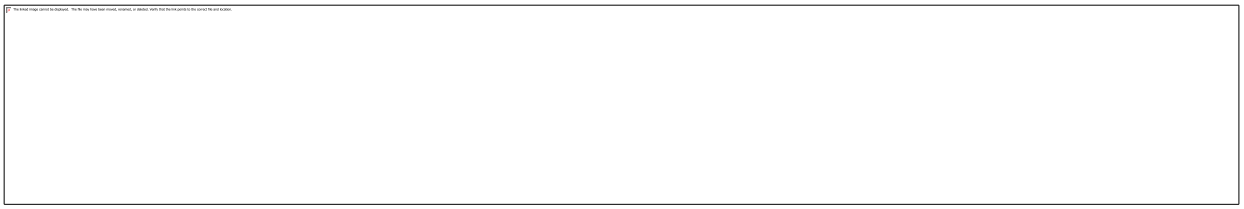


Manual Forecast Display button

1. Select and run the workflow to calculate the statistics (Flow Stats – Observed vs Simulated – Daily)

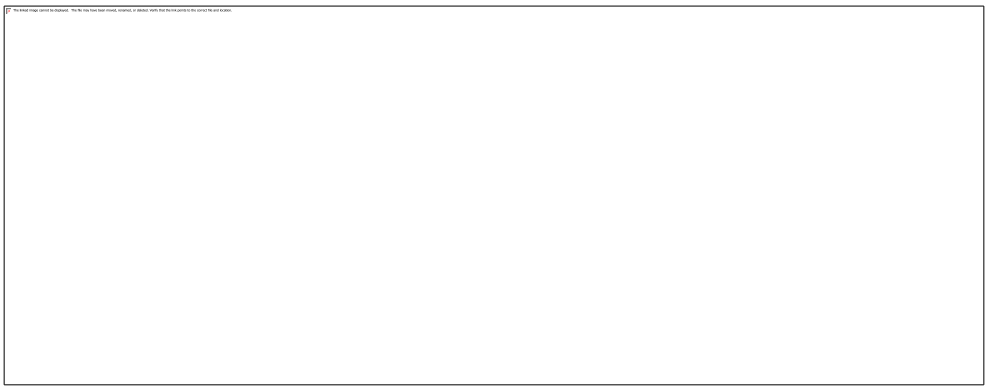


2. Open the database viewer (hit F12) and select the “Flow Stats” workflow



3. Select 1 or 2 timeseries and right click to select “Show Timeseries Dialog”

4. If using two timeseries, right click after the two time series are selected (use the Ctrl key to add to the selection). When the display comes up, select “Scatter Plot” from the statistical function dropdown menu at the top.

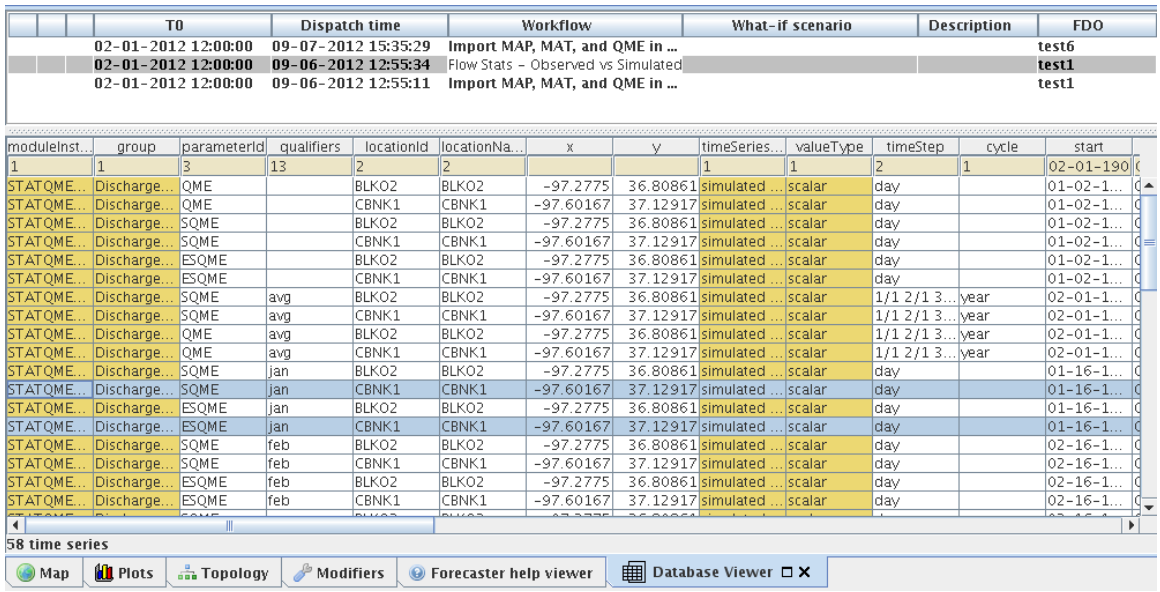


The following plots were developed modifying the *x* and *y*- axis time series accordingly by using the dropdown menu at the top. Once you have a plot up, you can automatically change the timeseries that you want to display (without right clicking) by highlighting the timeseries in the database viewer.

Identification of seasons

(i) Develop scatter plots for the error (*y*-axis) against simulated flow (*x*-axis) for each calendar month. Seasonality in the error used for identification of seasons. Two seasons (preferably bi-annual) with consecutive months is recommended.

Step 1: Select two rows in the database viewer, right click, and select show timeseries. Both rows, SQME and ESQME, should be for the same month. See the figure below:

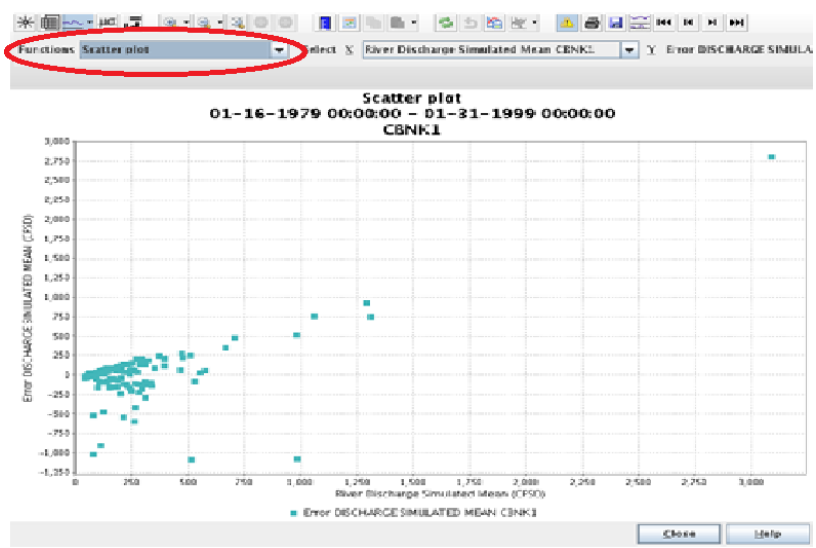


T0	Dispatch time	Workflow	What-if scenario	Description	FDO
02-01-2012 12:00:00	09-07-2012 15:35:29	Import MAP, MAT, and QME in ...			test6
02-01-2012 12:00:00	09-06-2012 12:55:34	Flow Stats - Observed vs Simulated			test1
02-01-2012 12:00:00	09-06-2012 12:55:11	Import MAP, MAT, and QME in ...			test1

moduleInst...	group	parameterId	qualifiers	locationId	locationNa...	x	y	timeSeries...	valueType	timeStep	cycle	start
1	1	3	13	2	2			1	1	2	1	02-01-190
STATQME...	Discharge...	QME		BLKO2	BLKO2	-97.2775	36.80861	simulated ...	scalar	day		01-02-1...
STATQME...	Discharge...	QME		CBNK1	CBNK1	-97.60167	37.12917	simulated ...	scalar	day		01-02-1...
STATQME...	Discharge...	SQME		BLKO2	BLKO2	-97.2775	36.80861	simulated ...	scalar	day		01-02-1...
STATQME...	Discharge...	SQME		CBNK1	CBNK1	-97.60167	37.12917	simulated ...	scalar	day		01-02-1...
STATQME...	Discharge...	ESQME		BLKO2	BLKO2	-97.2775	36.80861	simulated ...	scalar	day		01-02-1...
STATQME...	Discharge...	ESQME		CBNK1	CBNK1	-97.60167	37.12917	simulated ...	scalar	day		01-02-1...
STATQME...	Discharge...	SQME	avg	BLKO2	BLKO2	-97.2775	36.80861	simulated ...	scalar	1/1 2/1 3...	year	02-01-1...
STATQME...	Discharge...	SQME	avg	CBNK1	CBNK1	-97.60167	37.12917	simulated ...	scalar	1/1 2/1 3...	year	02-01-1...
STATQME...	Discharge...	QME	avg	BLKO2	BLKO2	-97.2775	36.80861	simulated ...	scalar	1/1 2/1 3...	year	02-01-1...
STATQME...	Discharge...	QME	avg	CBNK1	CBNK1	-97.60167	37.12917	simulated ...	scalar	1/1 2/1 3...	year	02-01-1...
STATQME...	Discharge...	SQME	jan	BLKO2	BLKO2	-97.2775	36.80861	simulated ...	scalar	day		01-16-1...
STATQME...	Discharge...	SQME	jan	CBNK1	CBNK1	-97.60167	37.12917	simulated ...	scalar	day		01-16-1...
STATQME...	Discharge...	ESQME	jan	BLKO2	BLKO2	-97.2775	36.80861	simulated ...	scalar	day		01-16-1...
STATQME...	Discharge...	ESQME	jan	CBNK1	CBNK1	-97.60167	37.12917	simulated ...	scalar	day		01-16-1...
STATQME...	Discharge...	SQME	feb	BLKO2	BLKO2	-97.2775	36.80861	simulated ...	scalar	day		02-16-1...
STATQME...	Discharge...	SQME	feb	CBNK1	CBNK1	-97.60167	37.12917	simulated ...	scalar	day		02-16-1...
STATQME...	Discharge...	ESQME	feb	BLKO2	BLKO2	-97.2775	36.80861	simulated ...	scalar	day		02-16-1...
STATQME...	Discharge...	ESQME	feb	CBNK1	CBNK1	-97.60167	37.12917	simulated ...	scalar	day		02-16-1...

The locationid/locationNames/x/y will differ depending on your RFC

Step 2: In the Functions drop down menu, select Scatter Plot:



Sample scatter plot of error vs. simulated flow for January. This will differ based on your location

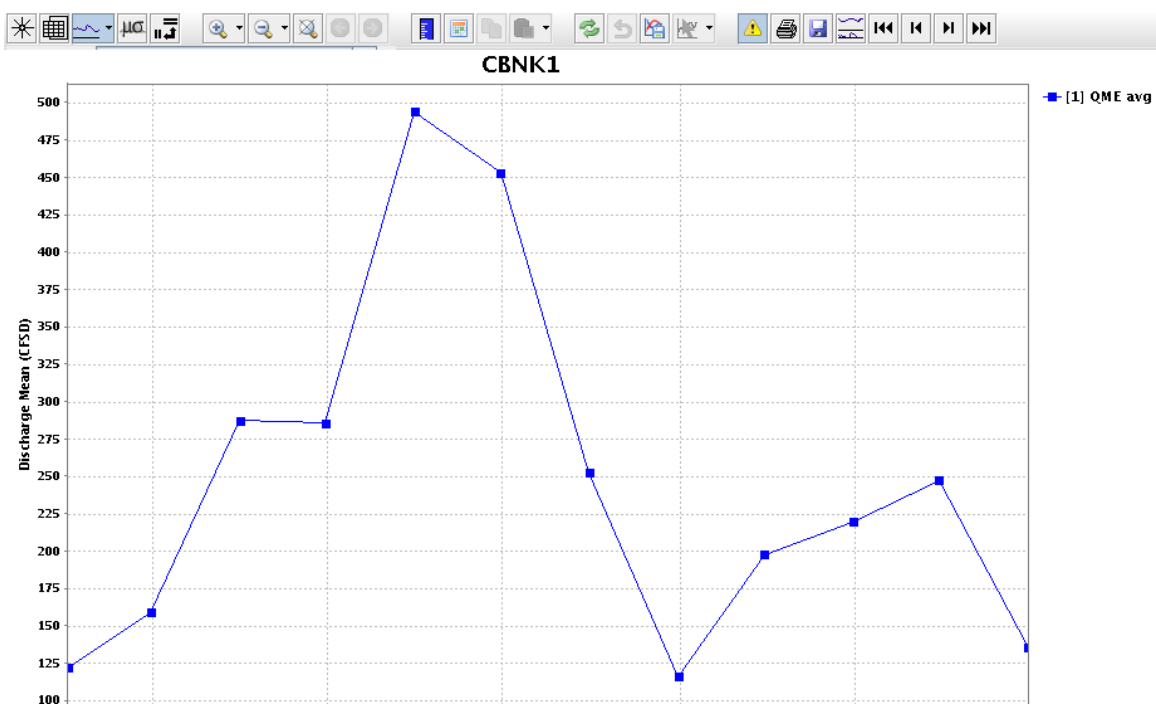
(ii) Develop annual hydrograph of observed flow. If the error in simulated flow does not exhibit seasonality, then seasonality of the observed flows is considered. If the observed flows are affected by regulations or other anthropogenic factors, then most likely the seasonality will be different from seasonality of natural flows at upstream or nearby locations; however, it is used for identification of seasons. Two seasons (preferably bi-annual) with consecutive months is recommended.

Step 1: Select the QME avg row in the database viewer, right click, and select show timeseries. See the figure below:

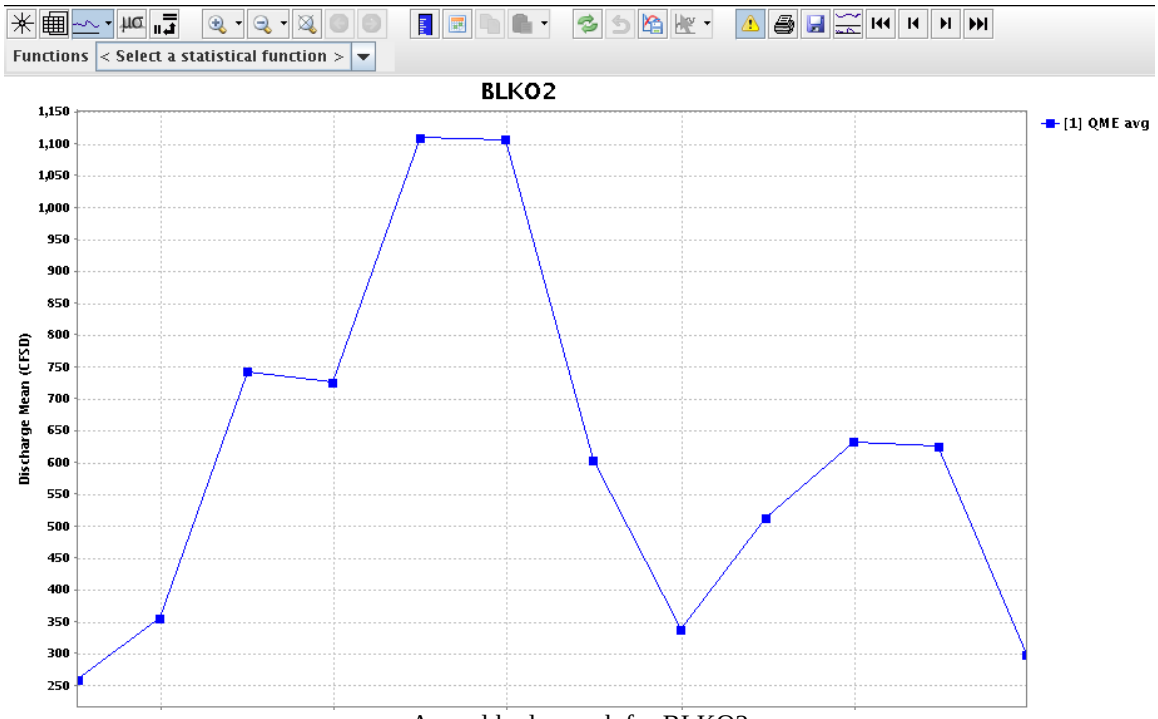
			T0	Dispatch time	Workflow	W
			04-30-2012 12:00	09-11-2012 19:56	Flow Stats - Observed vs Simulated - (D...	
			04-30-2012 12:00	09-11-2012 19:16	Import MAP, MAT, and QME in local time ...	

moduleInst...	group	parameterId	qualifiers	locationId	locationNa...	x	y	timeSeries...	valueType	timeStep	cycle	start	end
1	1	3	13	2	2			1	1	2	1	02-01-190	01-01-199
STATQME...	Discharge...	ESQME		CNNN6	Cannonsvi...	-75.378	42.067	simulated ...	scalar	day		01-01-1...	01-04-1...
STATQME...	Discharge...	QME		CNNN6	Cannonsvi...	-75.378	42.067	simulated ...	scalar	day		01-02-1...	01-01-1...
STATQME...	Discharge...	SQME		CNNN6	Cannonsvi...	-75.378	42.067	simulated ...	scalar	day		01-01-1...	01-04-1...
STATQME...	Discharge...	ESQME		WALN6	Walton	-75.14028	42.16611	simulated ...	scalar	day		01-01-1...	12-31-1...
STATQME...	Discharge...	QME		WALN6	Walton	-75.14028	42.16611	simulated ...	scalar	day		01-02-1...	01-01-1...
STATQME...	Discharge...	SQME		WALN6	Walton	-75.14028	42.16611	simulated ...	scalar	day		01-01-1...	12-31-1...
STATQME...	Discharge...	QME	avg	CNNN6	Cannonsvi...	-75.378	42.067	simulated ...	scalar	1/1 2/1 3...	year	02-01-1...	01-01-1...
STATQME...	Discharge...	SQME	avg	CNNN6	Cannonsvi...	-75.378	42.067	simulated ...	scalar	1/1 2/1 3...	year	02-01-1...	01-01-1...
STATQME...	Discharge...	QME	avg	WALN6	Walton	-75.14028	42.16611	simulated ...	scalar	1/1 2/1 3...	year	02-01-1...	01-01-1...
STATQME...	Discharge...	SQME	avg	WALN6	Walton	-75.14028	42.16611	simulated ...	scalar	1/1 2/1 3...	year	02-01-1...	01-01-1...
STATQME...	Discharge...	ESQME	apr	CNNN6	Cannonsvi...	-75.378	42.067	simulated ...	scalar	day		04-16-1...	04-15-1...
STATQME...	Discharge...	SQME	apr	CNNN6	Cannonsvi...	-75.378	42.067	simulated ...	scalar	day		04-16-1...	04-15-1...
STATQME...	Discharge...	ESQME	aug	CNNN6	Cannonsvi...	-75.378	42.067	simulated ...	scalar	day		08-16-1...	08-15-1...
STATQME...	Discharge...	SQME	aug	CNNN6	Cannonsvi...	-75.378	42.067	simulated ...	scalar	day		08-16-1...	08-15-1...
STATQME...	Discharge...	ESQME	dec	CNNN6	Cannonsvi...	-75.378	42.067	simulated ...	scalar	day		12-16-1...	12-15-1...
STATQME...	Discharge...	SQME	dec	CNNN6	Cannonsvi...	-75.378	42.067	simulated ...	scalar	day		12-16-1...	12-15-1...
STATQME...	Discharge...	ESQME	feb	CNNN6	Cannonsvi...	-75.378	42.067	simulated ...	scalar	day		02-16-1...	02-15-1...

The locationid/locationNames/x/y will differ depending on your RFC



Annual hydrograph for CBNK1



Annual hydrograph for BLKO2

	Season #	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
✖	1	☐	✔	✔	✔	✔	✔	✔	☐	☐	☐	☐	☐
✖	2	✔	☐	☐	☐	☐	☐	☐	✔	✔	✔	✔	✔

Seasons to be used for CBNK1 parameter estimation based on the above graphs.

	Season #	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
✖	1	☐	✔	✔	✔	✔	✔	✔	☐	☐	☐	☐	☐
✖	2	✔	☐	☐	☐	☐	☐	☐	✔	✔	✔	✔	✔

Seasons to be used for BLKO2 parameter estimation based on the above graphs.

Defining a threshold flow (CUTOFF)

(iii) Develop scatter plots for the error against simulated flow from all calendar months. The error in terms of variability and magnitude vary with respect to the magnitude of the simulated flow. Generally, the climatological median (i.e., 50th percentile) of observed flow is used as a threshold flow to categorize simulated flows as low (i.e., below median) and high (above-median). Unless a strong pattern in the error is seen for other flow thresholds and sufficient data is available, the climatological median of observed flow is recommend.

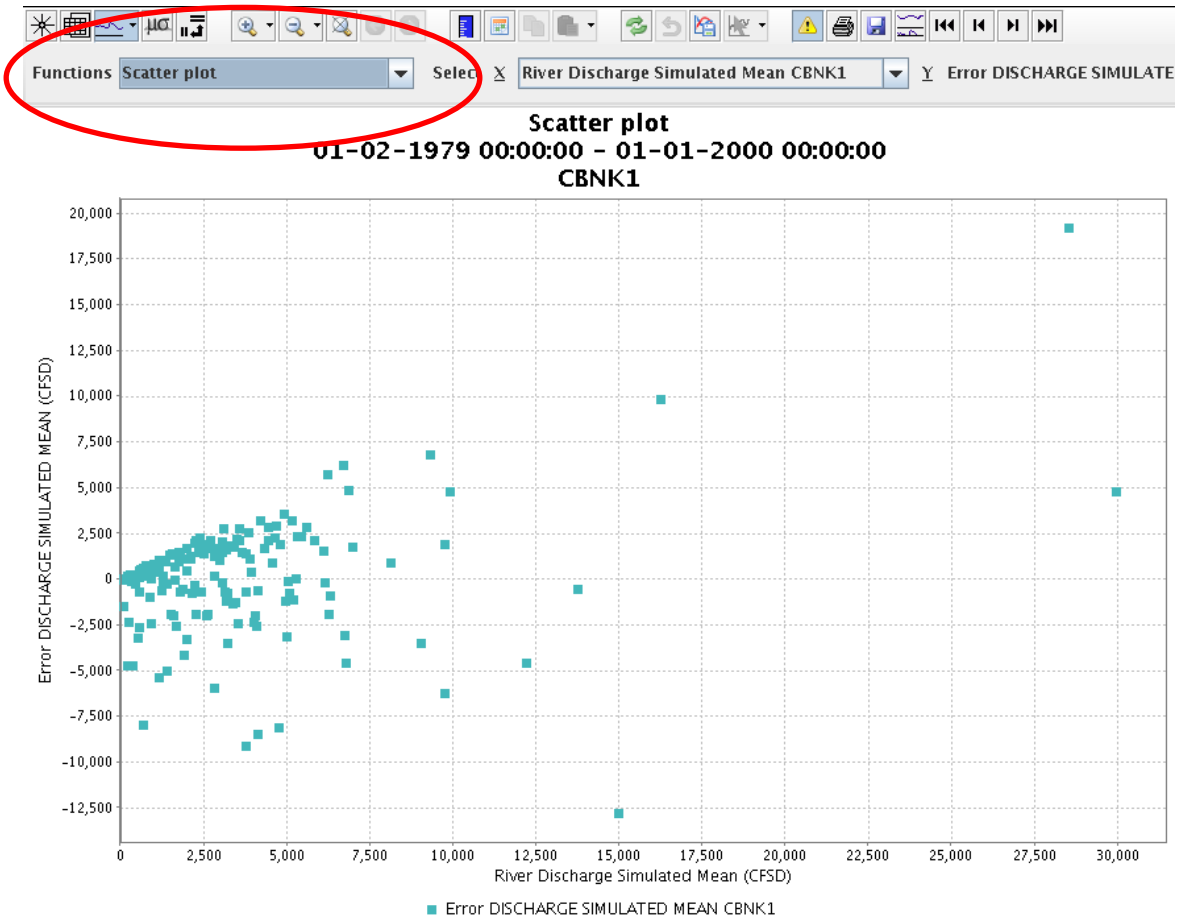
Step 1: Select two rows in the database viewer, right click, and select show timeseries. Both rows, SQME and ESQME, should be for the entire period (no qualifier). See the figure below:

			T0	Dispatch time	Workflow	What-if scenario
			02-01-2012 12:00:00	09-07-2012 15:35:29	Import MAP, MAT, and QME in ...	
			02-01-2012 12:00:00	09-06-2012 12:55:34	Flow Stats - Observed vs Simulated	
			02-01-2012 12:00:00	09-06-2012 12:55:11	Import MAP, MAT, and QME in ...	

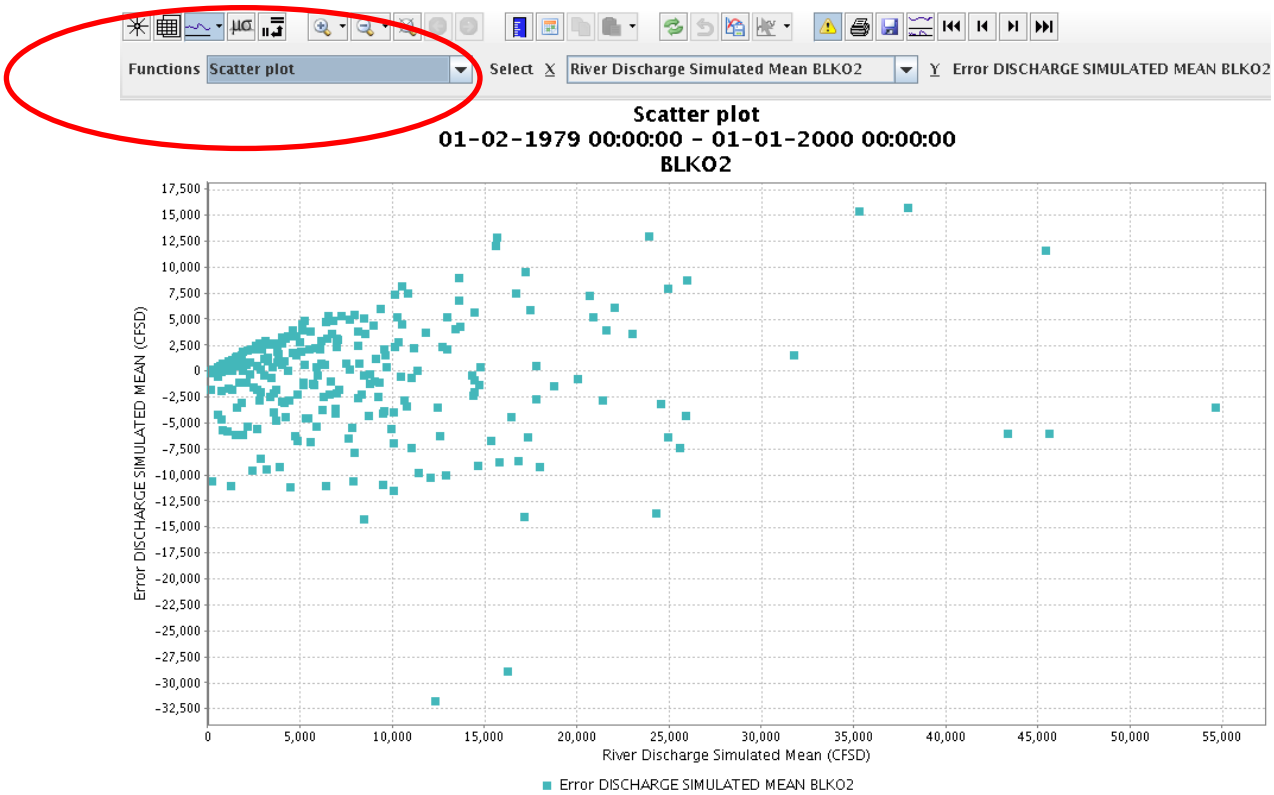
moduleInst...	group	parameterId	qualifiers	locationId	locationNa...	x	y	timeSeries...	valueType	
1	1	3	13	2	2			1	1	2
STATQME...	Discharge...	QME		BLKO2	BLKO2	-97.2775	36.80861	simulated ...	scalar	d
STATQME...	Discharge...	QME		CBNK1	CBNK1	-97.60167	37.12917	simulated ...	scalar	d
STATQME...	Discharge...	SQME		BLKO2	BLKO2	-97.2775	36.80861	simulated ...	scalar	d
STATQME...	Discharge...	SQME		CBNK1	CBNK1	-97.60167	37.12917	simulated ...	scalar	d
STATQME...	Discharge...	ESQME		BLKO2	BLKO2	-97.2775	36.80861	simulated ...	scalar	d
STATQME...	Discharge...	ESQME		CBNK1	CBNK1	-97.60167	37.12917	simulated ...	scalar	d
STATQME...	Discharge...	SQME	avg	BLKO2	BLKO2	-97.2775	36.80861	simulated ...	scalar	1,
STATQME...	Discharge...	SQME	avg	CBNK1	CBNK1	-97.60167	37.12917	simulated ...	scalar	1,
STATQME...	Discharge...	QME	avg	BLKO2	BLKO2	-97.2775	36.80861	simulated ...	scalar	1,
STATQME...	Discharge...	QME	avg	CBNK1	CBNK1	-97.60167	37.12917	simulated ...	scalar	1,
STATQME...	Discharge...	SQME	jan	BLKO2	BLKO2	-97.2775	36.80861	simulated ...	scalar	d
STATQME...	Discharge...	SQME	jan	CBNK1	CBNK1	-97.60167	37.12917	simulated ...	scalar	d
STATQME...	Discharge...	ESQME	jan	BLKO2	BLKO2	-97.2775	36.80861	simulated ...	scalar	d

The locationid/locationNames/x/y will differ depending on your RFC

Step 2: In the Functions drop down menu, select Scatter Plot:



Scatter plot of error vs. simulated stream flow for CBNK1 for the entire period



Scatter plot of error vs. simulated stream flow for BLKO2 for the entire period

Omega controlling the upper tail of the Obs CDF (OBS_OMEGA):	3.5
Omega controlling the upper tail of the Sim CDF (SIM_OMEGA):	3.5
Stream flow above/below cutoff probability (CUTOFF):	0.5
Back transform integration upper bound (INT_MAX):	4.75
Back transform integration lower bound (INT_MIN):	-4.75
Back transform number of integration intervals (INT_NUM):	50
Target parameter optimization lead time (CALIB_DAY; days):	1
Number of ensemble members (TRACES):	1000
Root Mean Square Error Weight (QRMSE):	0
Quantile Flow Root Mean Square Error Weight (QQRMSE):	0
Continuous Rank Probability Score Weight (MCRPS):	1