Calibration Configuration Guide

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The National Water Center

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1 Revision History

Date	Version	Description	Author
11/18/13	1.0	First CHPS release	Nick and Cham
02/09/15	2.0	Added installing the STATQ module and updated PEAKFLOW module	Cham
09/01/15	3.0	Added additional PEAKFLOW statistics	Gautam
07/12/16	4.0	Section 3 is updated for the new configuration templates. Deleted sections 4 and 5.	Cham
03/06/19	5.0	Updated Figure 1 to use LZFSC instead of LZFSF and template WATBAL_SACSMA_Calibration.xml	Cham

2 Overview

Installing Calibration requires adding and updating a number of FEWS configuration files. This guide provides instructions for installing and configuring the calibration components. In cases where a configuration file is new, the file has been included. For such cases where a configuration file requires a change, the content has been provided herewith. Note that calibrations in CHPS requires CHPS-5.3.1 or later.

This document is a general guide to installing calibration within FEWS. As such, the references to WGCM8, SLYP1AWK, CREC1 and HETC1 are just examples. Please replace all instances of WGCM8, SLYP1AWK, CREC1 and HETC1 to a local segment that you are configuring for your RFC.

This document is also a guide to creating a calibration configuration for a local segment which already has been configured in an existing SA. For adding a completely new segment, please make use of CHPS Configuration Training guides for setting up the basic workflows and modules.

2.1 Pre-installation

CHPS calibration configurations are generated on a standalone (SA) system. To create a new calibration configuration, RFCs should copy their existing SA and rename it to a name with "***_calb" (e.g. nwrfc_calb)*** then add the FEWS and OHD statistical, display, and reporting features described in this document. For new ("from scratch") calibration locations, a basin with a similar configuration should be used as a template. OHD does not provide scripts to convert from NWSRFS input decks to CHPS configurations.

Once configured, CHPS calibration activities will also be conducted on a standalone system. Calibration team recommends streamlining the Topology.xml on the SA so only the calibration nodes are visible, instead of adding them to the bottom of a long list of operational nodes. Since this will be an SA implementation, there is no need to display all the operational nodes.

Make sure that these calibrations are done within a standalone (SA) environment. Except for the calibrated parameter config files (in ModuleParFiles) and updated initial files stateI.txt and prev_param.xml (in ColdStateFiles), calibration configurations should NOT be uploaded to the live system.

2.2 Notation

The following notation is used in this document:

- All graphical user interface components are **bold** and capitalized where appropriate.
- All command line entries are in a `fixed-width font` and prefaced with a `$`.
- All numbered entries presented inside a box are for first time setup and configuration. **These steps are ONLY needed for first time Calibration setup.**

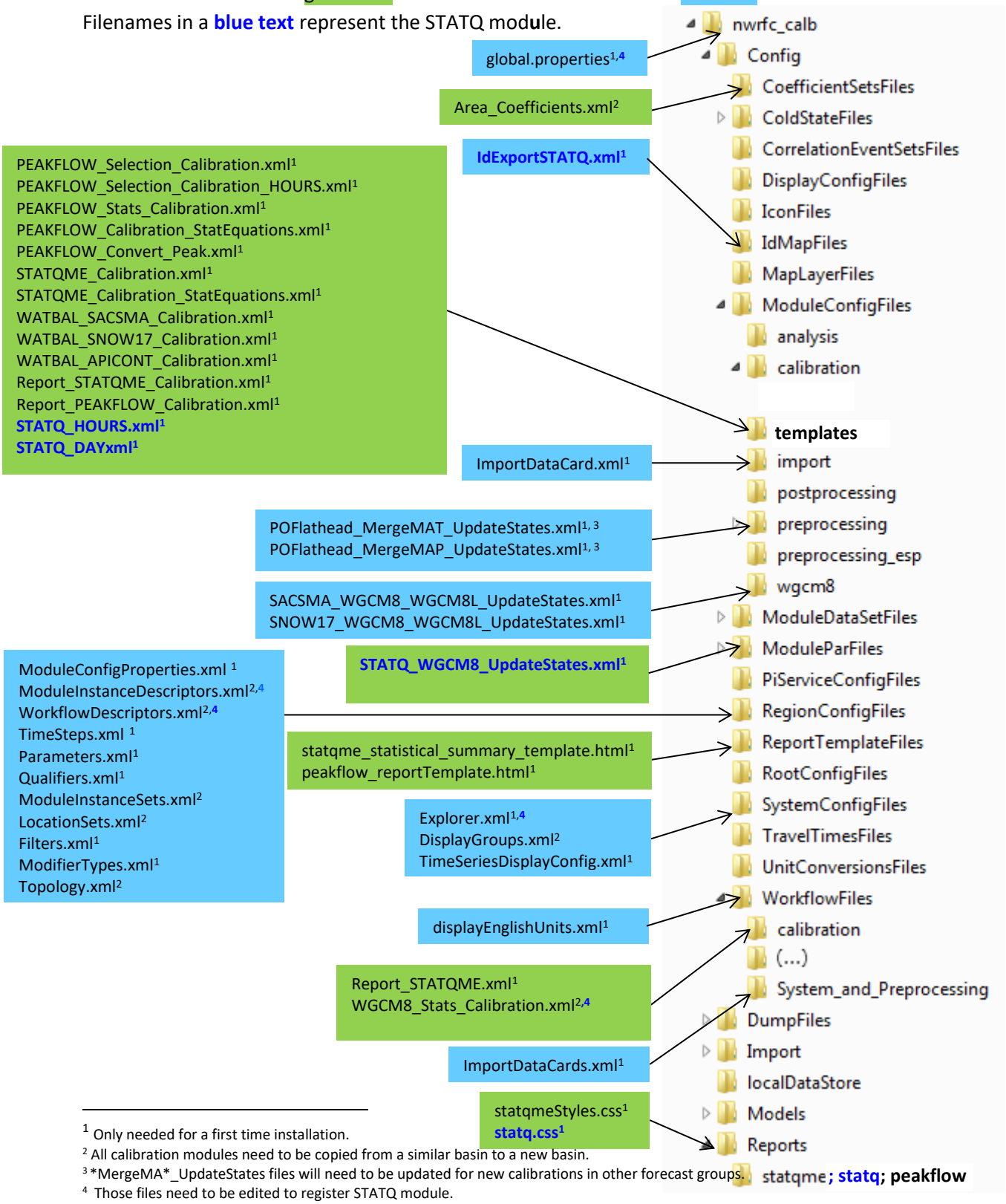
2.3 Directories of Note

The following directories will be referred to in this document:

- <Region_calb_dir>: the standalone directory used to develop your RFC calibrations (e.g., nwrfc_calb).
- <Config_dir>: <Region_calb_dir>/Config (e.g., nwrfc_calb/Config/)
- < CoefficientSetsFiles_dir>: <Config_dir>/CoefficientSetsFiles
- <ModuleConfigFiles_dir>: <Config_dir>/ModuleConfigFiles
- < RegionConfigFiles_dir>: <Config_dir>/RegionConfigFiles
- < ReportTemplateFiles_dir>: <Config_dir>/ReportTemplateFiles
- < SystemConfigFiles_dir>: <Config_dir>/SystemConfigFiles
- < UnitConversionsFiles_dir>: <Config_dir>/UnitConversionsFiles
- < WorkflowFiles_dir>: <Config_dir>/ WorkflowFiles
- <ColdStateFiles_dir>: <Config_dir>/ColdStateFiles
- <ModuleParFiles_dir>: <Config_dir>/ModuleParFiles
- <IdMapFiles_dir>:<Config_dir>/IdMapFiles
- <Reports_dir>: <Region_calb_dir>/Reports
- <release_dir>: the root directory of the untarred release package.
    - (e.g., CHPS-5.3.1/OHD-CORE-CHPS-4.4.a/)
- <template_dir>: the directory of template configuration files
    - (e.g., <release_dir>/calibration/**ConfigTEMPLATE**)
- <sample_dir>: the directory of sample configuration files
    - (e.g., <release_dir>/calibration/ConfigSAMPLE_slyp1awkAPICONT_12Z, ConfigSAMPLE_wgcm8_00Z)
    - Configuration files in the <template_dir> directory contain further instructions about how to edit your existing files to make use of Calibration.

2.4 Affected Configuration Files

The image to the right summarizes all the configuration files affected by the installation steps provided herewith. Filenames in a green box are new files and filenames in a blue box are to be modified. Filenames in a **blue text** represent the STATQ module.



[1] Only needed for a first time installation.
[2] All calibration modules need to be copied from a similar basin to a new basin.
[3] *MergeMA*_UpdateStates files will need to be updated for new calibrations in other forecast groups.
[4] Those files need to be edited to register STATQ module.

This table shows important XML examples from a number of files and explains their purpose.

ModuleConfigFiles/calibration/templates/PEAKFLOW_Stats_Calibration.xml	
<transformation id="maximumAroundPeak"> <selection> <maximumAroundPeak> <inputVariable> <variableId>SQIN_6hr</variableId> </inputVariable> <inputPeaksVariable> <variableId>QME_Peak</variableId> </inputPeaksVariable> <timeWindowInCalendarDays>2</timeWindowInCalendarDays> <maximumAtActualTime> <variableId>SQIN.Peak</variableId> </maximumAtActualTime> ***<!-- 3 output variables below are optionals -->*** <maximumAtPeakTime> <variableId> Q.Sim.max.atPeakTime </variableId> </maximumAtPeakTime> <valueDifference> <variableId> Q.peaks.error </variableId> </valueDifference> <timeDifference> <variableId> Time.peaks.error </variableId> </timeDifference> </maximumAroundPeak> </selection> </transformation>	Use FEWS transformation <maximumAroundPeak> to find for each observed peak an associated maximum in the simulated input time series. The (optional) output time series that can be used by existing transformation statistical functions.
WorkflowConfigFiles/calibration/XXXXX_Stats_Calibration.xml	
<string key=" FLOW_INTERVAL_VALUES" value="25. 50. 100. 200. 350. 600"/> Or <string key=" FLOW_INTERVAL_VALUES " value=""/>	The key "flowIntervals" is an option to specify the flow intervals in the statistical summary. 6 values may be entered in increasing order (CMSD) or left blank and default values will be computed. These values are needed by the new basin to be calibrated.
<!-- Use USGS peak --> <activity> <properties> <string key="GAGE" value="XXXXX"/> <string key="SEGMENT" value="XXXXX"/> </properties> <runIndependent>false</runIndependent>	This is an example to compute observation peak by using USGS peak or FEWS transformation.

<moduleInstanceId>PEAKFLOW_XXXXX_Convert_Peak</moduleInstanceId> <moduleConfigFileName>**PEAKFLOW_Convert_Peak**</moduleConfigFileName> </activity> OR <!-- Use FEWS computed peak --> <activity> <properties> <string key="GAGE" value="XXXXX"/> <string key="SEGMENT" value="XXXXXX"/> <string key="QME_MODULE_ID" value="ImportDataCard"/> </properties> <runIndependent>false</runIndependent> <moduleInstanceId>PEAKFLOW_XXXXXX_Selection_Calibration</moduleInstanceId> <moduleConfigFileName>**PEAKFLOW_Selection_Calibration**</moduleConfigFileName> </activity>	
CoefficientSetFiles/Area_Coefficients.xml	
<locationCoefficientSet> <location> <locationId>WGCM8</locationId> </location> <user> <simple> <coefficient id="area_km2" value="**2921.0**"/> </simple> </user> </locationCoefficientSet>	This is an example to add the drainage area that is needed by the new basin to be calibrated. The area_km2 value comes from input deck - card 1 col 21-30 or obtains from DRAINAGE_AREA parameter in ModuleParFiles/xxxxx/UNITHG* Note: Need to convert the DRAINAGE_AREA in square miles to square kilometers
RegionConfigFiles/ModifierTypes.xml	
<numberParameter id="SCF">> <minimumValue>0</minimumValue> <interModelRelation>preserve ratio</interModelRelation> </numberParameter>	This XML snippet allows the configuration of fixed ratios or differences for the parameters, like for SCF. Min and max values can also be configured for each parameter.
RegionConfigFiles/ModifierTypes.xml	
<userDefinedXYEditor> <xAxisParameterId>percolation demand</xAxisParameterId> <xAxisTitle>lzdefr</xAxisTitle>	This is an example of an equation modifier used to modify a model's curve.

<invertXAxis>true</invertXAxis> <yAxisTitle>percolation demand</yAxisTitle> <xAxisStart>0</xAxisStart> <xAxisEnd>1</xAxisEnd> <xAxisScaleUnit>0.1</xAxisScaleUnit> <expression>(LZFPM*LZPK + LZFSM*LZSK)*(1+ZPERC*lzdefr^REXP)</expression> </userDefinedXYEditor>	
RegionConfigFiles/ModifierTypes.xml	
<multipleModuleParameterModifier id="snow17 calibration" name="snow17 calibration"> **<expiryTimeDeletedModifiers unit="week" multiplier="1"/>**	This snippet of XML code defines the expiry time of deleted modifiers.
RegionConfigFiles/Topology.xml	
<node id="WGCM8" name=" WGCM8 : MF Flathead R nr West Glacier"> … **<showRunApprovedForecastButton>true</showRunApprovedForecastButton>** </node>	Setting the bolded text to true will enable the **Run Approved Forecast** button that is usually disabled during segment runs.

Table 1: XML snippets

3 Installing the CHPS Calibration Components

The following section provides general instructions for installing the CHPS calibration configurations. Several sample configurations and templates have been provided.

Notes:

- Calibration runs in local time by assuming all the data are in GMT so no time zone offsets are required anywhere in the configuration, including the import data and the UpdateStates General Adapter modules for SACSMA/APICONT and SNOW17.
- There is no need to shift data to match cardinal 6-hour time steps.
- The STARTLOCALHOUROFDAY variable has been set to zero as well (see <RegionConfigFiles_dir>/ ModuleConfigProperties.xml).
- The STATQ module in CHPS requires OHD_CORE_CHPS_4.4.a or later.

For guidance on the subject as it relates to FEWS, refer to Appendix A: Use of Time Zones in FEWS.

See sample configurations for more details (<sample_dir> directory in the OHD-CORE-CHPS release package).

See section in 2.3 (Directories of Note) for the definition of directories referred to with variables (e.g. <template_dir>)

Make sure to replace all instances of wgcm8, WGCM8, slyp1awk, SLYP1AWK, crec1, CREC1, hetc1, HECT1 and xxxxx with your new basin ID.

3.1 ModuleConfigFiles

3.1.1 Make a directory for the calibration module templates

```
$ mkdir -p <ModulesConfigFiles_dir>/calibration/templates
```

3.1.2 Copy the set of provided Calibration modules xml templates to the calibration templates directory (e.g., templates).

```
$ cp -f <template_dir>/ModuleConfigFiles/calibration/templates/*
<ModuleConfigFiles_dir>/calibration/templates/
```

3.1.3 Check STATQ Calibration modules template (e.g., <ModuleConfigFiles_dir>/calibration/templates/STATQ_DAY.xml and STATQ_HOURS.xml) for

- Correct relativeViewPeriod end time references

If your sites run calibration by setting T0 to a date/time with "00Z" then you should replace the provided STATQ template module configuration files like the following:

Change:
```
<relativeViewPeriod unit="hour" end="-24"/>
```

To:
```
<relativeViewPeriod unit="hour" end="0"/>
```

3.1.4 Check WATBAL_SNOW17 Calibration module template (e.g., <ModuleConfigFiles_dir>/calibration/templates/WATBAL_SNOW17_Calibration.xml) for

- Correct timeStep references for the variables SWE_6hr and SASC_6hr; this should reference the SNOW17 UpdateStates General Adapter module

Skip this step if your basin doesn't utilize the SNOW17 model.

3.1.5 Comment out the variable and transformation for variableId "*Zone_SQIN_6hr*" and "*Zone_SQME_day_0hr*" in STATQME_Calibration.xml file if ONLY one zone of flow is computed.

3.1.6 Delete all Forecasts General Adapter modules.

```
$ rm -f <ModuleConfigFiles_dir>/xxxxx/*Forecast.xml
```

Replace `xxxxx` to a local segment that you are configuring for your RFC.

3.1.7 Comment out the "<loopTimeStep id='12Z'/>" in all UpdateStates General Adapter modules inside the <ModuleConfigFiles_dir>/xxxxx directory.

```
$ cd <ModuleConfigFiles_dir>/xxxxx
$ sed -i -- 's,<loopTimeStep id="12Z"\/>,<!--loopTimeStep id="12Z"\/--
>,g' *.xml
```

This makes sure the model does not loop every day and only writes a state at the end of run. Replace xxxxx to a local segment that you are configuring for your site.

3.1.8 Comment out the <timeZone> in all UpdateStates General Adapter modules inside <ModuleConfigFiles_dir>/xxxxx directory.

```
$ cd <ModuleConfigFiles_dir>/xxxxx
```

```
$ sed -i -- 's/<timeZone>/<!-- <timeZone>/g; s/<\/timeZone>/<\/timeZone> --
>/g'  *.xml
```

3.1.9 Add Import time series LZDEFR and SACSMA runoff components for ICP-like displays to all SACSMA UpdateStates to <ModuleConfigFiles_dir>/xxxxx/.

See template file at the location below and edit all UpdateStates modules using a global replace for the basin and catchments id.

<template_dir>/ModuleConfigFiles/wgcm8/SACSMA_WGCM8_WGCM8L_UpdateStates.xmltemplate

3.1.10 Add import time Series PSFALL, PRAIN, snow pack (SNTMP), Negative Heat Storage (NEGHS), Liquid Water Content (LIQW) and Energy Exchange (PQNET) for ICP-like displays to all SNOW17 UpdateStates to <ModuleConfigFiles_dir>/xxxxx/.

Skip this step if the SNOW17 model is not used. Otherwise, see template file at the location below and edit all UpdateStates modules using a global replace for basin and catchments id.

<template_dir>/ModuleConfigFiles/wgcm8/SNOW17_WGCM8_WGCM8L_UpdateStates.xmltemplate

3.1.11 Check timeZoneOffset to correct "-00:00" and add timeSeriesSet for QME and SQME in <ModuleConfigFiles_dir>/import/ImportDataCard.xml.

See template file at the location below.

<template_dir>/ModuleConfigFiles/import/ImportDataCard.xml

3.1.12 Add simple transformation for MAP/MAT cardfiles to MergeMAT_UpdateStates and MergeMAP_UpdateStates inside <ModuleConfigFiles_dir>/preprocessing directory reference (e.g. POFlathead_MergeMAT_UpdateStates). Rename *POFlathead* to the new basin's forecastgroup.

See template file at the location below.

<template_dir>/ModuleConfigFiles/preprocessing/POFlathead_MergeMAT_UpdateStates.xml

3.2 ModuleParFiles

3.2.1 Add the three lines below after the <group id="default"> tag to all SACSMA parameter xml files under <ModuleParFiles_dir>/xxxxx/.

Skip this step and 3.2.2 if RUNOFF_COMPONENT_INTERVAL already exists

```
<parameter id="RUNOFF_COMPONENT_INTERVAL">
   <intValue>6</intValue>
</parameter>
```

3.2.2 Copy the parameter files to the <ColdStatesFiles_dir> directory and refresh the zip file. Do this step for all SAC-SMA modules.

```
$ cd <ColdStateFiles_dir>/xxxxx
```

```
$ cp ../../<ModuleParFiles_dir>/xxxxx/SACSMA_XXXXX_XXXXXX_UpdateStates.xml
params_previous.xml
```

```
$ zip -f "SACSMA_XXXXX_XXXXXX_UpdateStates Default.zip" params_previous.xml
```

```
$ rm params_previous.xml
```

3.2.3 Copy the STATQ module parameter xml file from the provided "ConfigTEMPLATE/ModuleParFiles" directory and rename appropriately.

```
$ cp -f <template_dir>/ModuleParFiles/STATQ_XXXXX_UpdateStates.xml
<ModuleParFiles_dir>/xxxxx/
```

Replace xxxxx to a local segment that you are configuring for your site.

3.2.4 Edit the STATQ module parameter xml file (from step 3.2.3) and correct the value for parameterId "BASIN_AREA_IN_KM2" and "PROCESSING_TIMESTEP_IN_HOURS" **<ModuleParFiles_dir>/xxxxx/STATQ_XXXXX_UpdateStates.xml**

The "***PROCESSING_TIMESTEP_IN_HOURS***" must be greater or equal to the time step of the two time series.

The "***BASIN_AREA_IN_KM2***" value obtains from DRAINAGE_AREA parameter in ModuleParFiles/xxxxx/UNITHG*.

Note: Need to convert the DRAINAGE_AREA in square miles to square kilometers.

3.3 WorkflowFiles

3.3.1 Create a calibration workflow directory.

```
$ mkdir <WorkflowFiles_dir>/calibration
```

3.3.2 Copy the provided template calibration workflow xml file and rename appropriately.

```
$ cp -f <template_dir>/WorkflowFiles/calibration/XXXXX_Stats_Calibration.xml
<WorkflowFiles_dir>/calibration/
```

There are several sample workflow templates; Use the one that most closely matches the analysis you want to do.

See template files at <template_dir>/WorkflowFiles/calibration/

`CREC1_Stats_Calibration.xml` –

- run PEAKFLOW_Selection_Calibration_HOURS to compute observed peak using FEWS transformation, and
- STATQ_HOURS module for 1-hour time step

`HETC1_Stats_Calibration.xml` –

- run PEAKFLOW_Convert_Peak using USGS peak, and
- STATQ_DAY module for 24-hour time interval

`SLYP1AWK_Stats_Calibration.xml` –

- run PEAKFLOW_Selection_Calibration,
- WATBAL_APICONT_Calibration, and
- STATQ_DAY module for 24-hour time interval

3.3.3 Edit Stats_Calibration workflow (from step 3.3.2) and correct the values for all properties (e.g. GAGE, SEGMENT, TS (time step) SQIN_MODULE_ID, QME_MODULE_ID, OBSPEAK_MODULE_ID, DAILYORHOURLY, SQIN_LOC…,).

For example: The values for all properties TS, GAGE, SEGMENT, SQIN_LOC, QME_MODULE_ID, and SQIN_MODULE_ID are from the STATQME_Calibration module shown in the snippet below.

```
<properties>
  <string key="TS" value="6"/>
  <string key="GAGE" value="HETC1"/>
  <string key="SEGMENT" value="HETC1H"/>
  <string key="SQIN_LOC" value="HETC1"/>
  <string key="QME_MODULE_ID" value="ImportDataCard"/>
  <string key="SQIN_MODULE_ID" value="LAGK_HETC1H_LAG_HET_UpdateStates"/>
</properties>
```

3.3.4 Check the <WorkflowFiles_dir>/calibration/XXXXX_Stats_Calibration.xml module for

- **A correct value for the "SQIN_MODULE_ID" property; Set to the moduleInstanceId for the module where the SQIN data is coming from.**

For example, SQIN in HETCH1 is from the ***LAGK*** module shown in the snippet below. The module could ***be ADDSUB, UNITHG***, etc. Please check and change the module accordingly. Check that the time step is correct for your configuration as well.

```
<timeSeriesSet>
  <moduleInstanceId>LAGK_HETC1H_LAG_HET_UpdateStates<moduleInstanceId>
  …
  <parameterId>SQIN</parameterId>
  …
  <timeStep unit="hour" multiplier="6"/>
</timeSeriesSet>
```

- **A correct value for the "OBSPEAK_MODULE_ID" property; Set to the "PEAKFLOW_XXXXX_Convert_Peak" module if the PEAKFLOW_Convert_Peak module is used.**

See template file at the location below.

<template_dir>/WorkflowFiles/calibration/HECT1_Stats_Calibration.xml

- **A correct value for the "RSELCATCHMENT" property value**
- **A correct setting for the "DAILYORHOURLY" property**

Note: In order to do an hourly Peakflow analysis (vs a daily Peakflow analysis) a property key "DAILYORHOURLY" should be set to "HOURLY" or "DAILY"

See template file at the location below.

<template_dir>/WorkflowFiles/calibration/HECT1_Stats_Calibration.xml (DAILYORHOURLY set to "DAILY")

Or

<template_dir>/WorkflowFiles/calibration/CREC1_Stats_Calibration.xml (DAILYORHOURLY set to "HOURLY")

3.3.5 Comment out "activity" from all RRS_Preprocessing modules in <WorkflowFile_dir>/System_and_Preprocessing/ImportDataCards.xml or ImportScalars.xml.

See sample file at the location below.

<sample_dir>/WorkflowFiles/System_and_Preprocessing/ImportDataCards.xml

3.4 RegionConfigFiles

3.4.1 Copy the appropriate provided Filters.xml or Filters.xmlWithoutSNOW17 file to <RegionConfigFiles_dir>.

```
$ cp -f <template_dir>/RegionConfigFiles/Filters.xml <RegionConfigFiles_dir>/
```

OR

```
$ cp -f <template_dir>/RegionConfigFiles/Filters.xmlWithoutSNOW17
<RegionConfigFiles_dir>/Filters.xml
```

OR

```
$ cp -f <template_dir>/RegionConfigFiles/Filters.xmlwithAPICONT
<RegionConfigFiles_dir>/Filters.xml
```

If NO SNOW17 model is used, then copy the Filters.xmlWithoutSNOW17 file. If APICONT is used, then copy the Filters.xmlwithAPICONT file in all other cases use Filters.xml.

3.4.2 This template is provided as an example and will require changes if you want to add more filters or data to display. Edit Filters.xml as needed. Add appropriate gage and catchments to the Gages_Calibration and Catchments_Calibration location sets to <RegionConfigFiles_dir>/LocationSets.xml.

See template file at the location below.

<template_dir>/RegionConfigFiles/LocationSets.xmltemplate

3.4.3 Add multipleModuleParameterModifier id "*snow 17 calibration*" and "*sacsma calibration*" to <RegionConfigFiles_dir>/ModifierTypes.xml before the <unitHydrographModifiers> tag.

Ignore "snow17 calibration" if NO SNOW17 model is used. See template file at the location below.

<template_dir>/RegionConfigFiles/ModifierTypes.xmltemplate

3.4.4 Check STARTLOCALHOUROFDAY to make sure the value is set to 0 in <RegionConfigFiles_dir>/ModuleConfigProperties.xml.

See sample file at the location below.

<sample_dir>/RegionConfigFiles/ModuleConfigProperties.xmltemplate

Calibrations are run in local time by assuming all data are in GMT time, STARTLOCALHOUROFDAY offsets the calibrations to align with GMT. Set this value to zero.

3.4.5 Add new Calibration modulesInstanceDescriptor ids to <RegionConfigFiles_dir/ ModuleInstanceDescriptors.xml before the </moduleInstanceDescriptors> tag.

See template file at the location below.

<template_dir>/RegionConfigFiles/ModuleInstanceDescriptors.xmltemplate

3.4.6 Add appropriate modules to the calibration sets in <RegionConfigFiles_dir>/ModuleInstanceSets.xml before the </moduleInstanceSets> tag.

See template file at the location below.

<template_dir>/RegionConfigFiles/ModuleInstanceSets.xmltemplate

3.4.7 Add appropriate parameters to old and new parametersGroup ids in <RegionConfigFiles_dir>/Parameters.xml.

See template file at the location below.

<template_dir>/RegionConfigFiles/Parameters.xmltemplate

3.4.8 Add <allowReferencingUndefinedQualifiers>true</allowReferencingUndefinedQualifiers> to <RegionConfigFiles_dir>/Qualifiers.xml after the <qualifiers> tag.

See template file at the location below.

<template_dir>/RegionConfigFiles/Qualifiers.xmltemplate

3.4.9 Add thresholdValueSet id "Percent Bias" to <RegionConfigFiles_dir>/ThresholdValueSets.xml before the </thresholdValueSets> tag.

See template file at the location below.

<template_dir>/RegionConfigFiles/ThresholdValueSets.xmltemplate

3.4.10 Add levelThreshold ids for "PCTBIAS" and "NEG-PCTBIAS" to <RegionConfigFiles_dir>/ Thresholds.xml before the </thresholdGroup> tag

See template file at the location below.

<template_dir>/RegionConfigFiles/Thresholds.xmltemplate

3.4.11 Copy the provided TimeSteps.xml template file to <RegionConfigFiles_dir> directory

```
$ cp -f <template_dir>/RegionConfigFiles/TimeSteps.xml
<RegionConfigFiles_dir>/
```

3.4.12 Copy the provided Topology.xml template file to <RegionConfigFiles_dir> directory; edit the file using a global replace for the new basin id.

```
$ cp -f <template_dir>/RegionConfigFiles/Topology.xml
<RegionConfigFiles_dir>/
```

The Topology.xml is streamlined so that only the calibration nodes are visible. This template is provided as an example and will require changes if you want to add more nodes for the new basin.

3.4.13 Add appropriate calibration workflow descriptors to <RegionConfigFiles_dir>/WorkflowDescriptors.xml; edit the file using a global replace for the new basin id.

See template file at the location below.

<template_dir>/RegionConfigFiles/WorkflowDescriptors.xmltemplate

3.5 ReportTemplateFiles

3.5.1 Create the ReportTemplateFiles directory inside <Config_dir> if one does not already exist.

```
$ mkdir <ReportTemplateFiles_dir>
```

3.5.2 Copy the provided HTML template files into the newly created directory.

```
$ cp -f
<template_dir>/ReportTemplateFiles/statqme_statistical_summary_template.html
<ReportTemplateFiles_dir>/
```

```
cp -f <template_dir>/ReportTemplateFiles/peakflow_reportTemplate.html
<ReportTemplateFiles_dir>/
```

Customize the files for your own use.

3.6 SystemConfigFiles

3.6.1 Copy the appropriate provided "ICP-like" DisplayGroups.xml or DisplayGroups.xmlwithAPICONT or DisplayGroups.xmlWithoutSNOW17 template file to the <SystemConfigFiles_dir> directory; edit the file using a global replace for the new basin id.

```
$ cp -f <template_dir>/SystemConfigFiles/DisplayGroups.xml
<SystemConfigFiles_dir>/
```

Or

```
$ cp -f <template_dir>/SystemConfigFiles/DisplayGroups.xmlWithoutSNOW17
<SystemConfigFiles_dir>/DisplayGroups.xml
```

Or

```
$ cp -f <template_dir>/SystemConfigFiles/DisplayGroups.xmlwithAPICONT
<SystemConfigFiles_dir>/DisplayGroups.xml
```

If NO SNOW17 model is used, then copy the *DisplayGroups.xmlWithoutSNOW17* file. If APICONT model is used, then copy the *DisplayGroups.xmlWithAPICONT* file. This template is provided as an example and will require changes if you want to add more display group for new basin.

3.6.2 Copy-and-paste the contents in <template_dir>/SystemConfigFiles/Explorer.xml to <SystemConfigFiles_dir>/Explorer.xml before the </explorerTasks> tag.

3.6.3 Add the contents in <template_dir>/SystemConfigFiles/TimeSeriesDisplayConfig.xml to <SystemConfigFiles_dir/TimeSeriesDisplayConfig.xml before the </parametersDisplayConfig> tag.

3.7 CoefficientSetsFiles

3.7.1 Create the CoefficientSetsFiles directory if it does not already exist.

```
$ mkdir <CoefficientSetsFiles_dir>
```

3.7.2 Copy the provided Area_Coefficients.xml to the newly created directory. Edit the locationId and coefficient value reference to the new basin.

```
$ cp -f <template_dir>CoefficientSetFiles/Area_Coefficients.xml
<CoefficientSetsFiles_dir>/
```

This template is provided as an example and will require changes if you want to add the drainage area for new basin that is needed by computing the flow interval biases.

3.8 UnitConversionsFiles

3.8.1 Add the ouputUnitType for CFSD.LOG and CFSD^2 to <UnitConversionsFiles_dir>/displayEnglishUnits.xml.

See template file at the location below.

<template_dir>/UnitConversionsFiles/displayEnglishUnits.xmltemplate

3.9 Reports

3.9.1 Create the statq, peakflow and statqme "Reports" subdirectories if they do not already exist.

```
$ mkdir -p <Region_calb_dir>/Reports/statqme

$ mkdir -p <Region_calb_dir>/Reports/peakflow

$ mkdir -p <Region_calb_dir>/Reports/statq
```

3.9.2 Copy the provided statqmeStyles.css and statq.css files to the Reports directory.

```
$ cp -f <template_dir>/Reports/statqmeStyles.css <Reports_dir>/

$ cp -f <template_dir>/Reports/statq.css <Reports_dir>/
```

The css file determines the style, the look and feel, of the fields in the report and can be customized.

3.10 Setup your web browser.

Add the contents in template file <template_dir>/sa_global.propertiesTemplate to the <Region_calb_dir>/sa_global.properties file.

3.11 IdMapFiles

3.11.1 Copy the provided IdExportSTATQ.xml file to IdMapFiles directory.

```
$ cp -f <template_dir>/idMapFiles/IdExportSTATQ.xml <IdMapFiles_dir>/
```

3.12 Repair DataCards

3.12.1 Create a backup directory if one does not already exist.

```
$ mkdir -p <Region_calb_dir>/Import/backup/cardfiles/
```

3.12.2 Copy QME/MAT/MAP datacards (i.e., .../nwsrfs/calb/data/area_ts/) to <Region_calb_dir>/Import/backup/cardfiles directory.

```
$ cp -f .../nwsrfs/calb/data/area_ts/*
<Region_calb_dir>/Import/backup/cardfiles/
```

Prior to importing the OHD format datcards into FEWS for use during the Calibration runs, the following changes may be needed:

- Start at column 35 in the datacard header line then change USGS id to the FEWS location id or add locationId if missing (e.g. WGCM8).
- No zero are allowed in the months, use a global search and replace is necessary (e.g., :%s/ 01/ 1/g).

3.13 Repair USGS peak

Skip 3.13 section if you don't use the **PEAKFLOW_Convert_Peak** module.

3.13.1 Create a peakflow directory if one does not already exist.

$ mkdir –p <Region_calb_dir>/Import/peakflow

3.13.2 Download the USGS peak data

- In order to use the PEAKEFLOW_Convert_Peak.xml module (which is used to convert USGS formatted Peakflows to FEWS PI-XML), peakflow data must be downloaded from the USGS site. Go to the following URL:

http://nwis.waterdata.usgs.gov/nwis/peak?search_criteria=search_site_no&submitted_form=introduction

Or to retrieve peakflow data as rdb file from the USGS web site use

http://nwis.waterdata.usgs.gov/nwis/peak?site_no=**12358500**&agency_cd=USGS&format=rdb

(Where the text in red is the USGS site id.)

- File name is saved as <locationId>.peak (i.e, *wgcm8*.peak) and place them into a directory (i.e., <Region_calb_dir>/Import/peakflow). The directory specified will be referred to by the peakflowDir property in **PEAKFLOW_Convert_Peak.xml** module.

4 Verify the Installation of the CHPS Calibration Components

The following sections will verify that the calibration features have been successfully installed and configured.

To Import DataCard and run Calibration, set T0 and ColdState to 10-01-YYYY **12**:00:00 (GMT) if <modelTimeStep> tag set to 12Z in the SACSMA or APICONT UpdateStates General Adapter modules inside ModuleConfigFiles/xxxxx/ directory; otherwise, set them to 10-01-YYYY **00**:00:00 (GMT)

4.1 Verify the Calibration Software has been Successfully Installed

Objective: To verify the successful run of CHPS calibration

Note: The times below are based on running on a local time (non-12Z). If running at 12Z, be sure the times are 12:00:00.

Preparation:

- FEWS 2015.02, and OHD_CORE_CHPS_4.4.a
- Run this test under your calibration standalone area
- Edit Region_calb_dir/Config/ModuleConfigFiles/import/ImportRating.xml file as follows
  Commented out <!--importType>NWS-DATACARD-RATING-CURVE</importType-->
  Added for <parserClassName>nl.wldelft.fews.pi.PiRatingCurveParser</parserClassName>

Procedures:

- Start FEWS using <with_**calb** sa >
- cd to your calibration area (e.g. /awips/chps_share/sa/calb/)
- Bring up FEWs
  $ ./bin/fews.sh.rboff <Region_calb_dir> **&**
- Change the Current System Time to the end date of your desired calibration run (e.g. 10-01-2003 00:00:00 (GMT)); Or set T0 in sa.global.properties file
- Click on Logs window; press F12/H to delete localDataStore
- Copy data card files to the Import/cardfiles directory
  `$ cp Region_calb_dir/Import/backup/cardfiles/* Region_calb_dir/Import/cardfiles/.`
- Copy RatingCurves.xml file from the forecast SA to the Import/ratings directory
  `$ cp RatingCurves.xml Region_calb_dir/Import/ratings/.`

- Run Import data cards
  - Click on the icon
  - Select "Import Data Card" or "ImportScalars" workflow
  - Set ColdStates to the start of your calibration period (e.g., 10-01-1949 00:00:00)
  - Click on **Run** button then wait for import data card workflow completed
- Run Import rating curves
  - Click on the icon; Select "ImportRatings" workflow; then click **Run** button.

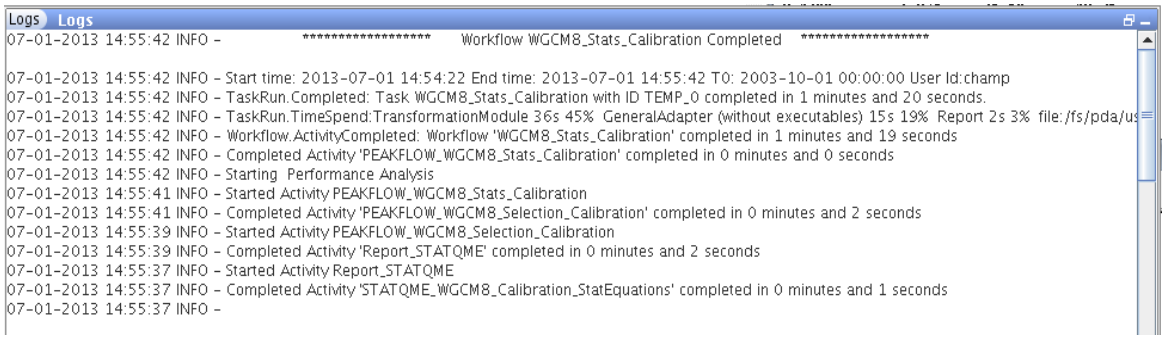
- Run from Manual Forecast
  - Click on the icon
  - Select your basin Stats_calibration workflow (e.g., WGCM8_Stats_Calibration)
  - Select the Cold States start at the beginning of your desired calibration run (e.g. 10-01-1970

00:00:00)

- Click on **Run** button

- Or Run from Forecast tab
  - Open appropriate node for your basin
  - Select basin and then select **Run options**
  - Change the Cold States start to the beginning of your calibration run (e.g. 10-01-1970 00:00:00)
  - Click on the icon

Expected result: Stats Calibration workflow completed and run without errors



```
Logs  Logs
07-01-2013 14:55:42 INFO -          ******************     Workflow WGCM8_Stats_Calibration Completed     ******************

07-01-2013 14:55:42 INFO - Start time: 2013-07-01 14:54:22 End time: 2013-07-01 14:55:42 T0: 2003-10-01 00:00:00 User Id:champ
07-01-2013 14:55:42 INFO - TaskRun.Completed: Task WGCM8_Stats_Calibration with ID TEMP_0 completed in 1 minutes and 20 seconds.
07-01-2013 14:55:42 INFO - TaskRun.TimeSpend:TransformationModule 36s 45%  GeneralAdapter (without executables) 15s 19%  Report 2s 3%  file:/fs/pda/us
07-01-2013 14:55:42 INFO - Workflow.ActivityCompleted: Workflow 'WGCM8_Stats_Calibration' completed in 1 minutes and 19 seconds
07-01-2013 14:55:42 INFO - Completed Activity 'PEAKFLOW_WGCM8_Stats_Calibration' completed in 0 minutes and 0 seconds
07-01-2013 14:55:42 INFO - Starting  Performance Analysis
07-01-2013 14:55:41 INFO - Started Activity PEAKFLOW_WGCM8_Stats_Calibration
07-01-2013 14:55:41 INFO - Completed Activity 'PEAKFLOW_WGCM8_Selection_Calibration' completed in 0 minutes and 2 seconds
07-01-2013 14:55:39 INFO - Started Activity PEAKFLOW_WGCM8_Selection_Calibration
07-01-2013 14:55:39 INFO - Completed Activity 'Report_STATQME' completed in 0 minutes and 2 seconds
07-01-2013 14:55:37 INFO - Started Activity Report_STATQME
07-01-2013 14:55:37 INFO - Completed Activity 'STATQME_WGCM8_Calibration_StatEquations' completed in 0 minutes and 1 seconds
07-01-2013 14:55:37 INFO -
```

4.2 Verify the Statistical Summary as an HTML Report

Objective: To verify the statistical summary as an HTML report (shown for a single location).

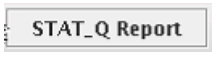
Preparation:

- This test should be run immediately after test 4.1. If not, repeat test 4.1.

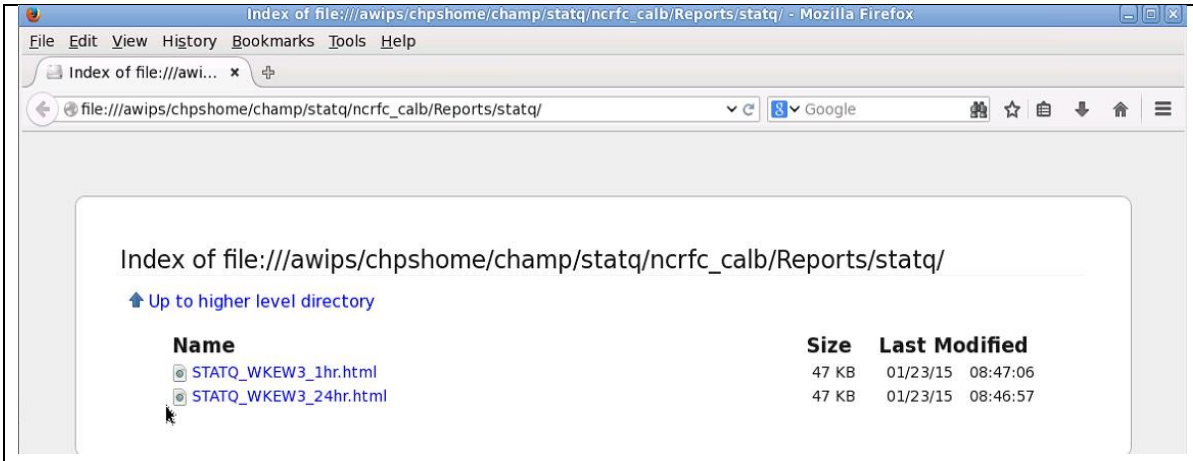
Procedures:

1. Click on the

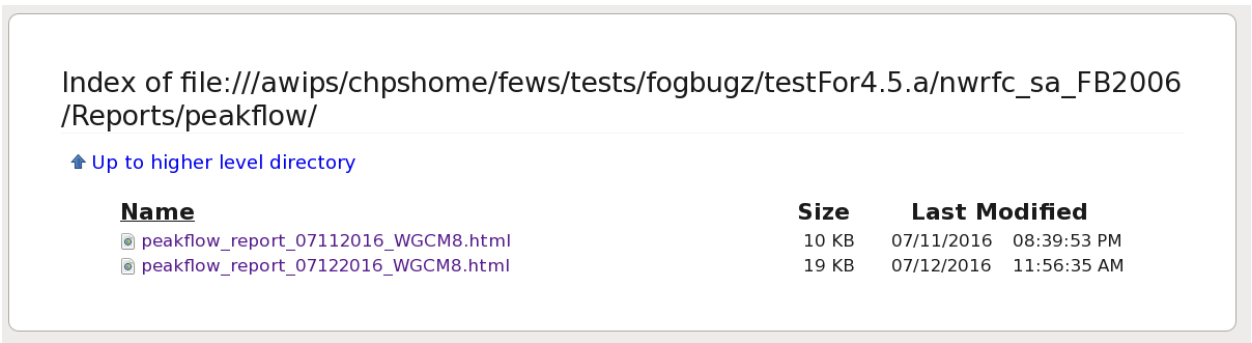
icon to display the following window:

2. Click on the HTML file for location just run (e.g. statqme_output_WGCM8.html)
3. Click on the 

icon to display the following window:



4. Click on the HTML file for location just run (e.g. STATQ_WKEW3_1hr.htm)
5. Click on the PEAKFLOW Report icon to display the following window:



6. Click on the HTML file for location just run (e.g. peakflow_report_mmddyyyy_WGCM8.html)

Note: Do not exit FEWS GUI.

Expected result:

Calibration Report: Seven tables should show up; Entire table column fields should not be blank or "no data"; And table titles are correct not garbled.

file:///nobk/chps_archive/champ/CALIBRATION/rel050213/OHDCalibrationStatqme/nwrfc_calb/Reports/statqme

INITIAL DATE:
05/01/2013

STATISTICAL SUMMARY

WGCM8 - MF Flathead R nr West Glacier

MONTHLY	SQME - River Discharge Simulated Mean CMSD	QME - River Discharge Observed Mean CMSD	% BIAS PCT	MONTHLY BIAS CMSD	MAXIMUM ERROR CMSD	% AVERAGE ABSOLUTE ERROR PCT	% DAILY RMS ERROR PCT
10/1949		21.118			290.839	738.70	805.2
11/1949	115.907	38.237	203.10	77.67	131.131	196.10	205.7
12/1949	66.97	40.728	64.40	26.242	37.755	64.10	65.9
01/1950	29.575	19.597	50.90	9.978	23.52	61.70	67.8
02/1950	18.781	19.507	-3.70	-0.726	6.60	11.30	14.9
03/1950	20.379	27.939	-27.10	-7.561	-18.816	26.80	30.9
04/1950	44.105	67.971	-35.10	-23.865	-116.022	37.20	59.9
05/1950	170.389	256.185	-33.50	-85.796	-297.068	34.40	44.8
06/1950	435.373	456.779	-4.70	-21.407	-256.289	16.70	21.7
07/1950	237.676	232.60	2.20	5.076	43.795	4.50	6.5
08/1950	65.943	57.365	15.00	8.579	21.566	16.60	18.3
09/1950	35.534	26.875	32.20	8.659	21.955	32.40	36.1

WATER YEAR	SQME - River Discharge Simulated Mean CMSD	QME - River Discharge Observed Mean CMSD	% BIAS PCT	MONTHLY BIAS CMSD	MAXIMUM ERROR CMSD	% AVERAGE ABSOLUTE ERROR PCT	% DAILY RMS ERROR PCT
1950		105.653			-297.068	39.20	67.5
1951	111.036	108.364	2.50	2.672	263.517	24.60	41.1
1952	81.363	81.977	-0.70	-0.614	-318.997	25.90	53.5
1953	81.16	89.146	-9.00	-7.985	-195.321	28.00	46.8
1954	95.259	102.541	-7.10	-7.283	-513.143	26.90	65.3

WATER YEAR	DAILY RMS ERROR CMSD	DAILY ABSOLUTE ERROR CMSD	CORRELATION COEF REAL	LINE OF BEST FIT A REAL	LINE OF BEST FIT B REAL
1950	71.2711	41.4098	0.8825	-13.1997	1.008
1951	44.477	26.6901	0.9171	4.9449	0.931
1952	43.8299	21.2766	0.8978	1.8235	0.985
1953	41.6521	24.9485	0.9636	-7.9579	1.196
1954	66.8466	27.5652	0.9083	2.6508	1.048

MULTI-YEAR STATISTICAL SUMMARY

MONTHLY	SQME - River Discharge Simulated Mean CMSD	QME - River Discharge Observed Mean CMSD	% BIAS PCT	MONTHLY BIAS CMSD	MAXIMUM ERROR CMSD	% AVERAGE ABSOLUTE ERROR PCT	% DAILY RMS ERROR PCT
October	36.595	29.847	22.60	6.748	290.839	37.50	92.70
November	41.259	34.466	19.70	6.793	-427.642	38.90	75.00
December	28.967	26.256	10.30	2.712	-205.681	38.10	69.30
January	21.086	20.711	1.80	0.375	-88.84	34.80	51.50
February	20.064	21.227	-5.50	-1.163	-132.755	40.00	66.80
March	26.57	24.967	6.40	1.602	92.203	40.90	62.00
April	82.472	84.836	-2.80	-2.364	-318.997	37.80	53.30
May	242.954	264.739	-8.20	-21.785	-513.143	23.20	33.40
June	294.52	301.982	-2.50	-7.462	-1289.787	21.10	30.90
July	117.22	121.754	-3.70	-4.534	232.953	19.50	29.10
August	42.915	40.878	5.00	2.037	158.025	17.40	28.00
September	29.222	27.601	5.90	1.621	77.595	24.30	39.20
Year Avg.	82.28	83.583	-1.60	-1.304	-1289.787	25.50	51.80

	DAILY RMS ERROR CMSD	DAILY ABSOLUTE ERROR CMSD	CORRELATION COEF REAL	LINE OF BEST FIT A REAL	LINE OF BEST FIT B REAL
Year Avg	43.2179	21.2897	0.9291	-0.0203	1.016

FLOW INTERVAL CMSD From	To	NUMBER OF CASES INT	SQME - River Discharge Simulated Mean CMSD	QME - River Discharge Observed Mean CMSD	% BIAS PCT	BIAS (SIM-OBS) MM	MAXIMUM ERROR CMSD	% AVERAGE ABSOLUTE ERROR PCT	% DAILY RMS ERROR PCT
0.00	25.00	7866	18.728	16.286	15.00	0.0722	290.839	36.70	78.10
25.00	50.00	4730	39.833	34.891	14.20	0.1462	271.722	32.90	49.80
50.00	100.00	2463	75.360	70.230	7.30	0.1518	161.883	28.90	39.40
100.00	200.00	2088	146.072	146.395	-0.20	-0.0095	232.953	24.90	31.90
200.00	350.00	1614	263.653	265.468	-0.70	-0.0537	308.569	21.40	27.80
350.00	600.00	889	371.733	439.306	-15.40	-1.9988	356.733	21.20	26.20
600.00	-	73	514.336	748.224	-31.30	-6.9182	-1289.787	33.60	41.80

QUARTERLY	OBSERVED MM	SIMULATED MM	ACC ERROR MM	ERROR THIS PERIOD MM
Dec 1949	90.17	319.03	228.85	228.8
Mar 1950	149.83	380.07	230.24	1.3
Jun 1950	856.41	967.95	111.54	-118.7
Sep 1950	1140.10	1271.84	131.74	20.2
Dec 1950	1309.38	1474.86	165.48	33.7

STAT_Q Report: All tables are properly displayed. The snapshot below captures only one table.

file:///nobk/chps_archive/champ/calb/nwrfc_calb/Reports/statq/STATQ_WGCM8_24hr.html

WGCM8 DATA INFORMATION

OBSERVED DATA:
It covers the time period from 10/1970 to 9/2002 in 24 hr intervals Its unit: CMSD
SIMULATED DATA:
It covers the time period from 10/1970 to 9/2002 in 24 hr intervals Its unit: CMSD

Analysis will be conducted for data between 10/1970 and 9/2002

- Total hours of data have been read are 280512
- Total lines of data read from observed data 11688
- Total lines of data read from simulated data 11688

- Maximum value of flow: 1540.44 (CMS)

- There are 280512 hours of good data.
- Total 0 hours of data were missing.

- BASIN AREA IS 326.300 KM^2

(All analyses are based on 24 hour intervals, except for the "STATISTICS FOR GIVEN EVENTS/TIME INTERVALS")
- Maximum value of flow: 1540.44 (CMS)

MULTI-YEAR STATISTICS												
% Bias	Abs. % Bias	Obs. Qmean CMS	Sim. Qmean CMS	Obs. std CMS	Sim. std CMS	Obs. Cv	Sim. Cv	% RMS	RMS (CMS)	R	Nash-S. r	Modi. Rm
0.437	24.0	80.8	81.2	111.	110.	1.37	1.36	46.1	37.3	0.943	0.886	0.939
Best line fit: Qobs = A+B*Qsim: A--> 3.96 (CMS) B--> 0.947												

PEAKFLOW Report: All tables are properly displayed.

INITIAL DATE:
09-01-2015 13:39

PEAKFLOW DISCHARGE AND TIMING ERROR SUMMARY

Location: **FRENCH BROAD/ROSMAN**

Date	Observed Peak (CMS)	Date	Simulated Peak (CMS)	Date	Discharge Error (CMS)	Date	Discharge Ratio (SIM/OBS)	Date	Timing Errors (DAYS)
12-07-1950	127.43	12-07-1950	137.18	12-07-1950	9.75	12-07-1950	1.08	12-07-1950	0.00
03-11-1952	160.27	03-11-1952	192.41	03-11-1952	32.13	03-11-1952	1.20	03-11-1952	0.00
02-21-1953	124.03	02-21-1953	79.09	02-21-1953	-44.94	02-21-1953	0.64	02-21-1953	0.00
01-22-1954	86.65	01-22-1954	54.59	01-22-1954	-32.06	01-22-1954	0.63	01-22-1954	0.00
05-22-1955	71.64	05-22-1955	45.60	05-22-1955	-26.04	05-22-1955	0.64	05-22-1955	0.00
04-15-1956	76.46	04-16-1956	48.53	04-15-1956	-27.92	04-15-1956	0.63	04-16-1956	-1.00
04-04-1957	146.68	04-04-1957	132.10	04-04-1957	-14.58	04-04-1957	0.90	04-04-1957	0.00
12-20-1957	95.71	12-20-1957	55.23	12-20-1957	-40.48	12-20-1957	0.58	12-20-1957	0.00
01-21-1959	99.96	01-22-1959	54.65	01-21-1959	-45.30	01-21-1959	0.55	01-22-1959	-1.00
10-09-1959	81.55	10-09-1959	40.76	10-09-1959	-40.79	10-09-1959	0.50	10-09-1959	0.00
02-25-1961	106.47	02-25-1961	62.69	02-25-1961	-43.78	02-25-1961	0.59	02-25-1961	0.00
12-12-1961	100.24	12-12-1961	69.49	12-12-1961	-30.75	12-12-1961	0.69	12-12-1961	0.00
03-06-1963	65.70	03-06-1963	48.37	03-06-1963	-17.33	03-06-1963	0.74	03-06-1963	0.00
09-29-1964	271.84	09-29-1964	234.34	09-29-1964	-37.50	09-29-1964	0.86	09-29-1964	0.00
10-04-1964	382.28	10-04-1964	294.87	10-04-1964	-87.41	10-04-1964	0.77	10-04-1964	0.00
02-13-1966	225.69	02-13-1966	213.76	02-13-1966	-11.92	02-13-1966	0.95	02-13-1966	0.00
06-04-1967	137.90	06-04-1967	188.73	06-04-1967	50.83	06-04-1967	1.37	06-04-1967	0.00
03-12-1968	115.53	03-12-1968	65.85	03-12-1968	-49.68	03-12-1968	0.57	03-12-1968	0.00
06-15-1969	108.45	06-15-1969	97.02	06-15-1969	-11.43	06-15-1969	0.89	06-15-1969	0.00
11-01-1969	66.26	11-01-1969	56.12	11-01-1969	-10.14	11-01-1969	0.85	11-01-1969	0.00
10-11-1970	139.89	10-11-1970	60.00	10-11-1970	-79.89	10-11-1970	0.43	10-11-1970	0.00
05-03-1972	121.20	05-03-1972	27.07	05-03-1972	-94.13	05-03-1972	0.22	05-03-1972	0.00
05-28-1973	258.82	05-28-1973	168.48	05-28-1973	-90.34	05-28-1973	0.65	05-28-1973	0.00
12-26-1973	127.99	12-26-1973	71.33	12-26-1973	-56.67	12-26-1973	0.56	12-26-1973	0.00
09-23-1975	128.56	09-24-1975	76.54	09-23-1975	-52.02	09-23-1975	0.60	09-24-1975	-1.00
10-17-1975	209.26	10-17-1975	180.36	10-17-1975	-28.90	10-17-1975	0.86	10-17-1975	0.00
03-13-1977	209.83	03-12-1977	220.08	03-13-1977	10.26	03-13-1977	1.05	03-12-1977	1.00
01-25-1978	139.60	01-26-1978	65.74	01-25-1978	-73.86	01-25-1978	0.47	01-26-1978	-1.00
03-04-1979	244.37	03-04-1979	349.57	03-04-1979	105.19	03-04-1979	1.43	03-04-1979	0.00
11-02-1979	179.53	11-02-1979	213.34	11-02-1979	33.81	11-02-1979	1.19	11-02-1979	0.00
05-27-1981	111.29	05-27-1981	48.31	05-27-1981	-62.98	05-27-1981	0.43	05-27-1981	0.00
02-03-1982	64.85	02-03-1982	53.29	02-03-1982	-11.56	02-03-1982	0.82	02-03-1982	0.00

02-02-1983	139.04	02-02-1983	79.17	02-02-1983	-59.87	02-02-1983	0.57	02-02-1983	0.00
12-11-1983	72.77	12-12-1983	58.04	12-11-1983	-14.73	12-11-1983	0.80	12-12-1983	-1.00
08-17-1985	80.14	08-17-1985	37.82	08-17-1985	-42.32	08-17-1985	0.47	08-17-1985	0.00
11-01-1985	60.60	11-01-1985	26.99	11-01-1985	-33.61	11-01-1985	0.45	11-01-1985	0.00
11-26-1986	170.47	11-26-1986	50.84	11-26-1986	-119.63	11-26-1986	0.30	11-26-1986	0.00
11-17-1987	62.30	11-17-1987	19.95	11-17-1987	-42.35	11-17-1987	0.32	11-17-1987	0.00
07-03-1989	105.62	07-04-1989	75.88	07-03-1989	-29.74	07-03-1989	0.72	07-04-1989	-1.00
02-16-1990	126.29	02-16-1990	91.78	02-16-1990	-34.51	02-16-1990	0.73	02-16-1990	0.00
03-29-1991	175.28	03-29-1991	54.33	03-29-1991	-120.95	03-29-1991	0.31	03-29-1991	0.00
11-22-1991	119.50	11-22-1991	36.13	11-22-1991	-83.37	11-22-1991	0.30	11-22-1991	0.00
11-22-1992	152.91	11-23-1992	45.98	11-22-1992	-106.93	11-22-1992	0.30	11-23-1992	-1.00
08-17-1994	325.64	08-17-1994	103.64	08-17-1994	-222.00	08-17-1994	0.32	08-17-1994	0.00
01-14-1995	147.81	01-15-1995	56.64	01-14-1995	-91.18	01-14-1995	0.38	01-15-1995	-1.00
10-05-1995	153.19	10-05-1995	56.10	10-05-1995	-97.10	10-05-1995	0.37	10-05-1995	0.00
11-08-1996	158.01	11-08-1996	41.67	11-08-1996	-116.34	11-08-1996	0.26	11-08-1996	0.00
01-07-1998	224.55	01-08-1998	124.47	01-07-1998	-100.08	01-07-1998	0.55	01-08-1998	-1.00
04-01-1999	66.83	04-01-1999	35.74	04-01-1999	-31.09	04-01-1999	0.53	04-01-1999	0.00
11-26-1999	116.10	11-26-1999	29.90	11-26-1999	-86.20	11-26-1999	0.26	11-26-1999	0.00
11-09-2000	53.80	11-10-2000	19.14	11-09-2000	-34.66	11-09-2000	0.36	11-10-2000	-1.00
09-27-2002	81.55	09-27-2002	32.99	09-27-2002	-48.56	09-27-2002	0.40	09-27-2002	0.00

Observed Peaks mean: 138.04 (CMS)
Simulated Peaks mean: 91.97 (CMS)
Discharge Error mean: -46.07 (CMS)
Discharge Ratio mean: 0.64

Discharge RMS Error: 68.12 (CMS)
Timing RMS Error: 0.46 (DAYS)
Average Percent Error: -33.37 %
Correlation Coefficient (Discharge): **R** = 0.75
Best Fit Line: OBSQ = A + B * SIMQ: **A** = 73.43 **B** = 0.70

4.3 Verify the CHPS calibration components displays

Objective: To verify the CHPS calibration components displays

Preparation:

- This test should be run immediately after test 4.2. If not, repeat test 4.1.

Procedures:

- Select Plots tab, click on icon (Short cuts)
- Select basin id **Calibration** and then select the display group lists as following:

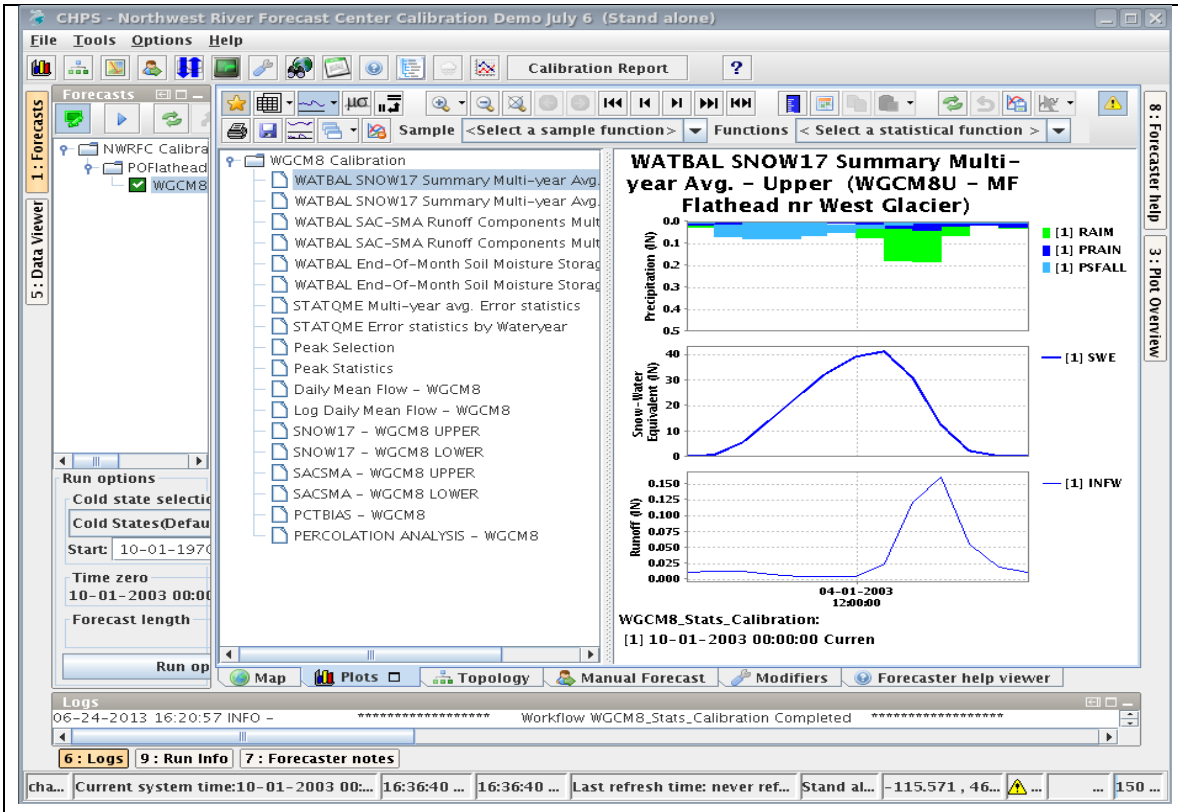


Figure 2: WATBAL_SNOW17 Summary Multi-year Avg – Upper

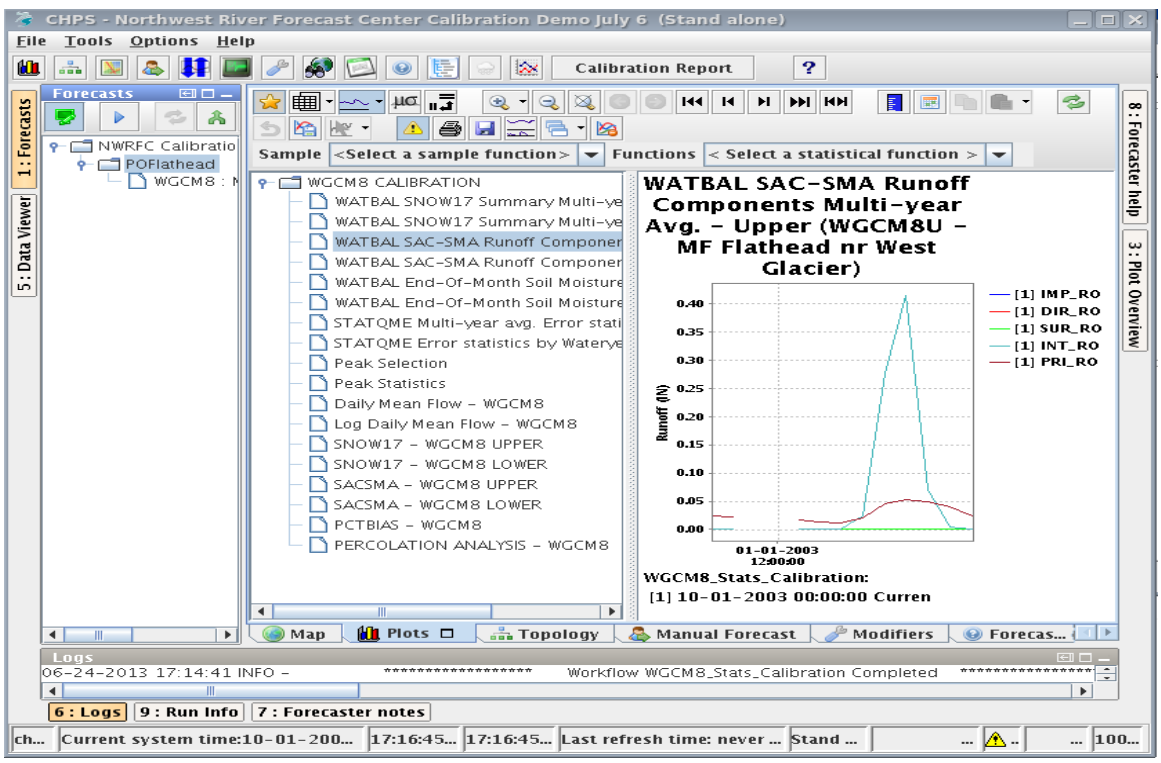


Figure 3: WATBAL SAC-SMA Runoff Component Multi-year – Upper

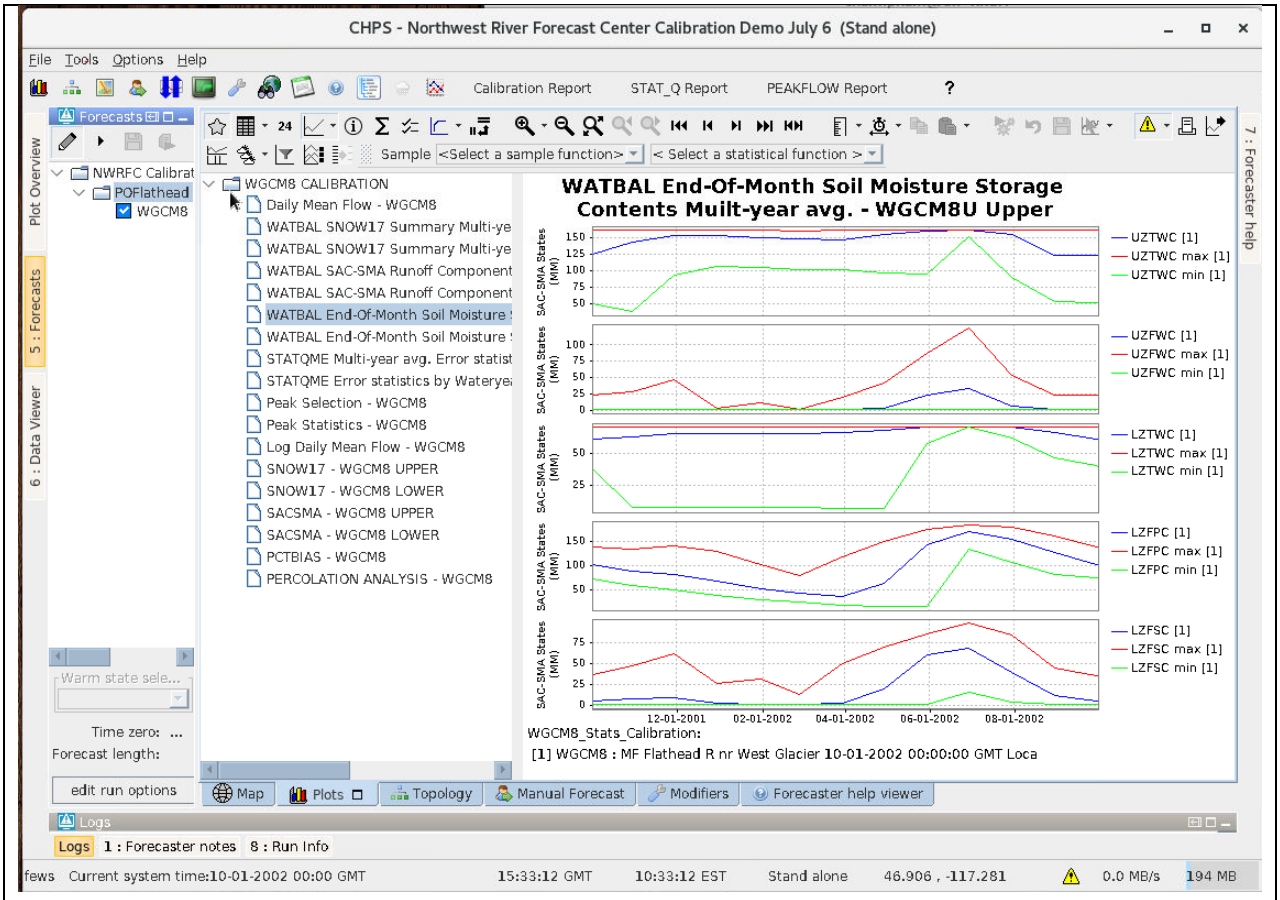


Figure 4: WATBAL End-Of-Month Soil Moisture Storage Contents Muilt-year avg. – Upper

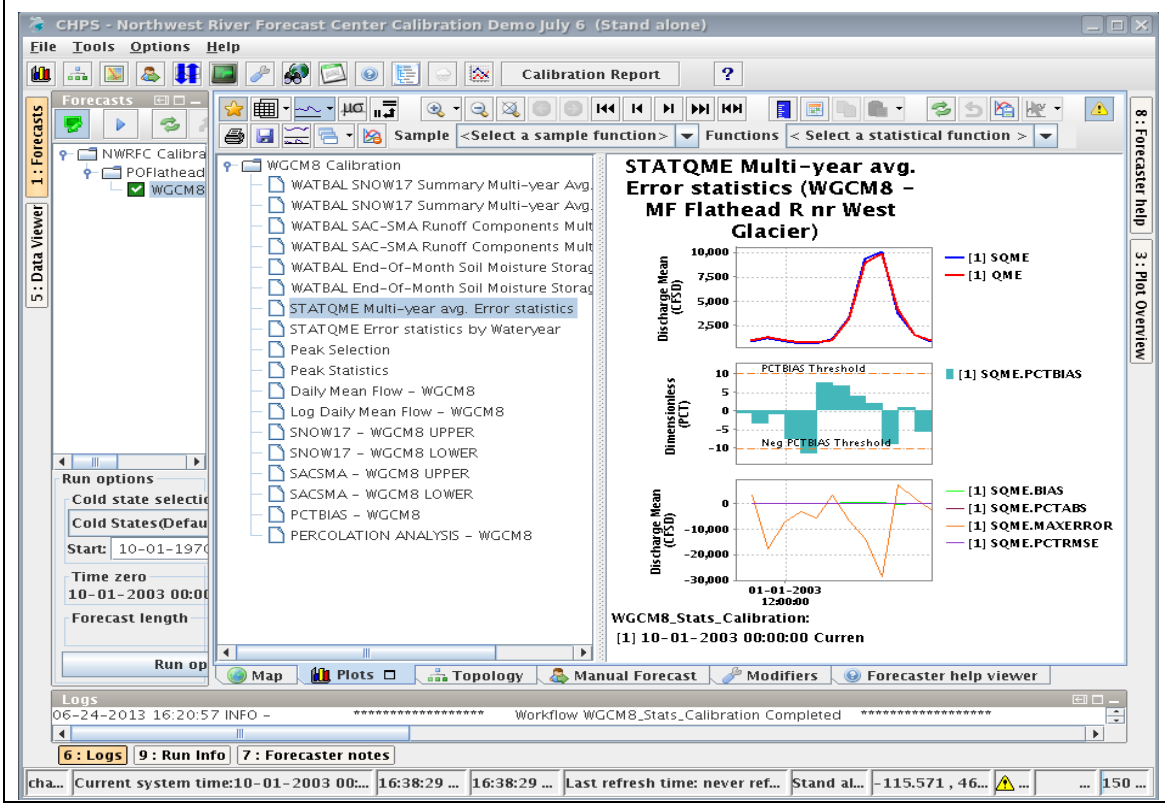


Figure 5: STATQME Multi-year avg. Error statistics

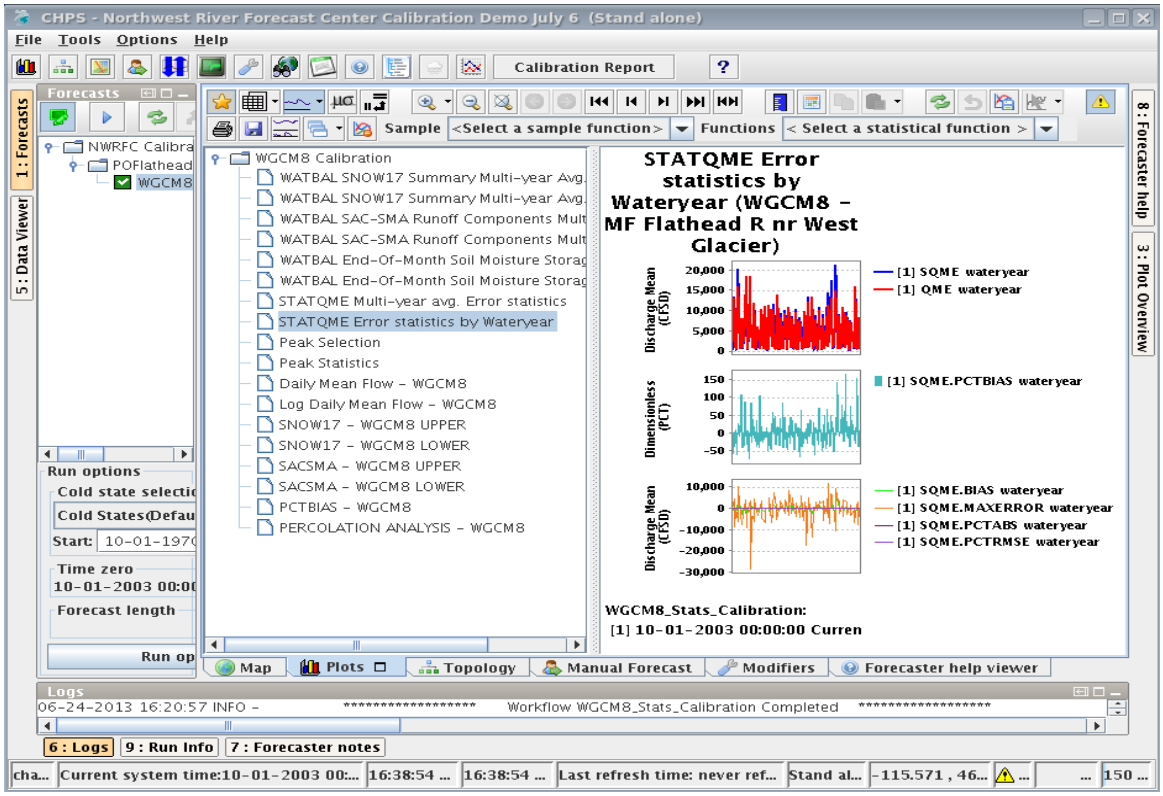


Figure 6: STATQME Error statistics by Wateryear

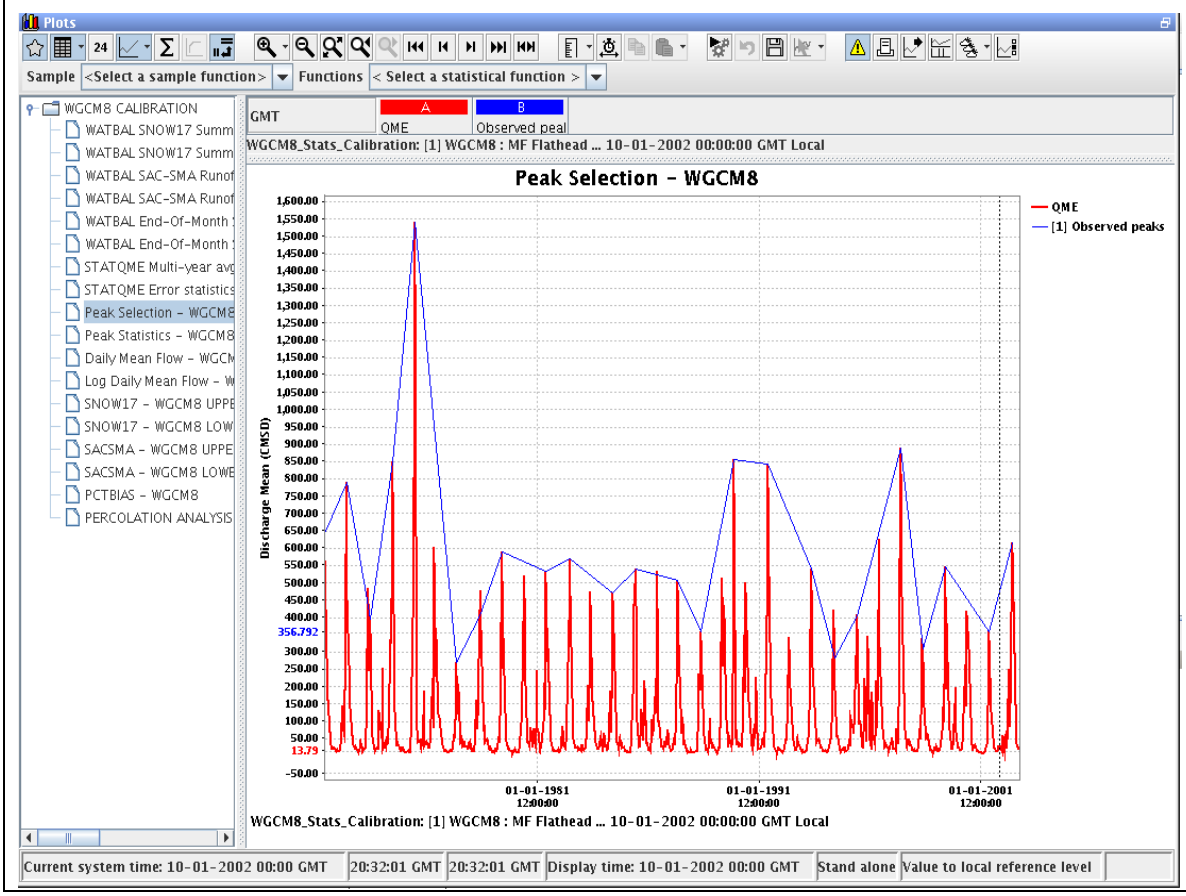


Figure 7: Peak Selection

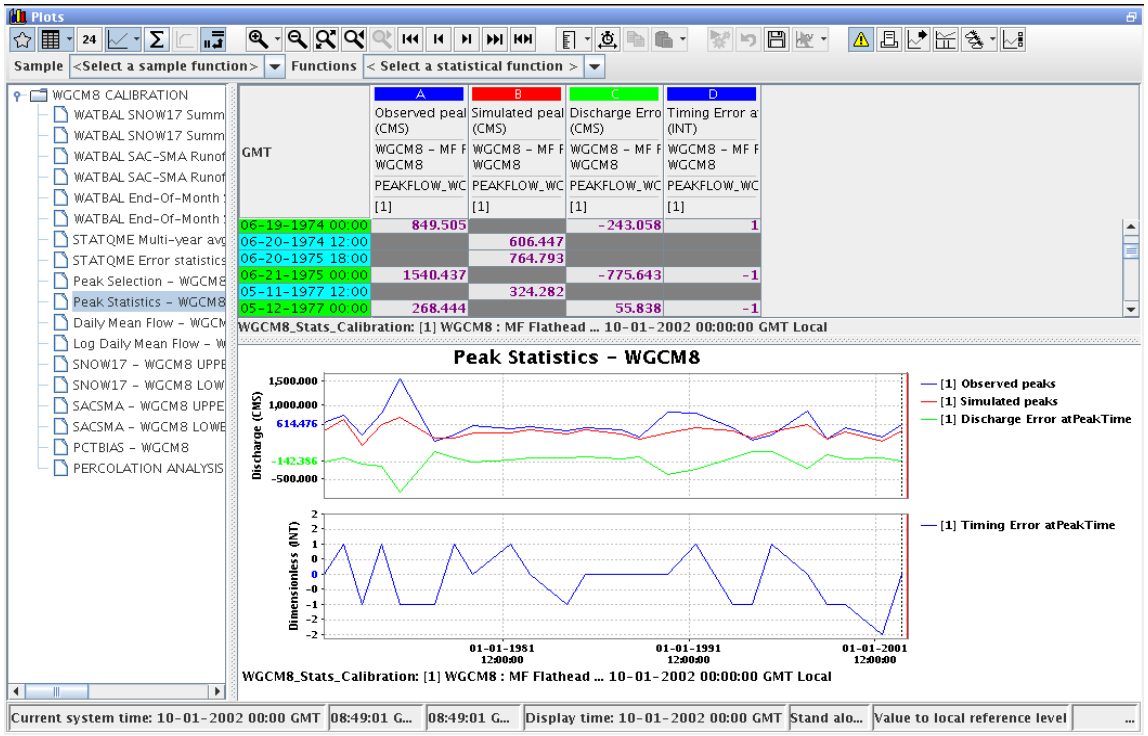


Figure 8: PEAK Statistics

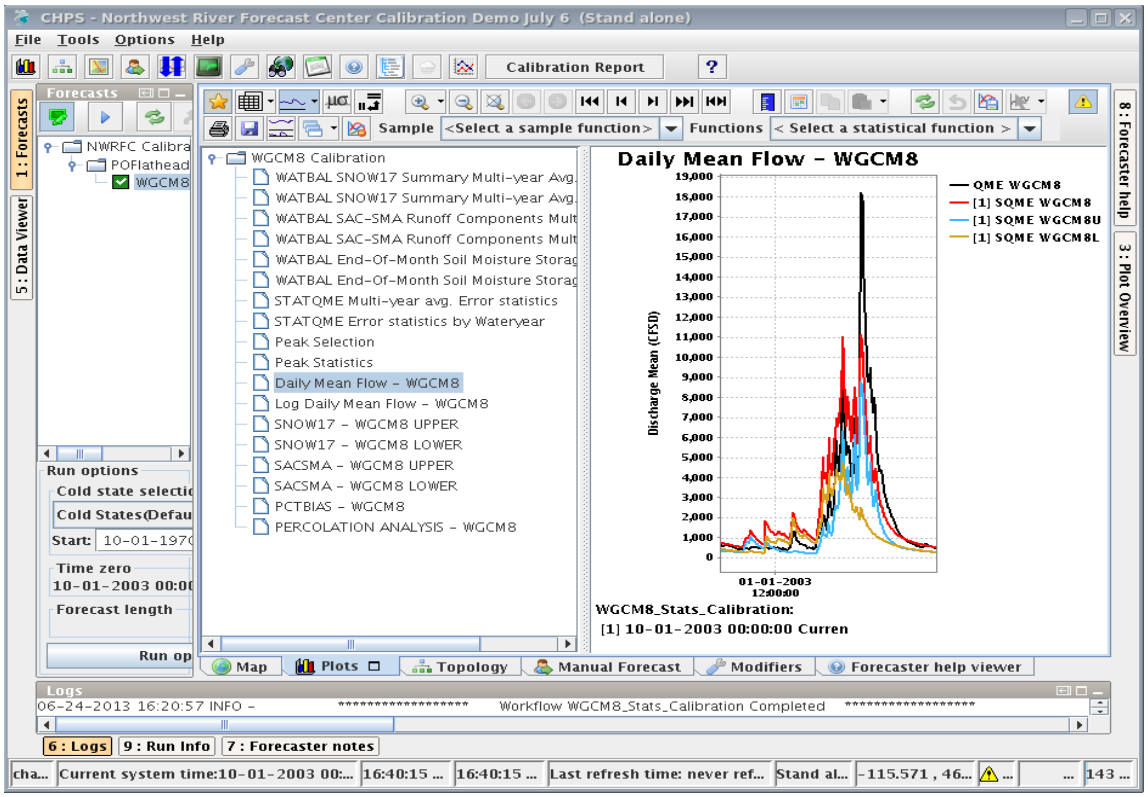


Figure 9: Daily Mean flow

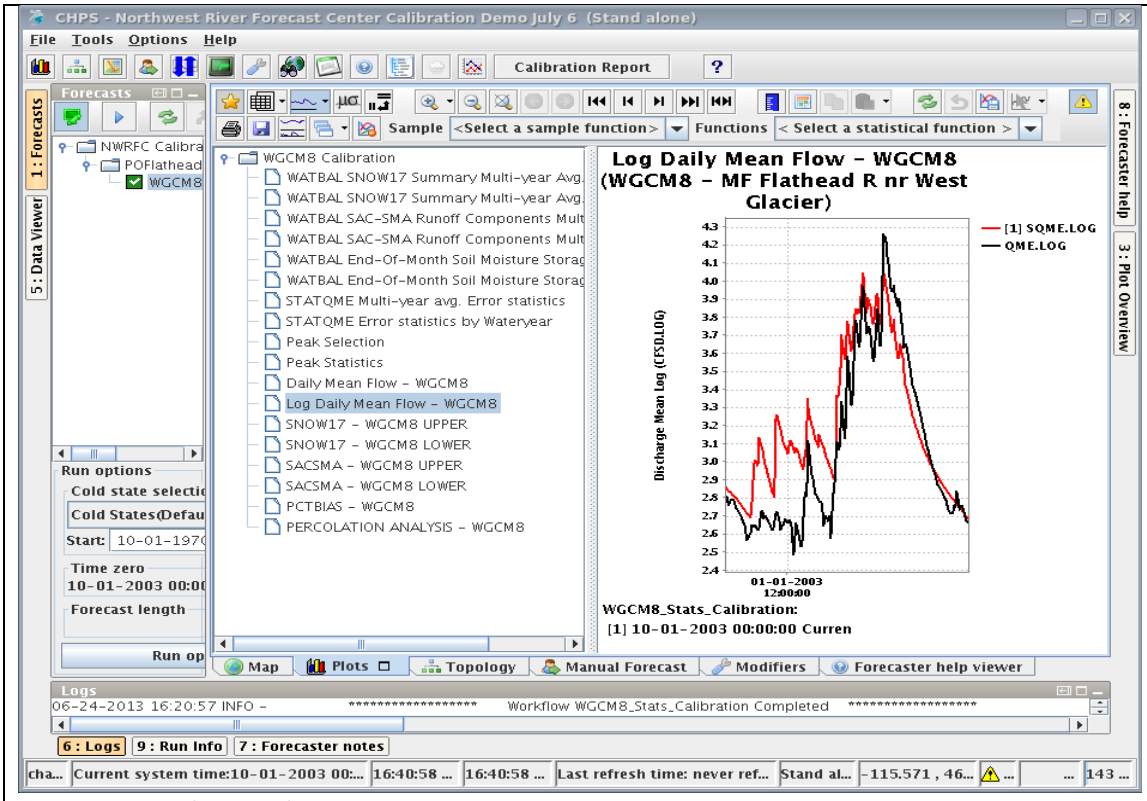


Figure 10: Log Daily Mean Flow

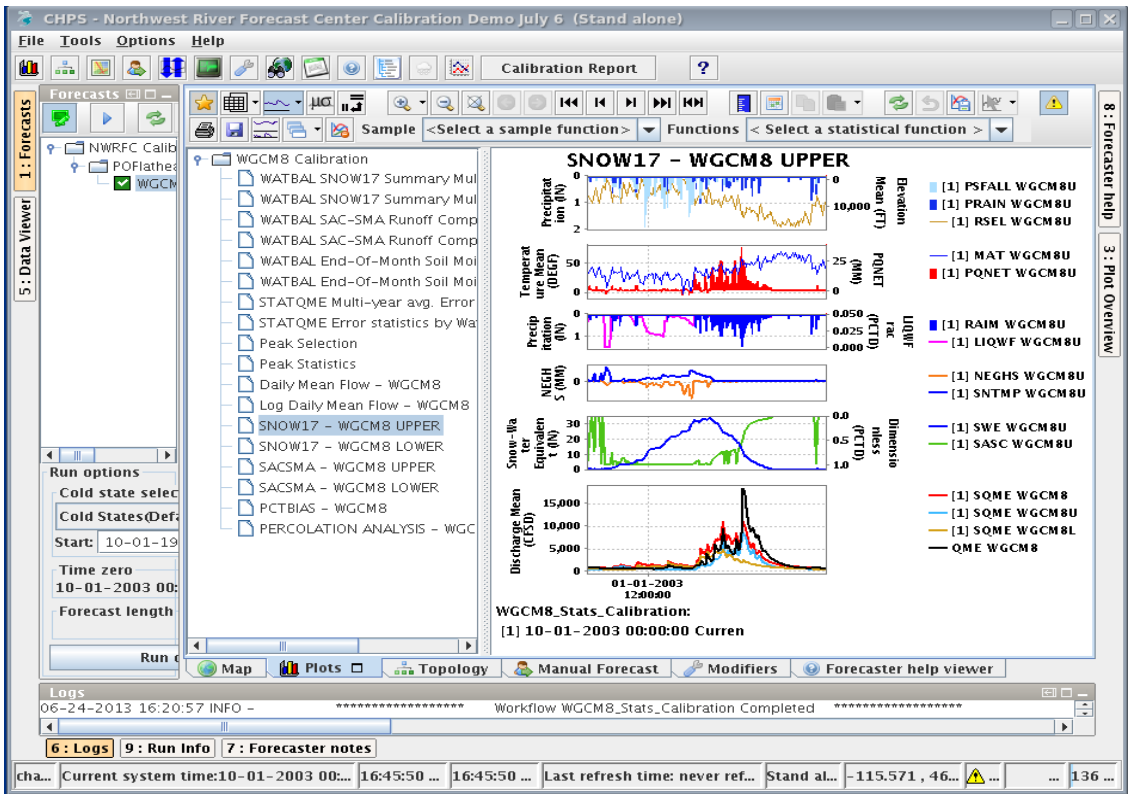


Figure 11: SNOW17 – WGCM8 UPPER (ICP-like displays)

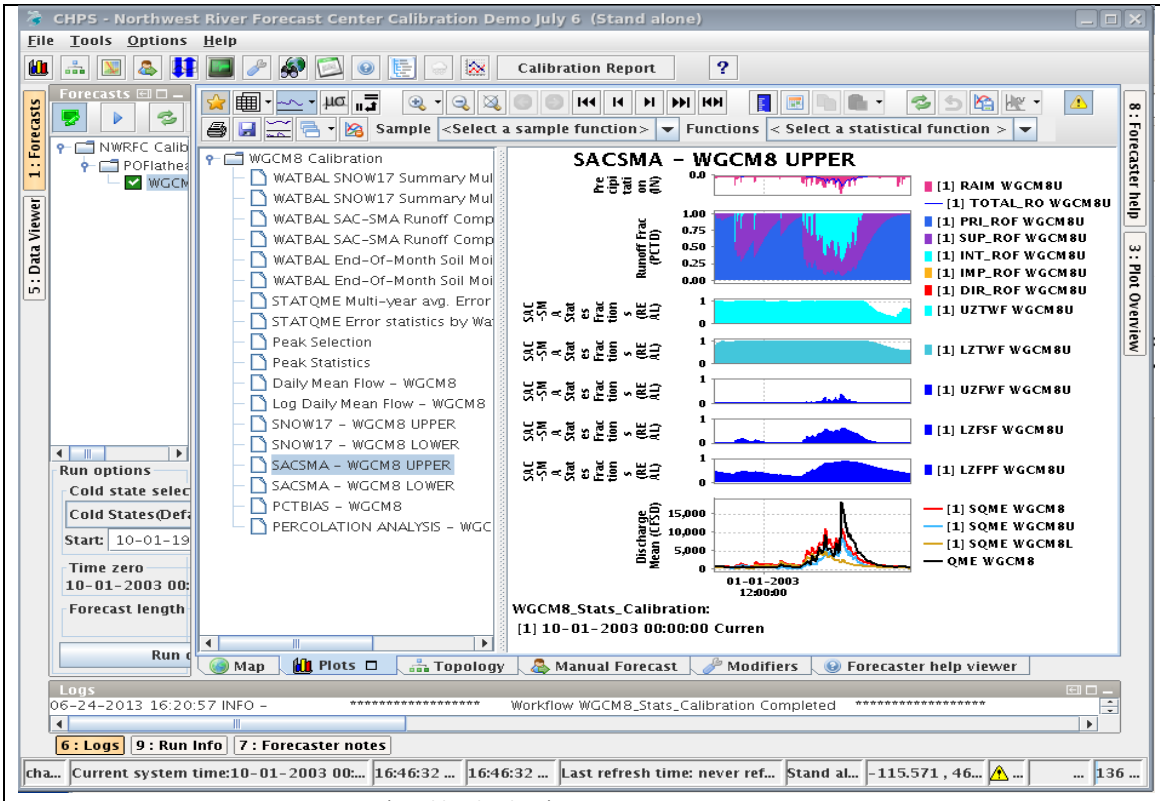


Figure 12: SACSMA – WGCM8 UPPER (ICP-like displays)

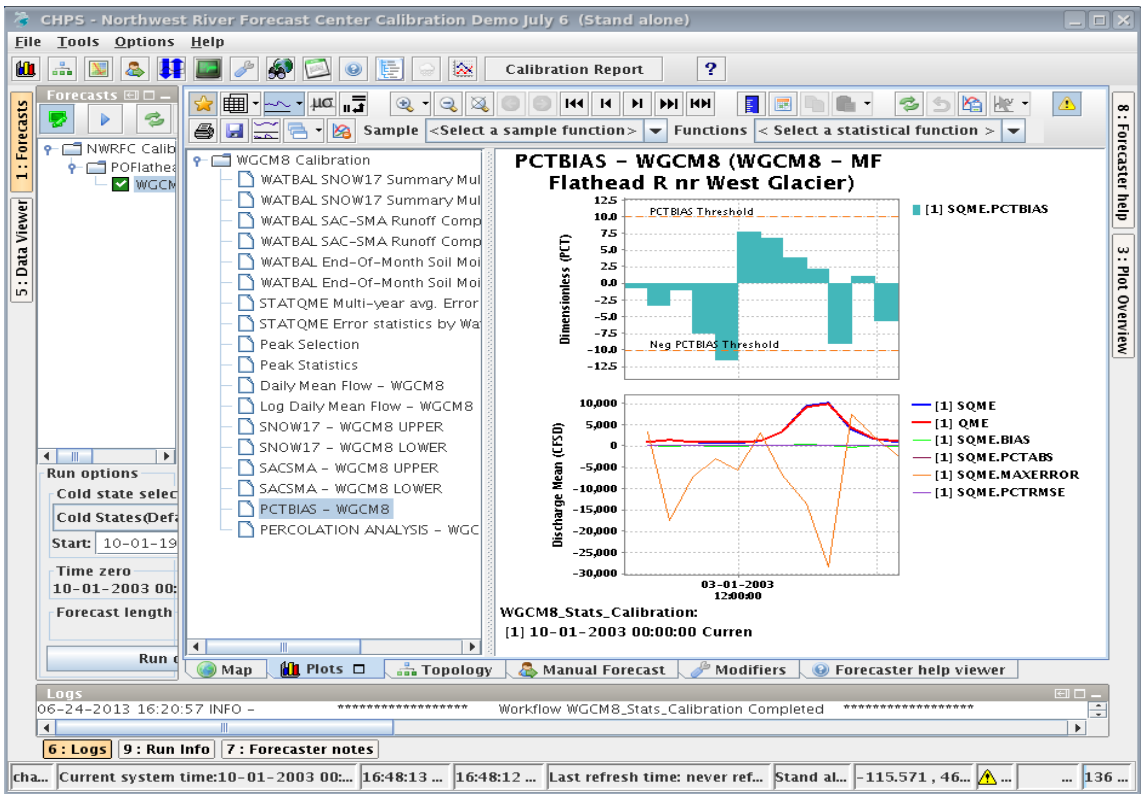


Figure 13: PCTBIAS – WGCM8

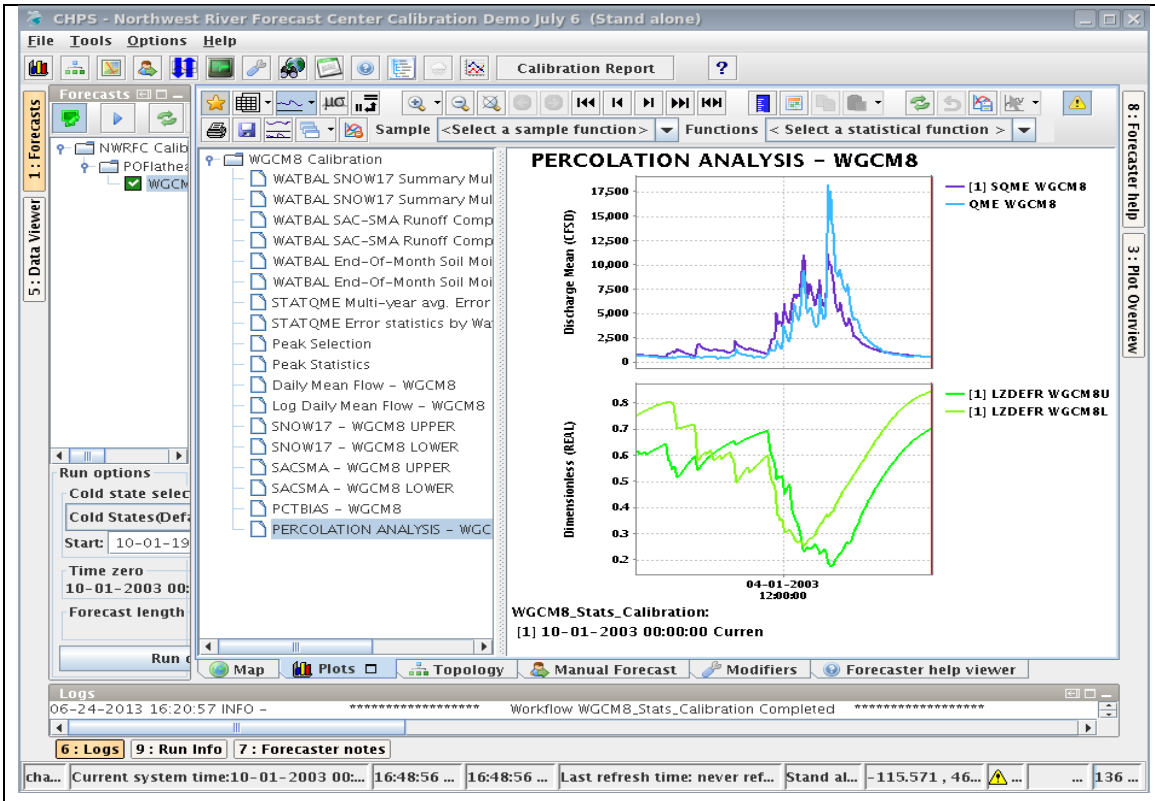


Figure 14: PERCOLATION ANALYSIS

Expected result: The plots are properly displayed.

Appendix A: Use of Time Zones in FEWS

Memo

To
NWS Calibration team

Date	**Number of pages**
11 February 2013	7

From	**Direct line**	**E-mail**
Matthijs Lemans	240 475 6707	matthijs.lemans@deltares-usa.us

Subject
Demo Calibration NWS – explanation of time zones and time steps and migration to local standard time

1 Introduction

This memo aims to clarify the time zone concept of Delft-FEWS, as well as the steps required for the migration of the calibration application in GMT time to local standard time. The first Chapter holds general information about time zone and time steps in FEWS. The second Chapter describes the required migration steps.

Content of the memo:

1. Introduction
2. General information
   2.1. Time zone and time steps
   2.2. Time zone communication with the world outside FEWS
   2.3. Time zone configuration for import 6h data in local standard time
   2.4. Display of time zone
   2.5. TimeStep.xml
   2.6. Summary Local time zone settings
3. Steps for migrating calibration environment to local standard time

2 General information

2.1 Time zone and time steps

FEWS is strict on the time steps and time zone handling. All time related information is stored in the FEWS database in GMT. This cannot be overruled by configuration. There are however settings that overrule the default GMT time zone when importing, exporting or displaying data.

A time step in FEWS is a set of all possible valid times. The time step, for example

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

is always referenced to GMT. For time steps larger than one hour, a shift is sometimes required to align the valid times with a time zone (see 2.3). The shift required is never larger than one time step.

Time steps in FEWS are always period ending. A day time step is midnight to midnight. Time steps are configured in the time series set. For verbose time steps it might be useful, and sometimes required, to define these predefined time steps once in the TimeStep.xml (see 2.5) and refer to them from other configuration files.

2.2 Time zone communication with the world outside FEWS

When FEWS imports or exports data, typically in an import, export, or general adapter module, the default time zone is GMT. Imported data is read by FEWS in GMT time, unless specified otherwise in the data format itself. When the time zone is not specified in the data format, the time zone can be configured in the general settings of the import module. This may be specified as a timeZoneOffset (of GMT), or as a specific timeZoneName.

The time zone setting in the General adapter is used when exporting or importing pi files that

do not have the time zone information. Configuration of a time zone in the general settings of a

General Adapter:

```
<timeZone>
    <timeZoneOffset>+00:00</timeZoneOffset>
</timeZone>
```

results in a pi.xml export timeseries:

```
<timeZone>0.0</timeZone>
    <series>
        <header>
            <type>instantaneous</type>
            <locationId>CT RIVER R1/334752.0</locationId>
            <parameterId>Flow Hydrograph</parameterId>
```

```
                <timeStep unit="second" multiplier="3600"/>
                <startDate date="2008-03-19" time="12:00:00"/>
                <endDate date="2008-03-20" time="12:00:00"/>
                <missVal>-999.0</missVal>
                <stationName>Connecticut River at Thompsonville C3</stationName>
                <units>CFS</units>
            </header>
            <event date="2008-03-19" time="12:00:00" value="30128.951" flag="0"/>
            <event date="2008-03-19" time="13:00:00" value="29877.951" flag="0"/>
```


whereas using a timeZoneOffset of 2 hours,


```
<timeZone>
    <timeZoneOffset>+02:00</timeZoneOffset>
</timeZone>
```


results in a pi.xml timeseries in local time


```
<timeZone>2.0</timeZone>
<series>
    <header>
        <type>instantaneous</type>
        <locationId>CT RIVER R1/334752.0</locationId>
        <parameterId>Flow Hydrograph</parameterId>
        <timeStep unit="second" multiplier="3600"/>
        <startDate date="2008-03-19" time="14:00:00"/>
        <endDate date="2008-03-20" time="14:00:00"/>
        <missVal>-999.0</missVal>
        <stationName>Connecticut River at Thompsonville C3</stationName>
        <units>CFS</units>
    </header>
    <event date="2008-03-19" time="14:00:00" value="30128.951" flag="0"/>
    <event date="2008-03-19" time="15:00:00" value="29877.951" flag="0"/>
```


Another reason for using the time zone in the GA may be model specific, for example the SNOW17 models in CHPS. This model must (and always has) run in local time as there are internal interpolations which require it to know if it is morning or night.

Hence, FEWS exports data to the snow model in local time. The data is not shifted or moved or anything. It is simply exported with time stamps that are local times. So no data values are changing. And data values are not moving in time. The bit of configuration needed to ensure the data is time stamped in local time, is a part of all the snow model configurations in the NWS configurations.

2.3 Time zone configuration for import 6h data in local standard time

As described earlier, for time steps larger than one hour, a shift is sometimes required to align the valid times with a time zone. A good example is the NWS data cards. The time zone in the data card is in local time, say GMT -8hr. There is however no indication of the time zone in the file. This means that the time steps in the file are (04Z, 10Z, 16Z & 22Z) or in local time (0,6,12,18). That does not match with the 6 hour time step in FEWS (0Z, 6Z, 12Z, 18Z)

Now when importing a time series the time value in the file must match the valid time steps of the time series to be imported to. If, as would be correct, the datacard is set in import to be at GMT-8 using the setting

```
<importTimeZone>
        <timeZoneOffset>-08:00</timeZoneOffset>
</importTimeZone>
```

Then the valid time steps in the time series to be imported to must also be in that time zone. This can be indicated in the time series set

```
<timeStep unit="hour" multiplier="6" timeZone="GMT-8"/>
```

To display the data, the time series in the filters must be in the same time zone as it is imported in. So if the data was imported in GMT-8 then the timeStep in the filter should also be

```
<timeStep unit="hour" multiplier="6" timeZone="GMT-8"/>
```

If the data is imported in GMT then it should be defined as

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

You can also use the Database viewer to check the time series imported, as this will always show the data in the time zone it is in. In the database viewer the time step is reconstructed from the database. The time step id is not stored. So a 6hours GMT+4 time step equals a 6 hours GMT-8 time step, as they contain the same times.

The present NWS applications imports the data cards with time zone GMT-6, and accepts in this way a shift of the data. By doing so, the data is stored and aligned at the (0Z, 6Z, 12Z, 18Z) time interval, and no time zone corrections need to be made in the configuration and OHD models.

2.4 Display of time zone

The time zone definition in the Explorer.xml defines the default time zone for the system. The default time zone is used for all times in user displays, unless locally overruled. This includes time series displays and the system time. If this optional entry is not included then the time zone is considered to be UTC+0:00 (or GMT). Setting the time zone to a local standard time does not mean data get saved or get imported in local time!

2.5 TimeStep.xml

You can reference time steps defined in the regionConfig/timeSteps.xml. It is comparable with a global property, it makes no difference to use the global time step or the verbose time stepId of the time step. Only specify the id attribute when referring to a predefined time step. In the regionConfig/timeSteps.xml the time steps list both the id and the attributes that define the time step. If no time zone is defined, then dates and times are in GMT.

Some examples are:

```
<timeStep id="12Z" times="12:00"/>
```

Defines the time step by a list of times without dates.

```
<timeStep id="6hr" unit="hour" multiplier="6" timeZone="GMT-8"/>
```

Defines the time step in a certain time zone

```
<timeStep id="monthly" monthDays="--01-31 --02-28 --03-31 --04-30 --05-31 --06-30 --07-31 --
08-31 --09-30 --10-31 --11-30 --12-31"/>
```

Defines a pattern of days in a month. This pattern will be repeated every month. Each day in the month can have a different aggregation period. The start of the aggregation period is exclusive and the end of the aggregation period is inclusive. To get a monthly time series at 12Z, a timeZone of GMT-12 needs to be added as last attribute of the time step.

```
<yearlyTimeStep id="season">
    <monthDay value="--01-02" start="--10-01" end="--03-31"/>
    <monthDay value="--07-01" start="--04-01" end="--09-30"/>
</yearlyTimeStep>
```

A timeStep that defines a pattern of dates in a year. This pattern will be repeated every year. Each date in the year can have a different aggregation period (season). The start of the aggregation period is exclusive and the end of the aggregation period is inclusive. This yearlyTimeStep is meant for seasons, therefore limited to four dates. If more than four dates in a year are required, then you should use the monthDays option in the timeStep element instead of this yearlyTimeStep

2.6 Summary Local time zone settings

All time related information is stored in the FEWS database in GMT. This cannot be overruled by configuration. There are however settings that overrule the default GMT time zone while importing, exporting or displaying data:

- *Explorer.xml*: defines default time zone for all times in FEWS displays.
- *Import/Export and General Adapter module*: The time zone setting in the general section is used when exporting or importing pi files that do not have the time zone information.

- *Workflowdescriptor*: time zone reference on workflow level. The attribute TimeZone is used for all time steps without time zone referenced in this workflow. Disadvantage of this setting is that this information is not passed to the workflow navigator, meaning this tool will not show the data. Hence to further explained in the memo.
- *timeSeriesSet*: time zone reference on local level. For example <timeStep unit="hour" multiplier="6" timeZone="GMT-8"/>
- *TimeStep.xml*: time zone reference on local level, with more options than the timeSeriesSet.

3 Steps for migrating calibration environment to local standard time

The current demo application for calibration is configured in GMT time. The ICP calibration environment of NWS runs in local time. Reason for running in local standard time is most likely that the import data from the data cards is always in local time, and shifting the data to a global GMT time interval is not desired. There as several steps needed to migrate the application to local standard time.

- Explorer.xml: Set the cardinal timestep to 1hr. Change the system time to local standard time:
  <timeZoneOffset>-08:00</timeZoneOffset>
- Timesteps.xml: Define local standard times for the hourly, 6hourly, daily and monthly time steps. For example:
  <timeStep id="6hr" unit="hour" multiplier="6" timeZone="GMT-8"/>
  <timeStep id="monthly" monthDays="--01-31 --02-28 --03-31 --04-30 --05-31 --06-30 --07-31 --08-31 --09-30 --10-31 --11-30 --12-31" timeZone="GMT-8"/>
- Import Data: Check the local time of the import data. For calibration, this is typically the daily QME data and the 6 hourly MAT/MAP data.
- Import Datacard: define a timezone in local standard time in the general settings.
  <importTimeZone>
  <timeZoneOffset>-08:00</timeZoneOffset>
  </importTimeZone>
  And define the corresponding timestep id, as defined in the timeSteps.xml, in the import timeseries configuration:
  <timeStep id="6hr"/>
  If the QME and MAT/MAP data are in different time zones, create separate import sections in the Import Datacards import module.
- Filters/Displaygroup: Change the current timesteps to the corresponding timestep id in local standard time
- ModuleConfigFiles: Change the current timesteps to the corresponding timestep id in local standard time. In addition for the General Adapter, change the startLocalHourOfDay setting, as defined in the SNOW17 modules to 0, or delete it.
  <int key="startLocalHourOfDay" value="0"/>

Also, if not already done, delete the loopTimeStep in the General Adapter. This does not work with local standard time. Furthermore, no midnight to 12Z sample transformations are necessary anymore in the STATQ module. Example configurations have to be provided by Deltares.

The replacement of timestep units by timestep Id's can probably easiest be done using a script.