Deltares

Delft-FEWS Basic Configuration Course

Exercises – Getting Starting and Using the Interface

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Number of pages
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1.1 Course Introduction Question

2 Module 02: Delft-FEWS Introduction

2.1 Start Basic Application

The Basic Course application is provided as zip file.

Unzip the zip file to a folder on your computer (if not done already)

1. Start the application by clicking on the link (Delft-FEWS.lnk)
2. Allow Access (Windows Firewall message) if prompted
3. Go to the Current System Time in the bottom left of the Application.
    1. Click the Current System Time
    2. Click on Now, and the Apply
4. Open the Forecast Tree on the left of the screen, and select Import ECCC Meteo Data”and select the “Import ECCC Forecasts” node, then “Import RDPA.
5. Start the import of RDPA precipitation data by pressing the Run arrow 
6. Press the Logs button near the bottom of the screen if not already open, to review the import progress.
7. Navigate to the Spatial Display  and review the imported data, under the Node ECCC Grids – GeoMet → RDPA → Precipitation [mm].
8. Check the play options to see the animated rainfall, and use to number of milliseconds [default=200] to control the speed.
9. If you like, press the red circle to export either a .avi of .gif of the precipitation.
10.

2.2 Explore Available Data

This exercise will show you how to explore data which is available in the Delft-FEWS application. The steps will illustrate how the data (provided in the LocalDataStore can be viewed and accessed in different ways.

1. Open the Delft-FEWS application, and set the system time to “Tue 07-07-2020 00:00:00”. This is done from the bottom toolbar.
2. Go to the Data Viewer tab, located on the left side toolbar, and click on it to open.
3. Select the data you’d like to see, for example Measured Data → Hydro Stations
4. Open a Data Display tab, and select an individual station and parameter. This will then show up in the plot display.
5. Try different combinations of data sources, locations and parameters to see the flexibility
6. Also look at plot options to see what is available.
6. Open the Spatial Display, again navigate through different data sources, using different view extents.
7. For precipitation, try using the accumulation slider. Double click on the legend, and note you can change colours.
8. Go to the Database Viewer, and see all data available by the workflow that created it.
9. Explore different views with this data, and right click on some to see the data in a plot or grid.
10. Take a photo of your favourite data view, and upload it as the assignment answer.

3 Module 03: Getting Started and Using the Interface

3.1 Import Measured Data

This exercise will show how recently measured data can be imported into the Delft-FEWS application. Note that it is internet connection dependent! If your internet is too slow, consider leaving the system time at Tue 07-07-2020 00:00:00, the system time when data was downloaded for the local data store.

Go to the Current system time, click on it and press “Now” then “Apply”. This will bring the system to the current time, rounded to the system cardinal timestep of 1 hour.

Navigate to the Forecast Tree, and open Import WSC Forecasts Data → Import Recent Hydrological Data (Past Day). Press the arrow at the top of the Forecast Tree (or F9) to run the workflow.

Open the Logs from close to the bottom toolbar to see that the Workflow has been started. Note that unable stations will return a warning This workflow will take some time to import (2 minutes), so feel free to continue to explore the application while it is running.

Re-select the → Import Recent Hydrological Data (Past Day), then open the Workflow Navigator. Check what is occurring with the ImportWSCHourly module. Don’t worry if it looks complex, we’ll learn more about it later.

Try right clicking on these options and open the Config file to see the underlying xml configuration.

You can also initiate import tasks for Import Hydrological Data and Import Meteo Station Data, or Import ECCC Forecasts and these tasks will run in the background.

3.2 Change System Caption

In this exercise, we'll use global properties to set the System Caption. While the caption is defined in Explorer.xml, we use a global variable definition to set it. This is indicated by the $$ in the .xml file.

1. Open Windows Explorer or Total Commander and open the file %REGION_HOME%\Config\SystemConfigFiles\Explorer.xml in a XML editor or text editor.
2. You need to go search in this xml file, but in the section <dateTime> there is a property tag between $$

```
<dateTime>
<timeZoneName>$TIMEZONE$</timeZoneName>
<timeZoneName>GMT</timeZoneName>
<dateTimeFormat>EEE dd-MM-yyyy HH:mm:ss</dateTimeFormat>
<cardinalTimeStep unit="hour" multiplier="1"/>
<adjustSystemTimeAutomatically>false</adjustSystemTimeAutomatically>
</dateTime>
```

3. Open the file %REGION_HOME%\\global.properties in a text editor
4. Change the tag TIMEZONE to “MST”.
5. Save the global.properties file and restart you FEWS application. The FEWS application will normally pick up any changes to files (such as configuration files) and can be re-loaded with F5. So re-save the Explorer.xml and press F5 to restart.
6. Check the changes in the available timezones at the System Time. You can now toggle through MST and GMT in the system.
7. You can look at other data in the system, measured or forecasted, and note that is all will change as you change the system time.
8. For consistency, leave the Timezone option setting in GMT.

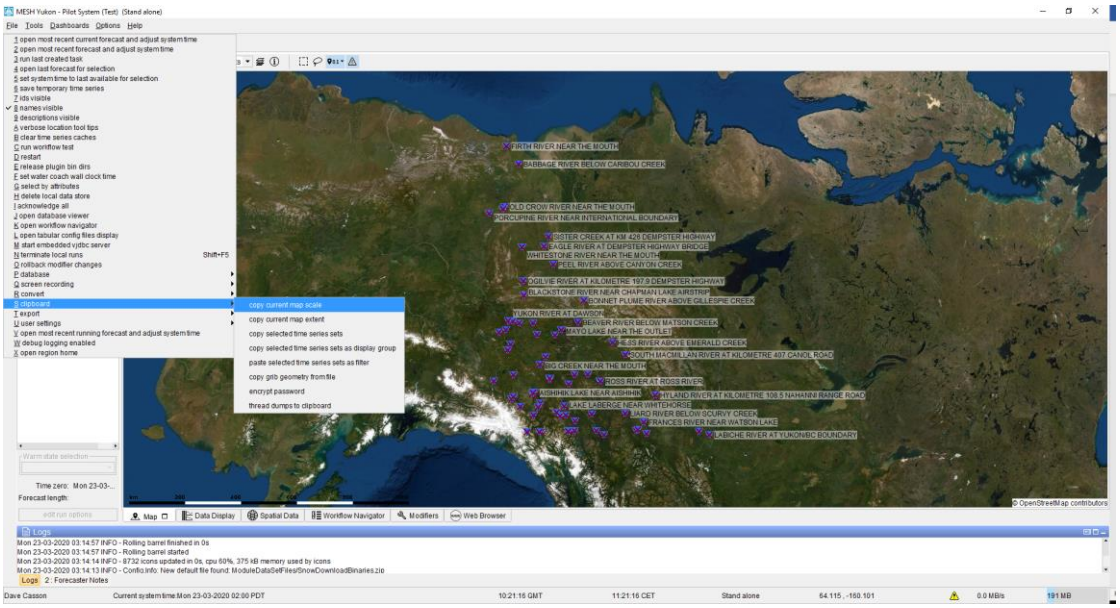
3.3 Add a new Zoom Extent

1. Go to the Explorer.xml file and identify the section that contains the Zoom Extents for the basins. For example.

```
<extraExtent id="World">
   <left>-180</left>
   <right>180</right>
   <top>90</top>
   <bottom>-70</bottom>
</extraExtent>
```

2. We can add another extent to this file using a utility in FEWS. From FEWS, go to the Map tab and bring the view to the desired extent (i.e. over the catchment of interest).

3. With the Logs open, press F-12, then S or simply navigate to the clipboard utility. Then select copy current map extent (the second from top).



4. In the xml, press paste. Put the co-ordinates provided in the correct format, and give a descriptive name (i.e. BestExtent)
5. This could also be added as the default extent if desired.
6. Reload the configuration and check the new zoom extent added.

4 Module 04: Configuration Overview

4.1 Create new workflow

In this exercise, we will add a new workflow that combines existing modules. This workflow will import recent hydrological and meteorological observations.

1. Open the Config Folder, and navigate to the WorkflowFiles folder, and then to Import, then to ECCCScalar.
2. Open each xml file to see the module that is being run.
3. Copy the Workflow file ImportECCCScalar.xml, and give it the new name ImportRecentObservations.xml
4. Open this new file, below the existing activities, add the Activity from ImportWSCHourly

```
<activity>
  <runIndependent>true</runIndependent>
  <moduleInstanceId>ImportWSCHourly</moduleInstanceId>
  <loopLocationSetId>WSCStations$REGION$</loopLocationSetId>
</activity>
```

5. Save this file as ImportRecentObservations.xml. If you are using an xml editor, check that the xml is valid (matches the Schema)
6. We now need to add the new workflow to the Workflow Descriptors. Navigate back the Config Folder → RegionConfigFiles → WorkflowDescriptors.xml
7. Add the line below workflow to the <!--Import Scalar Data Workflows-->

```
<workflowDescriptor id="ImportRecentObservations.xml" name="Import Recent Measured Data" visible="true" forecast="false" autoApprove="true" allowApprove="true"/>
```

7. Navigate to the bottom of the WorkfflowDescriptors.xml where the node definitions are shown. Add the new workflow to the node as below.

```
<node name="Near Real Time Data Import (MSC Datamart)">
```

```
        <workflowId>ImportWSCDaily</workflowId>
        <workflowId>ImportWSCHourly</workflowId>
        <workflowId>ImportECCCScalar</workflowId>
        <workflowId>ImportRecentObservations</workflowId>
    </node>
```

8. Save this file as . If you are using an xml editor, check that the xml is valid (matches the Schema)
9. Open your Delft-FEWS application, if it is already open the Logs Section and press F5 to reload the configuration.
10. Open the Manual Forecast Display, and then the Near Real Time Data Import node, select the Import Recent Measured Data Tab, which should now be available.
11. Press Crtl+r to open the modules that can be run for this workflow.
12. If you want, run the entire workflow or only the modules you have selected.

5 Module 05:Modules and Workflows

5.1 Add New Workflow to the Topology

In a previous exercise, we added the new workflow ImportRecentObservations.xml. When this workflow was registered in the WorkflowDescriptors.xml and the display nodes, it can immediately be seen in the Manual Forecast Display. To add this workflow to the Forecast Tree, it needs to be added to the Topology.xml

1. Navigate to and open the Topology.xml located in the Config RegionConfigFiles folder.
2. Inspect the Topology.xml and compare it to the Forecast Tree in the Delft-FEWS application.
3. To add the ImportRecentObservations workflow, first locate the ImportECCCStationNodes section.
4. You can use this section below as a template to add the new workflow (note optional elements have been removed compared to the provided file).

```
<nodes id="ImportECCCStationNodes" name="Import ECCC Meteo Data">
    <node id="ImportECCCStations" name="Import Meteo Station Data">
        <workflowId>ImportECCCScalar</workflowId>
    </node>
</nodes>
```

5. Copy and paste the section, and modify for the new workflow. An example of this is as follows

```
<nodes id="ImportRecentObservationsNodes" name="Import Recent Observational Data">
    <node id="ImportRecentObseration Nodes" name="Import Both Hydro and Meteo Data">
        <workflowId>ImportRecentObservations</workflowId>
    </node>
</nodes>
```

6. Save this file and reload the configuration. Check the logs that there are no errors. You should then see the new node and workflow available in the Forecast Tree. It can also be run from this section. If you ran the workflow in a previous exercise, it will be shown with a green check mark.

5.2 Explore the Forecast Tree

This exercise will look at the Forecast Tree, and functionality connected to it. The configuration of this section using the Toplogy.xml will be covered in the Running Workflows Modules.

1. With the application open, navigate to the Forecast Tree.

2. Go first to Information Sources, and select one of the Delft-FEWS or Operational Data options. Ensure a Web Browser tab is open, using Ctrl+R or the toolbar as necessary.
3. Navigate then to the Import Recent Hydrological Data (Past Day) which should have been run, or have data from the LocalDataStore.
4. With the workflow selected, open the Plot Overview from the right or left side toolbar. This will show pre-defined plots for select stations.
5. Navigate to the Import RDPA workflow, and run if it has not been already.

6 Module 06: Running Workflows

6.1 Run Models (Historic)

This application contains the ability to run two types of models, and both in historic and forecast mode. The application likely was provided to you with a LocalDataStore, but if not the data can be downloaded from the internet.

The LocalDataStore provided includes 10 years of historic re-analysis data from the Earth2Observe project. This data is accessed via an OpenDAP connection, and is available for over 30 years (1979-2014). It could be downloaded for any of this period of time, or for the entire duration. For this exercise, we'll use data that has been downloaded for 2004-2014.

1. If a LocalDataStore is available, open the application, and set the system time to Sat 30-12-2014 00:00:00. (Note 30th not 31st).
2. Navigate to the Run Liard, then the Run Liard Historic. Run this model by either clicking the run arrows in the Forecast Tree or pressing F9.
3. The model will run for a default period of 30 days. You can change this by going to the Edit Run Options at the bottom of the forecast tree, then Select initial state, then Cold state and set the Cold State selection to a time in the past (not more than 10 years).
4. If you would like to see the model run files, navigate to the Region Home and then to the Modules folder, then Raven. Here all information used to run the Raven model is located.
5. Repeat this procedure for the Snare model, but note that the model runtime is longer (5 minutes).
6. Navigate to the spatial display to see the Model Historic results for both the Snare and Liard models.

6.2 Run Models (Forecast)

The LocalDataStore provided includes forecast data for three types of forecasts provided by the Environment and Climate Change Canada . Two (RDPS and GDPS) are deterministic and one (REPS) is an ensemble.

The LocalDataStore provided contains forecast data downloaded for Tue 07-07-2020 00:00:00. The models can be run from this system time.

1. If a LocalDataStore is available, open the application, and set the system time to Tue 07-07-2020 00:00:00.
2. Navigate to the Run Liard, then the Run Liard GDPS. Run this model in forecast mode by either clicking the run arrows in the Forecast Tree or pressing F9. **Make sure the Cold State selection is not enabled like it was for the historic run!**

4. If you would like to see the model run files, navigate to the Region Home and then to the Modules folder, then Raven. Here all information used to run the Raven model is located.
5. Repeat this procedure for the Snare model, but note that the model runtime is longer.
6. Navigate to the spatial display to see the Model Forecast results for both the Snare and Liard models.
7. Try the other forecast runs, including the REPS ensemble.

Note that the forecasts could be downloaded and run using the current system time. To do this, set the current system time to Now, and download the forecasts from the Forecast Tree. In this case, you need to set a Cold State time that is midnight of the next day. So if today is the 13th, the Cold State selection has to be set for the 14th. This is because the model runs on a daily timestep, and without this change there would be missing data. Try it out at a later time.

7 Module 07: LocationSets

7.1 Export LocationSets

The LocationSets are defined in LocationSets.xml and often built from underlying csv and shp files which contain location metadata.

To first see what LocationSets are used in this application, go through the following steps:

1) Create a new folder outside of the FEWS folder structure, give it a descriptive name such as LocationSetTest. Note this folder much be empty.
2) In Delft-FEWS, open the logs, then press F12. This will open a long list of advanced options. Navigate to T Export, then location sets as csv files.
3) Select the folder you just created, and export the location sets as csv.
4) Go to this folder and see what LocationSets are available.
5). Open the LocationSets.xml (located in Config → RegionConfigFiles) and see how the LocationSets are defined. Do the LocationSets match what you expect? Leave a comment or any questions below.

Bonus question: For all regional ECCCStation definitions, two constraints are used. Why is this necessary?

7.2 Create a new LocationSet

LocationSets can be built from groupings of Locations, or other LocationSets. There are numerous examples of this in the provided LocationSets.xml.

Let’s say for example that you wanted to monitor the hydrology of all 3 Canadian territories (Northwest Territories, NT, Yukon, YK and Nunavut NU). Create a new LocationSet that would contain all these locations in one LocationSet.

There are different possibilities, so comment your way of defining it below.

8 Module 08: TimeSeriesSets

8.1 TimeSeriesSet in the Database Lister

In this exercise, we will explore TimeSeriesSets by looking at forecast data imported into the system.

1) Set the Current System Time to Now, using the clickable section at the bottom toolbar.
2)
3) Navigate to the Forecast Tree → Import ECCC Forecasts → Import GDPS and run the workflow.
4) Navigate to the Database Lister, using either the Icon, of the Tools dropdown menu (or ctrl+L).
5) Examine the data as it arrives. Note you can also explore other available data that has been imported by workflows.
5) Select the workflow, then click on data that has been imported.
6) Right click on the data, then select Copy Timeseries xml to Clipboard.
7) Then the dialog opens, examine the TimeSeriesSet. What is the value type? What is the timeSeriesType? What additional definitions are there?
8) You could paste this now into a xml file (with ctrl+v) but it is not required.
9) When the workflow is complete, there will be additional processed data for each of the catchments. Right clicked on the processed data (i.e. ModuleInstance → PreprocessGDPS), then again Copy Timeseries xml to Clipboard.
10. What are the differences between this and the original import? What is the same?
11. Try navigating the available data by sorting the columns, dragging and dropping the columns, and double-clicking to filter by attribute.
12. As a final response, what data is available for the SnareGrid location?

8.2 Data Visibility for External Forecasting TimeSeriesSet

Having completed the previous exercise, navigate to the Spatial Display.
1) Select the ECCC Grids – GeoMet → GDPS Forecast → Temperature. This will display the current grid.
2) Note the External forecast time in the bottom left of the Spatial Display. How does this time (labeled External) compare to the Current System Time.
3) Navigate to Current System Time, and go one day into the past. The GDPS forecast data will disappear (or if there is other GDPS forecasts in your local data store, the External Forecast time will change).
4) This is because when the system time is before the external forecast time, it is not viewable. This is the same for model runs. In this case, either no data is available, or the most recent forecast before the system time is used.
5) Move the System Time two days forward, and see that the forecast data is restored.

9 Module 09: Importing Data

9.1 Importing Data (Scalar)

A wide variety of external data can be imported into Delft-FEWS. In this exercise, we'll look at a simple example of importing historical hydrological data from a csv file.

1) Go to the Manual Forecast Tree, and select the directory Import Historic Data → Import WSC Historic Data.
2) Press F12 go get additional options, then Open Modules Config File (Ctrl+o). Select the module available to have the module configuration file opened.
3). Inspect this configuration file. Note the import type, the folder for import and the IdMapFile.

4) Also look at the timeSeriesSet, what is the value type? What is the timestep? What locations is the data imported for?
5) Navigate to the ID map (IdImportWSC) located in the Config folder → IdMapFiles → ECCC. Inspect this file to see the mapping from external to internal variables.
6) Navigate to the Region Home, and open the ImportBackup\WSC
7) Copy and paste the csv files to the Import\WSC folder.
8) Run the Import WSC Historic Data from the Manual Forecast Display
9) Go to the Database Lister to see the results of the Import WSC Historic Data workflow.
10) Right click on one of the Timeseries, and press Show Time Series Dialog (F10).
10) Get the xml definition of this timeseries by also right-clicking and Copy Timeseries xml to Clipboard.
11) Paste that timeseries definition in the exercise answers.

Advanced: Add these timeseries to the DataViewer by adding to the Filters.xml file. Note that new TimeseriesSets also need to be added to the Filters. When complete the new data should be visible from the DataViewer.

9.2 Importing Data (Grid)

We'll now look at downloading and importing Re-analysis Snow Water Equivalent Data from GlobSnow. This data is downloaded and imported in one workflow, however we'll break it into two steps to look at in more detail.

Set the system time to a period in the past year, for example 01-04-2020 00:00 GMT
Go to the Manual Forecast Display, and then to Import Snow Data. Click on Import GlobSnow, then press ctrl+R.
When the Select Modules to Run dialogue comes up, deselect ImportGLOBSNOW so that only RetrieveGLOBSNOW is checked.
Click ok and then run the workflow. Check the logs to see that a .bat file was used to call wget to download this data.
In Windows Explorer or Total Commander, navigate to the %REGION_HOME%/Import/GLOBSNOW.
There will be a compressed netCDF (.gz) file in this folder. If you want you can unzip this folder and inspect the netCDF If you don't have the right software to see the file, it is not required.

Again go to the Manual Forecast Display, and then to Import Snow Data. Click on Import GlobSnow, then press ctrl+R. This time select for ImportGLOBSNOW, click ok and run.

Go to the DataBase lister and see the data that was imported. Right click on the data and press Show Spatial Display to view the data on a grid.

Optional Exercise: Add the GlobSnow import to the Topology.

Advanced Optional Exercise: Add this new data import to the SpatialDisplay.xml. Tip: you can get the exact TimeSeriesSet definition by right-clicking on the data in the Database Lister, then copy TimeSeries xml to Clipboard.

10 Module 10: Processing Data

10.1 Add Thessian Polygon Data Processing

In this exercise, we'll look at adding a transformation for data processing. Specifically, the use of Thessian polygons to go from Spatial Measurement data to catchment averages.

Navigate to the folder %REGION_HOME%\Config\ModuleConfigFiles\Preprocess\ScalarData
Select the AccumulateForecastPrecipTemplate.xml file, copy it and paste it. Rename it to CalculateThessianPolygon.xml
Open the new file, to see the input data, output data (accum_precip) and transformation. You will be updating all three.
First to find the input data, open the PreprocessECCCScalar in the same folder, and locate the data output PC_Daily. It has the TimeSeriesSet definition as below.

```
<variable>
<variableId>PC_daily</variableId>
  <timeSeriesSet>
    <moduleInstanceId>ImportECCCScalar</moduleInstanceId>
    <valueType>scalar</valueType>
    <parameterId>PC.obs</parameterId>
    <locationSetId>$LOCATIONSET$</locationSetId>
    <timeSeriesType>external historical</timeSeriesType>
    <timeStep id="$DAY_TIMESTEP$"/>
    <relativeViewPeriod unit="day" start="$STARTTIME$" end="$ENDTIME$"/>
    <readWriteMode>add originals</readWriteMode>
  </timeSeriesSet>
</variable>
```

Copy and paste this definition as input in the new transformation file.
Now update the output of the transformation to be the daily precipitation, but for basin averages. You can accomplish this by copying the input data TimeSeriesSet, but replacing the LocationSet with the $MODELNAME1$Basins (you can see how this is defined in LocationSets.xml)

```
<variable>
<variableId>PC_daily_basin</variableId>
  <timeSeriesSet>
    <moduleInstanceId>ImportECCCScalar</moduleInstanceId>
    <valueType>scalar</valueType>
    <parameterId>PC.obs</parameterId>
    <locationSetId>$MODELNAME1$Basins</locationSetId>
    <timeSeriesType>external historical</timeSeriesType>
    <timeStep id="$DAY_TIMESTEP$"/>
    <relativeViewPeriod unit="day" start="$STARTTIME$" end="$ENDTIME$"/>
    <readWriteMode>add originals</readWriteMode>
  </timeSeriesSet>
</variable>
```

Finally update the transformation for Spatial Interpolation. There are many available, but we will use Thessian Polygon. We also use a GeoDatum reference to improve the processing. You can accomplish this by copying the input data TimeSeriesSet, but replacing the LocationSet with the $MODELNAME1$Basins (you can see how this is defined in LocationSets.xml).

```
<!--Transformations-->
<transformation id="thessian_precip_transformation">
  <interpolationSpatial>
    <thiessenPolygon>
```

```
            <inputVariable>
               <variableId>PC_daily</variableId>
            </inputVariable>
            <distanceGeoDatum>$DISTANCEGEODATUM$</distanceGeoDatum>
            <outputVariable>
               <variableId>PC_daily_basin</variableId>
            </outputVariable>
         </thiessenPolygon>
      </interpolationSpatial>
   </transformation>
```

The new module instance needs to be added to the ModuleInstanceDescriptors.xml. You can add this whereever you like, but it fits well under the Preprocess Scalar Data Section.

```
   <moduleInstanceDescriptor id="CalculateThessianPolygon">
      <description>Calculate Thessian Polygon based on scalar data</description>
   </moduleInstanceDescriptor>
```

Finally this new ModuleInstance needs to be added to the workflow. You can find this easily by going to the forecast tree, selecting Import Meteo Station, then opening the workflow navigator. Right click on the ImportECCCScalar workflow,then Open Config File.
With the ImportECCCScalar.xml workflow navigator open, add the new module at the bottom. Also update the properties to match the configuration below.

```
<properties>
   <string key="STARTTIME" value="-10"/>
   <string key="ENDTIME" value="0"/>
   <string key="LOCATIONSET" value="ModelMeteoStations"/>
</properties>
   <activity>
      <runIndependent>true</runIndependent>
      <moduleInstanceId>ImportECCCScalar</moduleInstanceId>
   </activity>
   <activity>
      <runIndependent>true</runIndependent>
      <moduleInstanceId>PreprocessECCCScalar</moduleInstanceId>
   </activity>
   <activity>
      <runIndependent>true</runIndependent>
      <moduleInstanceId>CalculateThessianPolygon</moduleInstanceId>
   </activity>
</workflow>
```

Reload the FEWS configuration, set the current system time to now, and run the Import ECCC Scalar workflow from the Forecast Tree. This should import the ECCC Scalar data and use Thessian methods to calculate catchment averages.

You can check this again in the workflow navigator.

11 Module 11: Visualizing Data in Plots

The following exercise will focus on modifying the visualization of data in the plot display. This will begin with changing the defaults for parameter displays.

11.1 Modifying Default Values in the TimeSeriesDisplayConfig

Locate the TimeSeriesDisplayConfig file in the SystemConfigFiles folder.
Open and review elements of this file to see the variety of files available. This includes the default values for the Legend Text, the default view period, and the legends for most parameters defined as class breaks. You can test any of these elements independent of this exercise.

Navigate to the ParametersDisplayConfig, and add default parameters for Temperature (both TA.obs and TA.nwp). Also default parameters for measured water level (HG.obs).

Take your most improved plot, whether from updated class breaks or parameter defaults and upload it for other participants to see.

11.2 Adding Data to the DataViewer using Filters

The current Meteo Station data imports are not visible in the DataViewer, although there TimeSeriesSets are defined. Determine why they are not shown (hint: check what filters are defined), and add them to the DataViewer Display.

Optional addition: Add in the results from one of the model runs. Do this by determining what the output data of the model runs are adding to both available timeSeriesSets and filters.

12 Module 12: Visualizing Data in the Spatial Display

In this exercise, we'll look at updating the view of data in both the Explorer.xml and the SpatialDisplay.xml.

12.1 Add a WMS Layer

Web Mapping Service (WMS) layers can be directly added to the SpatialDisplay.xml in order to integrate data from an external service provider. For an example in the Northwest Territories of Canada, links are available here: http://www.geomatics.gov.nt.ca/wms.aspx.

If you are interested in these layers, they can be explored by going to one of the three web service, selecting a layer and clicking the link. To see the layers available, "?service=WMS&request=GetCapabilities" needs to be added to the end of the link.

The layer can then be added to the Spatial Display using, for example the xml below:

```
        <wmsLayer id="NWT DEM">
   <url>https://www.image.geomatics.gov.nt.ca/ArcGIS/services/GNWT_Basemaps/Aster_DEM_Basemap/MapServer/WMSServer?service=WMS</url>
            <wmsVersion>1.3.0</wmsVersion>
            <wmsLayerName>1</wmsLayerName>
            <cacheDir>$MAPLAYERSCACHE_FOLDER$/GNWT</cacheDir>
        </wmsLayer>
```

Not this is the same url, but with &request=GetCapabilities removed. You may need to update the wmsLayerName, and the cacheDir and wmsLayer name if adding multiple layers.

To test, add the xml to the SpatialDisplay.xml, reload FEWS and go to the Spatial Data Display. There enable the layers and click off other WMS layers to see what remains.

An additional list of WMS layers and documentation is available by googling Delft-FEWS GeoMap.

12.2 Add Data to the Spatial Display

Add data from a previous exercise into the Spatial Display, this could be the Historic Hydrological Data from Module 9, the gridded GlobSnow data also from Module 9 or the Thessian Polygon from Module 11.

To do this, identify the TimeSeriesSets that need to be added, then add them to a GridPlotGroup, or make a new one by copy and pasting existing. Choose an example that roughly matches the new type of data you'd like to import.