

SSHP Data Transfer

1 Description of Algorithm

In order to keep the SAC-SMA model states up-to-date and to provide other necessary input data, the SSHP Data Transfer process moves data from the FEWS database at an RFC to the IHFS database at a WFO. The transfer process is executed once per day, after the forecast model and update states run at the RFC have completed.

Description	Data Source at RFC	Destination table at WFO in IHFS DB
SAC-SMA state variables	FEWS DB	SacSmaState
SAC-SMA parameters	FEWS DB	SacSmaParams
MAPE adjustment values (12 monthly values) OR ET-demand curve (12 monthly values)	FEWS DB	MonthlyValues
Prior Computed Runoff (INFW time series)	FEWS DB	FcstDischarge
MAPE Time Series (optional)	FEWS DB	FcstOther

1.1 Utility Parameters

The SAC-SMA parameters are retrieved from a parameter XML file which contains the states from the most recent run of UpdateStates via the FEWS PI REST Web Service. Definitions for these SAC-SMA parameters used by the SSHP Data Transfer are found in section 2 (Model Parameters) of the [Sacramento Soil Moisture Accounting](#) document.

1.2 Utility States

The SAC-SMA model states are retrieved from a FEWS database via the FEWS PI REST Web Service. The properties of these model states are described in section 3 (Model States) of the [Sacramento Soil Moisture Accounting](#) document.

1.3 Utility Time Series

The SSHP Data Transfer uses runoff (required) and potential evaporation (optional) time series from SAC-SMA model. The time series retrieve a string PI input xml from FEWS database via FEWS PI REST Web Service.

Input TimeSeries:

Time Series Type	Internal Model Units	Time Step	Missing Values Allowed	Required [Yes or No]
INFW	MM	Any	No	Yes
MAPE	MM	Fixed to 24	No	No

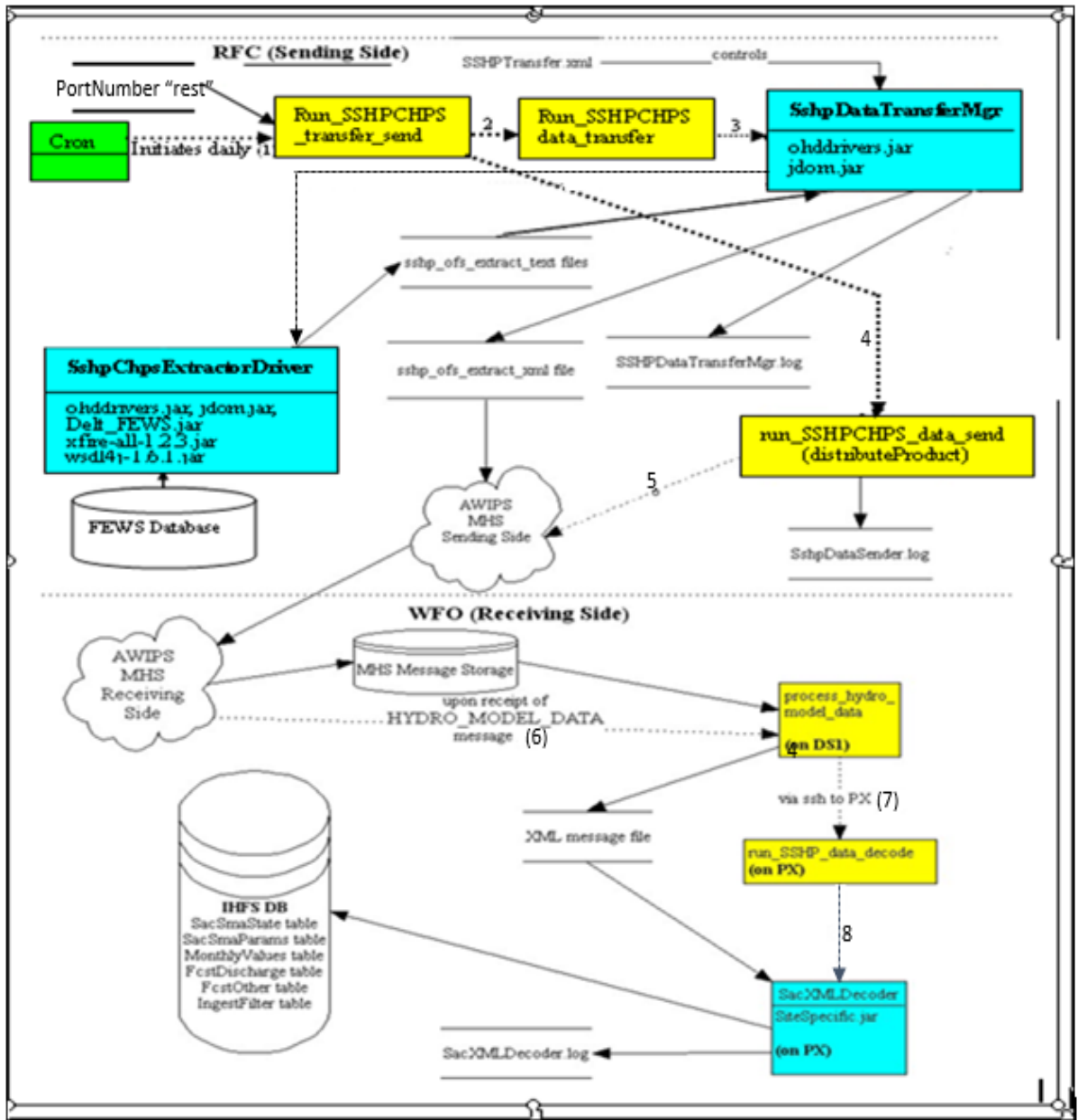
1.4 FEWS Adapter Used

N/A

1.5 Common Issues

Issues	Possible causes
SshpDataTransferMgrCHPS.log (in /awips/hydroapps/whfs/local/data/log/sshp)	
ERROR- /awips/hydroapps/whfs/local/data/sshp_transfer/ofs_extract_text/CRWI3_CRW13.2011_02_09_18_51_57.txt <i>not found.</i>	See the ofs extract text log file (in XML format) for more details.
WARNING- Could not get the correct moduleInstanceId "ARCT2" in the control file. Skip this forecast point....	Check the moduleInstanceId in the control file SSHPCHPSTransfer.xml
SshpDataTransferMgr.stdoutCHPS.log (in /awips/hydroapps/whfs/local/data/log/sshp)	
ERROR- the 'running' file does not exist.	Need to run the backend pi service
ERROR- Could not connect to PiService because running file is too old '< 1 minute'	Need to restart the backend pi service
ofs extract text log (in /awips/hydroapps/whfs/local/data/sshp_transfer/ofs_extract_text)	
ERROR- Webservice connection refused. Please check the PiServicePort.	The PiServicePort property in the pi service global properties file should be set to the same number.
ERROR- SSHP could not retrieve TIMESERIES from database	Check timeSeries Id in PiServiceConfigFile.
ERROR- SSHP could not retrieve Model STATE from database	Check moduleState id in PiServiceConfigFile.

2 Data Transfer Process



3 Sending Side (RFC) in FEWS Environment

3.1 Configuring SSHP Data Transfer in CHPS

3.1.1 SSHP Configuration Files

Executing SSHP Data Transfer in CHPS requires the following FEWS and AWIPS configuration files.

Type of File	Location	Description
Location Sets	Config/RegionConfigFiles/ LocationSets.xml	Defines a set of locations used by SSHP Data Transfer
Module Sets	Config/RegionConfigFiles/ ModuleInstanceSets.xml	Defines a set of SAC modules used by SSHP Data Transfer
Id Mappings	Config/IdMapFiles/ IdImportPiService.xml and Config/IdMapFiles/ IdExportPiService.xml	A pair of files that describe mappings for importing and exporting when using SSHP Data Transfer
FEWS Pi Rest Web Service Configuration	Config/PiServiceConfigFiles/ WebServices.xml	Defines defaultRequestParameterId to be exported data for SSHP Data Transfer
Filter Timeseries Sets	Config/RegionConfigFiles/ Filters.xml Config/RegionConfigFiles/ Filters-SSHPDataTransfer.xml	Defines SSHP timeseries sets.
AWIPS configuration	/awips/hydroapps/whfs/local/data/app/sshp/ SSHPCHPSTransfer.xml	Defines data to be exported for WFO.

3.1.1.a FEWS configuration XML files

i) Config/RegionConfigFiles

a) LocationSets.xml

The existing LocationSets.xml file is updated with a set of SSHP location ids.

For example:

```
<locationSet id="SSHP">
```

```

        <locationId>JHMM6</locationId>
        <locationId>TWNT1</locationId>
        <locationId>ANNM7</locationId>
        <locationId>ARLT1</locationId>
        <locationId>ATNA1SS</locationId>
        <locationId>BIRN7</locationId>
        ....
    </locationSet>

```

b) ModuleInstanceSets.xml

The existing ModuleInstanceSets.xml file is updated with a set of SSHP module instance Ids.

For example:

```

<moduleInstanceSet id="SSHP_SACSMA">
  <moduleInstanceSet id="SSHP_SACSMA">
    <moduleInstanceId>FGSSPEC_MergeMAPE_Forecast</moduleInstanceId>
    <moduleInstanceId>SACSMA_BLWM6_BLWM6SEG_Forecast</moduleInstanceId>
    <moduleInstanceId>SACSMA_LNDM6_LNDM6SEG_Forecast</moduleInstanceId>
    <moduleInstanceId>SACSMA_WOOM6_WOOM6SEG_Forecast</moduleInstanceId>
    <moduleInstanceId>SACSMA_CEPN7_CEPN7SEG_Forecast</moduleInstanceId>
    <moduleInstanceId>SACSMA_BOX44_BOX44SEG_Forecast</moduleInstanceId>
    <moduleInstanceId>SACSMA_IVYN7_IVYN7SEG_Forecast</moduleInstanceId>
    <moduleInstanceId>SACSMA_ANNM7_ANNM7SEG_Forecast</moduleInstanceId>
    <moduleInstanceId>SACSMA_ARLT1_ARLT1SEG_Forecast</moduleInstanceId>
    <moduleInstanceId>SACSMA_ATNA1SS_ATNA1SSG_Forecast</moduleInstanceId>
    <moduleInstanceId>SACSMA_BIRN7_BIRN7SEG_Forecast</moduleInstanceId>
    ...
  </moduleInstanceSet>
</moduleInstanceSet>

```

c) Filters.xml

The existing Filters.xml file is updated with a child foreignKey "SSHPDataTransfer" into filter id "WebService".

For example:

```

<?xml version="1.0" encoding="UTF-8"?>
<filters version="1.1" xmlns="http://www.wldelft.nl/fews"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="/awips/chps_share/schemas/filters.xsd">
  <defaultFilterId>LMRFC</defaultFilterId>
  <filter id="WebService">
    <child foreignKey="GraphGen"/>
    <child foreignKey="EnsPostPE_Historical_Data"/>
    <child foreignKey="HEFSGraphGen"/>
    <child foreignKey="MEFPPE_Historical_Data"/>
    <child foreignKey="SSHPDataTransfer"/>
  </filter>
</filters>

```

```

    <child foreignKey="piService"/>
  </filter>
  ....
</filters>

```

d) Filters-SSHPPDataTransfer.xml

The new Filters-SSHPPDataTransfer.xml file contains a set of SSHP timeseries.

For example:

```

<?xml version="1.0" encoding="UTF-8"?>
<filters 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/filters.xsd">
  <filter
    id="SSHPPDataTransfer">
    <timeSeriesSet>
      <moduleInstanceSetId>SSHPP_SACCSMA</moduleInstanceSetId>
      <valueType>scalar</valueType>
      <parameterId>INFW</parameterId>
      <locationSetId>SSHPP</locationSetId>
      <timeSeriesType>simulated forecasting</timeSeriesType>
      <timeStep unit="hour" multiplier="6" />
      <readWriteMode>read only</readWriteMode>
    </timeSeriesSet>
    <timeSeriesSet>
      <moduleInstanceSetId>SSHPP_SACCSMA</moduleInstanceSetId>
      <valueType>scalar</valueType>
      <parameterId>MAPE</parameterId>
      <locationSetId>SSHPP</locationSetId>
      <timeSeriesType>simulated forecasting</timeSeriesType>
      <timeStep id="12Z" />
      <readWriteMode>read only</readWriteMode>
    </timeSeriesSet>
  </filter>
</filters>

```

ii) Config/IdMapFiles

Create IdImportPiService and IdExportPiService XML files if they do not exist.

a) IdImportPiService.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://chps1/schemas/idMap.xsd">

```

```
<enableOneToOneMapping/>
</idMap>
```

b) IdExportPiService.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://chps1/schemas/idMap.xsd">

    <enableOneToOneMapping/>
</idMap>
```

iii) Config/PiServiceConfigFiles

The SSHP Data Transfer utility runs the FEWS PI REST Web Service as a backend process (without user interface) by using a script *fews_piservice.sh*. Information about this FEWS PI REST Web Service can be found at

<https://publicwiki.deltares.nl/display/FEWSDOC/FEWS+PI+REST+Web+Service>

Add “**SSHPDataTransfer**” defaultRequestParametersId to **WebServices.xml** file.

```
<?xml version="1.0" encoding="UTF-8" standalone="no"?>
<webServices xmlns="http://www.wldelft.nl/fews"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://www.wldelft.nl/fews ../../schemas/webServices.xsd">
    <general>
        <filters>
            <filterId>WebService</filterId>
        </filters>
        <exportIdmapId>IdExportPiService</exportIdmapId>
        <readonlyMode>>false</readonlyMode>
        <testPageEnabled>>true</testPageEnabled>
        <cardinalTimeStep unit="hour" multiplier="6"/>
    </general>
    <!-- Insert_Lines_Here -->
    <piRestService>
        <defaultRequestParameters id="GraphGen">
            <exportIdMap>IdExportPiService</exportIdMap>
        </defaultRequestParameters>
        <defaultRequestParameters id="EnsPostPE_Historical_Data">
        </defaultRequestParameters>
        <defaultRequestParameters id="HEFSGraphGen">
            <exportIdMap>IdExportHEFSGraphGen</exportIdMap>
        </defaultRequestParameters>
    </piRestService>
</webServices>
```

```

<defaultRequestParameters id="MEFPPE_Historical_Data">
  <exportIdMap>IdExportMEFPPE</exportIdMap>
</defaultRequestParameters>
<defaultRequestParameters id="SSHData Transfer">
  <exportIdMap>IdExportPiService</exportIdMap>
</defaultRequestParameters>
</piRestService>
</webServices>

```

3.1.1.b AWIPS configuration XML file

In AWIPS, SSHP Data Transfer already uses a configuration file to identify the RFC segments to extract data for and the WFO locations to send the data to.

An excerpt is show below.

AWIPS control file locates at
/awips/hydroapps/whfs/local/data/app/sshp/SSHPCHPSTransfer.xml

```

<?xml version="1.0" encoding="ISO-8859-1"?>
<SSHPTTransfer>
  <wfo>
    <name>KJAN</name>
    <mhsId>JAN</mhsId>
    <productId>KORNRR3ORN</productId>
    <fcstPoint>
      <moduleInstanceId>MEIM6_MEIM6SEG</moduleInstanceId>
      <ihfsLocId>MEIM6</ihfsLocId>
      <ihfsBasinId>MEIM6</ihfsBasinId>
      <sendMapeTimeseries>YES</sendMapeTimeseries>
    </fcstPoint>
    <fcstPoint>
      <moduleInstanceId>JHMM6_JHMM6SEG</moduleInstanceId>
      <ihfsLocId>JHMM6</ihfsLocId>
      <ihfsBasinId>JHMM6</ihfsBasinId>
      <sendMapeTimeseries>YES</sendMapeTimeseries>
    </fcstPoint>
  </wfo>
</SSHPTTransfer>

```

To execute SSHP Data Transfer in CHPS, the highlighted yellow line needs to be modified. The element “ofsSegmentId” was changed to “moduleInstanceId” and the value for “moduleInstanceId now includes a string of the form “SEGMENTID_OPERATIONID”. The SEGMENTID value is the same as in the

original xml file, but OPERATIONID is new information. OPERATIONID represents the id of the SAC-SMA model in the segment for a given wfo location.

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<SSHPTTransfer>
  <wfo>
    <name>KJAN</name>
    <mhsId>JAN</mhsId>
    <productId>KORNRR3ORN</productId>
    <fcstPoint>
      <moduleInstanceId>MEIM6_MEIM6SEG</moduleInstanceId>
      <ihfsLocId>MEIM6</ihfsLocId>
      <ihfsBasinId>MEIM6</ihfsBasinId>
      <sendMapeTimeseries>YES</sendMapeTimeseries>
    </fcstPoint>
    <fcstPoint>
      <moduleInstanceId>JHMM6_JHMM6SEG</moduleInstanceId>
      <ihfsLocId>JHMM6</ihfsLocId>
      <ihfsBasinId>JHMM6</ihfsBasinId>
      <sendMapeTimeseries>YES</sendMapeTimeseries>
    </fcstPoint>
  </wfo>
</SSHPTTransfer>
```

Element descriptions:

- <SSHPTTransfer> - mandatory root node
- <wfo> - For each WFO to which the RFC wants to send data, there will be 1 WFO element. It will contain the following sub-elements: <name>, <mhsId>, <productId>, and <fcstPoint>. There may be multiple <fcstPoint> elements.
- <name> - The abbreviated name of the WFO.
- <mhsId> - The AWIPS Message Handling System Id for the WFO.
- <productId> - The Product Id to use with distributeProduct.
- <fcstPoint> - The element that represents the information used to pull data out of OFS and send it with the correct information to the WFO. It contains the sub-elements: <moduleInstanceId>, <ihfsLocId>, <ihfsBasinId>, <sendMapeTimeseries>.

<moduleInstanceId> - Contains the name of the OFS segment id and operation id (SEGMENTID_OPERATIONID) from which data will be extracted for this particular forecast point.

<ihfsLocId> - Contains the location id of the forecast point as stored in the WFO's IHFS database.

<ihfsBasinId> - Contains the basin id associated with the forecast point as stored in the WFO's IHFS database. The MAPE data will be associated with this basinId. This should be the same basinId used for the MAP basin at the WFO.

<sendMaPeTimeseries> - Contains values (YES or NO), determines if the data extraction program will attempt to extract MAPE time series data. If so, then there will be an MAPE time series sent along with Monthly Adjustment factors. If not, then an MAPE demand curve will be sent.

3.2 Setting up SSHP Data Transfer in CHPS

The steps below summarize how to setup SSHP Data Transfer in CHPS.

3.2.1 Setup auto login from dx1 (or px1) to chps1 (REST) as user "fews"

- a. If you decide re-generate the public keys on dx1 (or px1)
 - Login to dx1 | px1-xxx
 - su - fews
 - /usr/bin/ssh-keygen -t dsa

- b. Copy the public key file from dx1|px1-xxx to chps1-xxx and append it to authorized file in fews (xxx – should be replace with the 3 letter id (see [table1 col. 2](#))
 - cd ~fews/.ssh/
 - scp -p *.pub fews@chps1-xxx:/tmp
 - ssh fews@chps1-xxx
 - ls /tmp/*.pub
 - cat /tmp/*.pub > ~/.ssh/authorized_keys2 rm -f /tmp/*.pub

- c. Make sure authorized_key2 file and .ssh directory permission must
 - -rw-r--r-- 1 fews fxalpha 600 Apr 14 12:49 authorized_keys2
 - drwx----- 2 fews users 4096 Apr 14 11:31 .ssh
 - exit

3.2.2 Setup REST FewsWebService

- The SSHP Data Transfer process in CHPS requires a functioning PI service. Make sure FEWS REST Web Service has been installed on **chps1**.
- Use the tomcat port (8443) on chps1.

3.2.3 Mount /awips/hydroapps on chps1 (REST service) machine

- SSHP Data Transfer makes use of scripts located in the WHFS bin directory (**\$WHFS_BIN_DIR=/awips/hydroapps/whfs/bin**) and AWIPS fxa directory (**/awips/fxa**). In order for these scripts to be accessible from chps1 (REST WebService), an nfs mount of /awips/hydroapps and a copy of /awips/fxa must exist on chps1. To do this Type:

```
nas1:awipsHYDRO /awips/hydroapps nfs tcp,timo=600,nfsvers=3
```

3.2.4 Installation SSHP scripts

- SSHP Data Transfer uses the following files which are delivered as part of CHPS.

Deliverable	File Location
ohddrivers.jar	OHD-CORE bin
Delft_FEWS.jar	OHD-CORE bin
jdom2-2.0.6.1.jar	OHD-CORE bin
json-simple-1.1.1.jar	OHD-CORE bin
run_SSHPCHPS_data_transfer (shell script)	OHD-CORE scripts
run_SSHPCHPS_data_send (shell script)	WHFS bin directory
run_SSHPCHPS_transfer_send (shell cron script)	WHFS bin directory

- ohddrivers.jar – An existing OHD CHPS deliverable that contains new java code for extracting SAC data from the RFC database and converting it to an xml format for sending to the WFO.
- jdom2-2.0.6.1.jar – needed to use PI and Web service API in FEWS and SSHP application
- json-simple-1.1.1.jar – needed to use FEWS PI REST Web Service and SSHP application
- Delft_FEWS.jar – Deltares java library containing FEWS PI REST Web Service API methods

- *run_SSHPCHPS_transfer_send* – a new script to run SSHP Data Transfer in CHPS and send the data over the AWIPS WAN (located in \$WHFS_BIN_DIR=/awips/hydroapps/whfs/bin). Today, the script runs as a cron once per day. It should be scheduled at least 5 minutes after the FWS Update States run has ended. It initiates the data transfer process.
 - *run_SSHPCHPS_data_transfer* – a new script run SSHP Data Transfer in CHPS (located in \$OHDSCRIPT_DIR=/awips/chps_local/ohd/scripts)
 - *run_SSHPCHPS_data_send* - a new script invokes distributeProduct and sends the data files over the AWIPS WAN via the Message Handling System (MHS) (located in \$WHFS_BIN_DIR=/awips/hydroapps/whfs/bin).
- The *run_SSHPCHPS_transfer_send* and *run_SSHPCHPS_data_send* shell scripts need to be manually placed in the appropriate directory (\$whfs_bin_dir). They are included in the tar file (OHD-CORE-XX.X.X package).
 - The jar files **and** *run_SSHPCHPS_data_transfer* scripts are installed as part of the OHD-CORE-XX.X.X release installation.

3.2.5 SSHP Data Transfer Cron script

Today the SSHP Data transfer process is initiated by a cron script on either the **dx1** (or **px1**) machine. This cron can remain during the testing period.

A new cron should be to **dx1** (or **px1**) for user “**fews**” to run the updated

***run_SSHPCHPS_transfer_send* takes arguments.**

For REST FewService

- port number (Tomcat web port number)

An example cron entry is show below. It should be set to run 10 minutes after the Update States run.

```
#RUN SSHP Data Transfer Script to transfer SACSMA Parameters and State Values
# FEWS REST WebService
```

```
30 18 * * * fews /awips/hydroapps/whfs/bin/run_SSHPCHPS_transfer_send 8443 >
/home/public/bin/obslog_sshpchs
```

4 Receiving Side (at each targeted WFO) in FEWS Environment

N/A

5 Instructions to add a new location to the existing FEWS SSHP configuration

1. Add new location to FEWS configuration xml files

- a. Add a new locationId to **locationSet id=" Catchments_SiteSpecific"** under *Config/RegionConfigFiles/ LocationSets.xml* file

Example:

```
<locationSet id=" Catchments_SiteSpecific">
    <locationId>PHAO1</locationId>
    ....
</locationSet>
```

- b. Add a new moduleInstanceId to **moduleInstanceSet id="SSHP_SACSMa"** under *Config/RegionConfigFiles/ ModuleInstanceSets.xml* file

Example:

```
<moduleInstanceSet id="SSHP_SACSMa">
<moduleInstanceId>SACSMa_PHAO1_PHAO1_Forecast</moduleInstanceId>
...
</moduleInstanceSet>
```

- c. If MAPE is used, then make sure to check

```
<parameter id="MAPE_INPUT">
    <description/>
    <boolValue>true</boolValue>
</parameter>
```

2. Add new wfo focus points to AWIPS configuration xml file

- a. Edit */awips/hydroapps/whfs/local/data/app/sshp/SSHPCHPSTransfer.xml*
- b. Add a new element `<fcstPoint>` that represents the information used to pull data out of OFS and send it with the correct information to the WFO. It contains the sub-elements: `< moduleInstanceId>`, `<ihfsLocId>`, `<ihfsBasinId>`, `<sendMapeTimeseries>`.

Example:

```
<fcstPoint>
    <moduleInstanceId>PHAO1_PHAO1</moduleInstanceId>
    <ihfsLocId>PHAO1</ihfsLocId>
    <ihfsBasinId>PHAO1</ihfsBasinId>
```

```
<sendMapeTimeseries>TRUE</sendMapeTimeseries>  
</fcstPoint>
```