

# Development of a Multi-Hazard Platform (MHP) for forecasting local level climate extremes and physical hazards for Iskandar Malaysia

MHP-IM User Manual



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# 1 Introduction

This document is designed to provide guidance on installing, navigating, and using the Multi Hazard Platform Iskandar Malaysia (MHP-IM). It also outlines basic operational procedures such as importing data, running preconfigured workflows and exporting data. This document is intended for end users and operators to utilize MHP-IM. This document, along with the working MHP-IM, is the output of Activity 3.1.

## 2 Installation of MHP-IM Stand Alone (SA) Application

This section describes how the user can install MHP-IM Stand Alone (SA) application on their own computers. This SA application will be mandatorily used by Delft-FEWS configurator (technical staff) to test the Delft-FEWS configuration before it is uploaded to the Delft-FEWS Operating Client (OC). This SA application was installed and used during the demonstration and training on using MHP-IM.

The steps that provided below allows user to install MHP-IM SA application in their own computer.

Below are the steps to install the MHP-IM Stand Alone application.

**Step 1:** MHP\_IM is provided as a zip file: "MHP\_IM.zip".

**Step 2:** Get the zip file and store the zip in a local folder on your laptop.

**Step 3:** Double click on this .zip file using Windows Explorer and it will show its content (MHP\_IM folder).

**Step 4:** The MHP\_IM folder inside the .zip must be copied to a local folder on your desktop/laptop. For example, copied to c:\MHP\_IM. Copy the MHP\_IM folders using Windows Explorer (right-mouse button).

**Step 5:** Go to the c:\MHP\_IM folder and paste the file that you copied.

**Step 6:** All the files from the folder will be copied the c:\MHP\_IM folder.

**Step 7:** After copying the MHP\_IM folder, user can then open MHP\_IM folder and double click on MHP-IM.Ink to start the application.

Name	Date modified	Type	Size
bin	10/02/2025 09:19	File folder	
Config	02/12/2024 09:14	File folder	
DumpFiles	12/02/2025 15:24	File folder	
Export	26/08/2024 10:21	File folder	
Import	19/11/2024 14:29	File folder	
ImportBackup	11/09/2024 17:52	File folder	
ImportFailed	11/09/2024 17:52	File folder	
localDataStore	10/02/2025 17:14	File folder	
MapsCache	01/02/2024 13:26	File folder	
Modules	17/02/2025 07:48	File folder	
Reports	18/01/2024 12:26	File folder	
temp	04/12/2024 17:28	File folder	
_build_manifest.txt	03/12/2024 08:17	Text Document	1 KB
_readme.txt	03/12/2024 08:17	Text Document	2 KB
clientConfig.xml	02/12/2024 09:41	XML Document	1 KB
exportedModuleDataSetFiles.txt	17/02/2025 07:48	Text Document	8 KB
few-splash.jpg	04/12/2024 13:50	JPG File	123 KB
Help.pdf	02/12/2024 11:17	PDF Document	215 KB
log.txt	17/02/2025 07:51	Text Document	3 KB
log.txt.old	12/02/2025 17:03	OLD File	399 KB
MHP-IM	12/02/2025 17:14	Shortcut	1 KB
patch.jar	12/12/2024 10:32	Executable Jar File	937 KB
running	17/02/2025 10:05	File	1 KB
sa_global.properties	20/01/2025 11:41	PROPERTIES File	2 KB
user_settings.ini	12/02/2025 17:03	Configuration settings	21 KB

Figure 2.1 Opening MHP-IM by Double Clicking on MHP-IM Shortcut

**Step 8:** MHP-IM will start with Splash-Screen with a Windows Security Alert pop-up.

**Step 9:** Press **Allow Access** button to continue. The message tells you that MHP-IM would like to access external data.

**Step 10:** MHP-IM Stand Alone application will start and show the main Map Display as shown below. Congratulations, you have now successfully installed MHP-IM Stand Alone application in your computer.



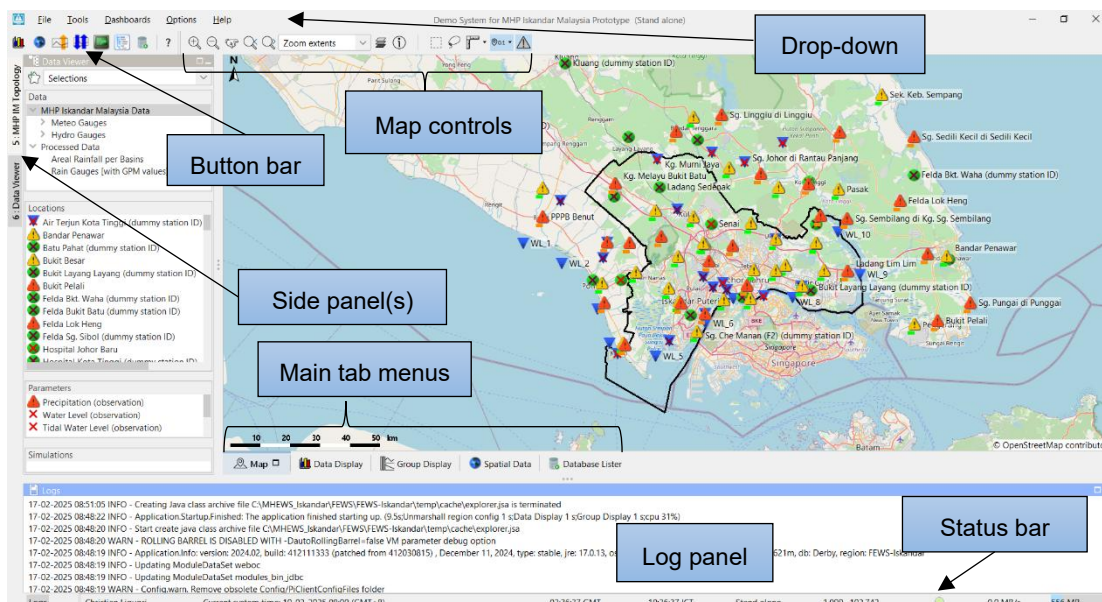
Figure 2.2 MHP-IM Splash Screen



# 3 MHP-IM Explorer

## 3.1 Overview

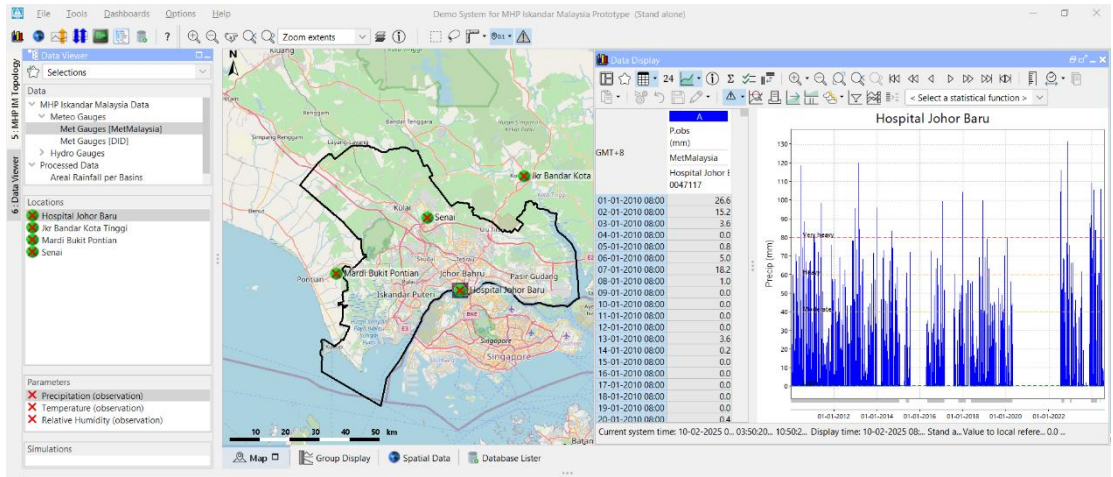
One of the main windows of the system is the FEWS Explorer shown in **Figure 3.1** below. In this case it is the Map window or Map Display.



**Figure 3.1** MHP-IM Explorer with the Map Display and One Side Panel Open

The following elements of the Delft-FEWS Explorer are always shown, regardless of which window or tab is currently open: the drop-down menus, button bar, main tab menus, log panel, status bar and any side panels. These are described in more detail in the subsequent paragraphs.

The user can resize, hide or open panels like the Logs or Data Viewer (one of the side panels) by pressing the panel buttons. It is also possible to make any of the tab menus floating and to put them on an additional screen (**Figure 3.2**). The current layout can be saved through the menu File – Save Layout. It is always possible to go back to the default layout from the same menu.



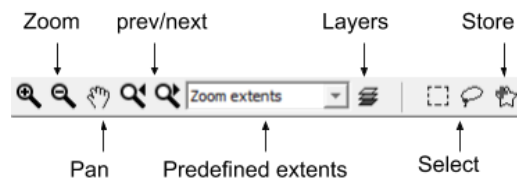
**Figure 3.2** MHP-IM Explorer with the Map Display and One Tab Menu Floating

### 3.2 Map Display

The map display serves a double purpose. The first is to give an overview of the available locations for the selected combination of filters and to allow the user to select or deselect locations by clicking the location icon. The second is to provide a geographical background to the locations.

The navigation & selection bar can be used to navigate and zoom through the map display, customize layers, select locations and store the selected custom locations.

The navigation & selection bar can be used to navigate through the map display, customize layers, select locations and store the selected custom locations.



**Figure 3.3** Navigation and Selection Bar

### 3.3 Drop-Down Menus

The drop down menu bar provides access to all displays configured for the MHP-IM application.

- **File** : gives options to deal with Layout (Load, Save, Default), Export desired time series and Exit the Delft-FEWS Explorer.
- **Tools** : gives access to a number of different windows and tools, some of which are also included in the button bar.
- **Options** : allows the user to open the Explorer Options and Permissions.

- Help : gives a user guide for the Delft-FEWS system and an About window, which displays the current version and technical information about the MHP IM system.

The Explorer Options Dialog can be used to define various user specific layout options, like information on the map, status bar, current system time, colour scheme and font size.

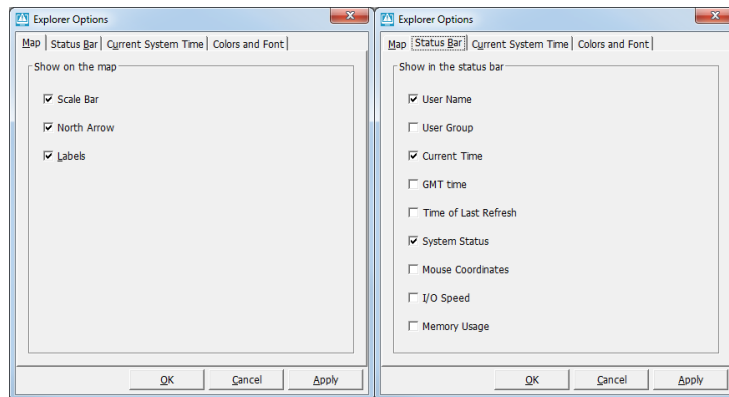










Figure 3.4 Two Example Tabs from Within the Explorer Options Dialog

### 3.4 Button Bar

The button bar provides quick access to frequently used tools (Plots, Grids, Forecast Management, System Monitor, etc.). Most of these tools are plug-ins to the Delft-FEWS Explorer, which can also be accessed through the drop down menu described in the previous paragraph.

Table 3.1 MHP-IM Button Bar

Button	Description of tool
	<i>Data Display: display data in graphs and/or tables</i>
	<i>Spatial Data: display grid data on a background map</i>
	<i>Manual Forecast: used to run the preconfigured workflows</i>
	<i>Forecast Management: controls all previously carried out forecasts</i>
	<i>System Monitor: monitors the status of the system</i>
	<i>Workflow Navigator: a tool for understanding the hierarchical structure of workflows, modules, module instances, and time series.</i>
	<i>Database Lister: a display to inspect and verify time series written to the database from a workflow</i>
	<i>Help: opens the Delft-FEWS User Guide pdf document</i>

### 3.5 Log Panel

The Log Viewer relays high level messages generated by active system components. In the OC these are mainly the start/completion of a workflow. System log messages can also be viewed through the System Monitor (see Chapter 7).

### 3.6 Status Bar

The Status Bar provides information about the status of the forecasting system:

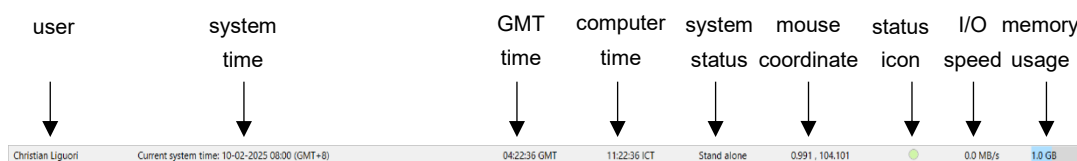
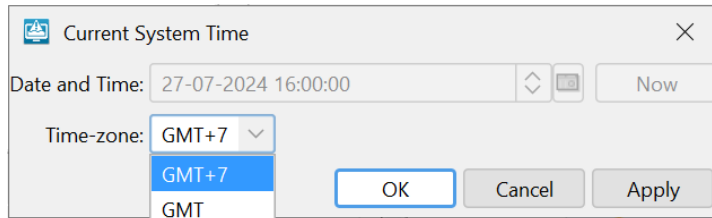


Figure 3.5 Delft-FEWS Status Bar

- User : shows the user name of the person logged in (derived from the operating system).
- System time : the time in which the system 'lives'. In MHP-IM the system time moves forward with steps of 1 hour, which can be seen as the system time step.
- GMT time : displays current GMT time.
- Computer time : the actual computer time (current time), set in the regional settings of the computer.
- System status : Indicates if the system is (1) logged off (red), (2) synchronizing with the server (purple), (3) fully synchronized with the server (green) or (4) connecting (orange).
- Mouse coordinates : coordinates of the mouse pointer on the map in the coordinate system in which the system is configured. For MHP-IM Cambodia is in WGS'84 (Lat-Lon).
- Status icon : indicates whether the system operates normally or that severe errors are encountered.
  - Green System is running normally. Some warnings may have been encountered.
  - ▲ Yellow System encountered severe errors in the past 48 hours. This means that at least one system message has been generated with log level ERROR. After all messages with this log level have been acknowledged by the user via the System Monitor, the icon becomes green again.
  - ✖ Red System encountered fatal errors in the past 48 hours. This means that at least one system message has been generated with log level FATAL.
- I/O speed : estimate of internet speed connection.
- Memory Usage : memory load of the system.

Through the Explorer Options Dialog (**Figure 3.4**) the user can configure which information should be shown on the status bar.

By double clicking on the System Time, the Current System Time dialog pops up, where the user can define the time zone which should be used to display times in the application. The default is GMT+8 because Iskandar Malaysia is located in the GMT+8 time zone. One can also select GMT, which more commonly used in meteorological forecasting.



**Figure 3.6** Dialog to Define the Display Time Zone

## 3.7 Side Panels

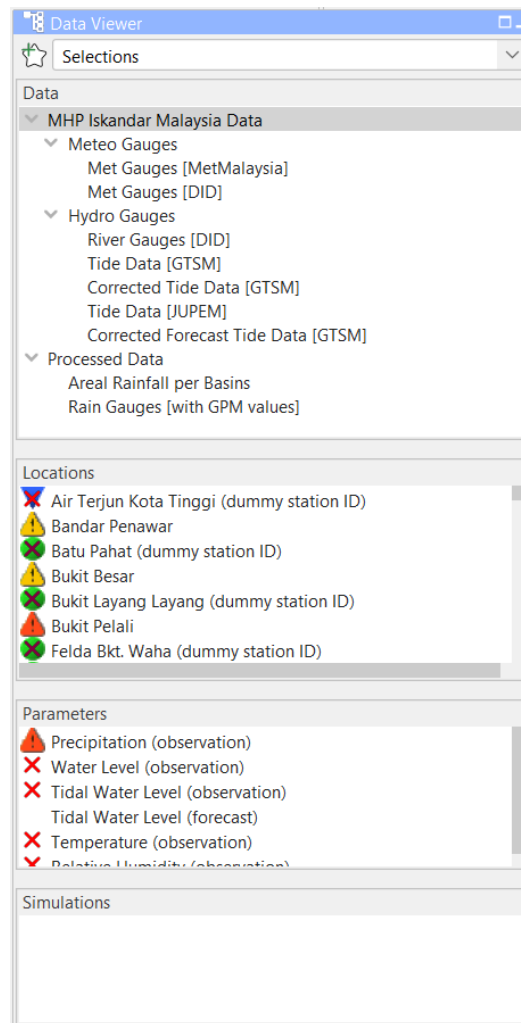
The MHP-IM contains two side panels; Data Viewer and MHP-IM Topology. As with most elements of the Delft-FEWS Explorer these can be resized, hidden, (un)docked, etc. The side panel will be discussed in following subchapters.

### 3.7.1 Data Viewer

The Data Viewer allows the user to view categorized data both in the Map View and in the Data Display. The Data Viewer can be used to create a graph or table, or show locations/icons on the map. It contains several list boxes (also called filters), which are required to identify the data to be displayed in a graph or table, or the icons on the map.

There are four list boxes, as numbered in **Figure 3.7**.

1. Data Sources
2. Locations
3. Parameters
4. Simulations



1. **Data Sources:**  
This display all possible data sources, grouped on several levels.
2. **Locations:**  
The locations at which combined selection is (or could be) available.
3. **Parameters:**  
This different parameters available with the combined selection.
4. **Simulations:**  
Different simulations available with the combined selection.

**Figure 3.7** Data Viewer Display

Once a selection is made within a single filter, the other filters will update to show only those items which can be combined with the current selection. This works in multiple directions; if no Location is selected yet, but the user does select a certain parameter, the Locations filter will be updated accordingly, and vice versa. It is also possible to select multiple items from the same filter by holding down the Shift and/or Ctrl key.

Right clicking on a certain filter will reveal a number of additional selection/filtering options (**Figure 3.8**). For example, it is possible to use a checkbox selection or to change the way the filter is updated based on the current selection in other filters.

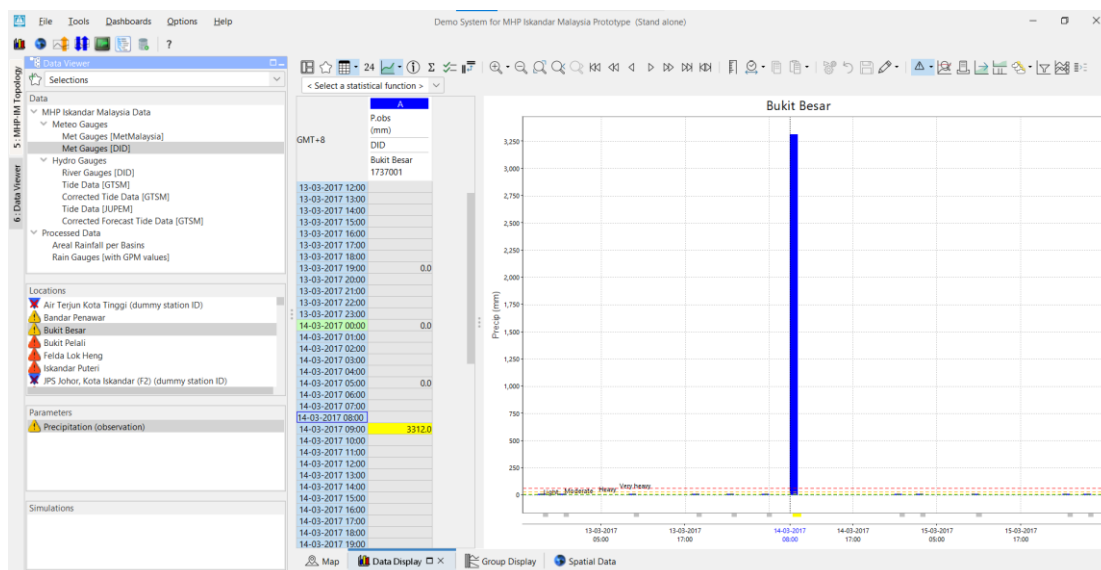
CheckBox Selection	Ctrl+Alt+C
✓ No Filter	
Currently Available	
Somewhere Available	
Show Only Selected Locations	Ctrl+Alt+O
Show All	Ctrl+Alt+A
Select all	Ctrl+A
Expand selection	Ctrl+NumPad +
Shrink selection	Ctrl+NumPad -

**Figure 3.8** Right Click Menu for the Locations List Box of the Data Viewer

The Data Display window offers graphical and tabular displays for presenting and editing of data, with the following features:

- Display of time series in tables and graphs:
- Display of actual data with historical events and threshold levels
- Tabular data editor

For displaying graphs, click the graph-button [Ctrl+D] or open the Plots tab (one is opened upon start up by default). By clicking the table button [F7], a table with all data will appear on the left-side of the graph. The most left column in the table shows the date and time of displayed data. The amount of records in the table corresponds with the timespan shown on the x-axis of the graph. Normally, data in the tables is shown in black, but from **Figure 3.9** it can be seen that data in one cell has been coloured in a different colour. This is an example of a data flag.



**Figure 3.9** Example of Data Flagging for Values Exceeding the Set Threshold

If the Map window is open while the Data Viewer is used, the locations shown on the map will update according to the current selection. Additionally, it is possible to select a location on the map instead of from the Locations filter, as these are linked with each other.

### 3.7.2 MHP-IM Topology

This side panel is often referred to as "Topology" due to its role in illustrating the interconnection of various elements within the Delft-FEWS system.

The side panel has two main sections:





1. Important Dataset : shortcut for displaying relevant scalar and gridded data that have been integrated into MHP-IM and used for producing hazard maps.
2. Hazard Maps : shortcut for displaying hazard maps data.

The content of this side panel is also used to configure which data are displayed on the MHP-IM Web OC.

# 4 Displaying and Editing Data in MHP IM





## 4.1 Icons






Icons are shown on the Map Display and in the Locations list-box. Five types of icons are used in MHP-IM:

- Meteorological gauging station : 
- Hydrological gauging station : 
- Hydromet gauging station : 
- Sea level gauging station : 




To indicate if data is available for a location, ‘overlays’ are used to show if data is present within the ‘relative view-period’, outside this period or not at all. The relative view-period is the period of interest relative to current time. For MHP-IM this view period is set at T0 – 7 days, where T0 stands for the current/present time.

**Table 4.1** Map Icons

Icon	Description
	No cross: Data is available for this location within the view-period
	No cross, but light grey, meaning that the selected parameter is not configured to be available for this location.
	Light-red cross: Data is available for this location, but outside the view-period
	Dark-red cross: No data is available for this location

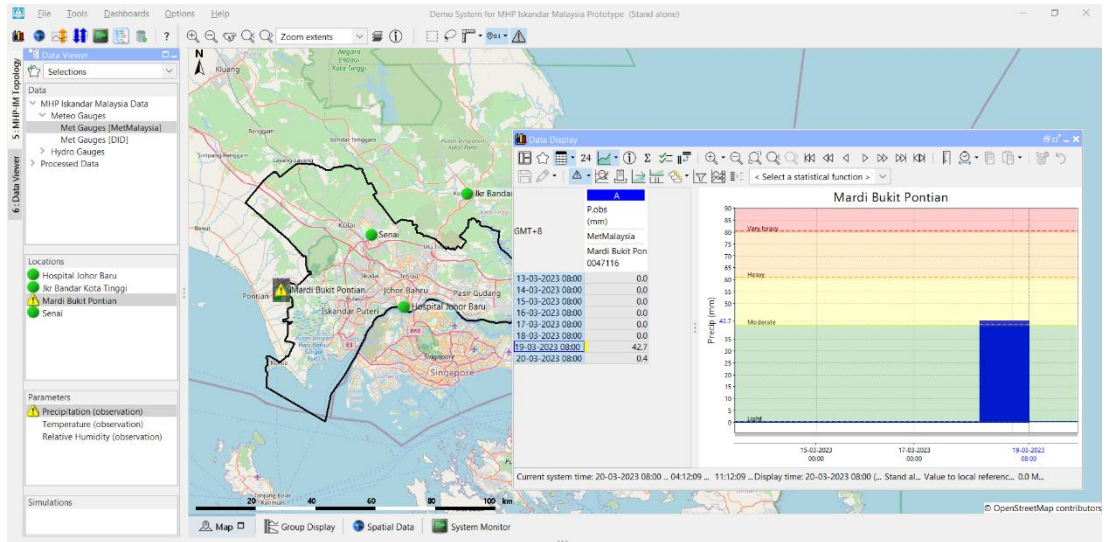
To indicate if a certain flood level has crossed the specified warning level, icons are displayed. The MHP-IM uses the warning levels as specified in the [Public Info Banjir Website](#) both for rainfall and water level values. If a warning level is crossed within the relative view-period, the icon will change from  or  to  or  or  depending on the threshold crossing. The different levels indicate the severity of the situation.

**Table 4.2** Threshold Value and Icon Overlay for Rainfall Parameter

Rainfall Category	Hourly Rainfall [mm]	Daily Rainfall [mm]	Icon Overlay	Description
Light	0.5 - 10	0.5 – 40	No overlay	-
Moderate	11 - 30	41 - 60		Alert level
Heavy	31 - 60	61 - 80		Warning level
Very Heavy	> 60	> 80		Danger level

Source: [Public Info Banjir Website](#)

Warning icons are displayed both next to each relevant location in the Plot overview and on the Map. The different threshold crossings for an example location can be seen in **Figure 4.1**.



**Figure 4.1** Map Display Showing Threshold Warning Icons for Mardi Bukit Pontian Location

## 4.2 Accessing Data via Data Viewer

The Data Display window offers graphical and tabular displays for presenting and editing of data, with the following features:

- Display of time series in tables and graphs:
- Display of actual data with historical events and threshold levels
- Tabular data editor

Data can be displayed in either a table, a graph, or in both simultaneously. The splitter between the table and graph can be moved to modify the display. Select the data series which should be displayed with help of the filters (**Figure 3.7**), by selecting one or more of the following:

1. Data Sources
2. Locations
3. Parameters
4. Simulations

There are a number of different data categories that can be selected, namely (**Error! Reference source not found.**):

- Meteo Gauges
- Hydro Gauges
- Processed Data

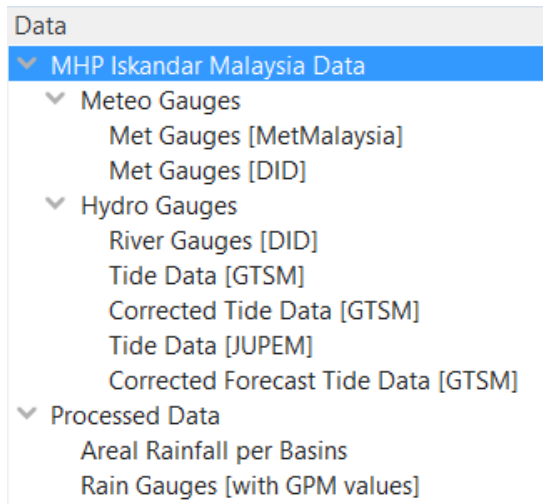


Figure 4.2 Data Categories List Box of the Data Viewer

When a selection is made, the locations on the map will be updated to reflect this selection. Data of different parameter types (e.g. water level and precipitation) are shown in separate graphs. An example of this is shown in **Error! Reference source not found.**, which displays the water level data for Hospital Johor Bahru.

For displaying graphs, click the graph-button (4) [Ctrl+D] or open the Data Display tab (one is opened upon start up by default). By clicking the table button (5) [F7], a table with all data will appear on the left-side of the graph. The most left column in the table shows the date and time of displayed data. The amount of records in the table corresponds with the timespan shown on the x-axis of the graph.

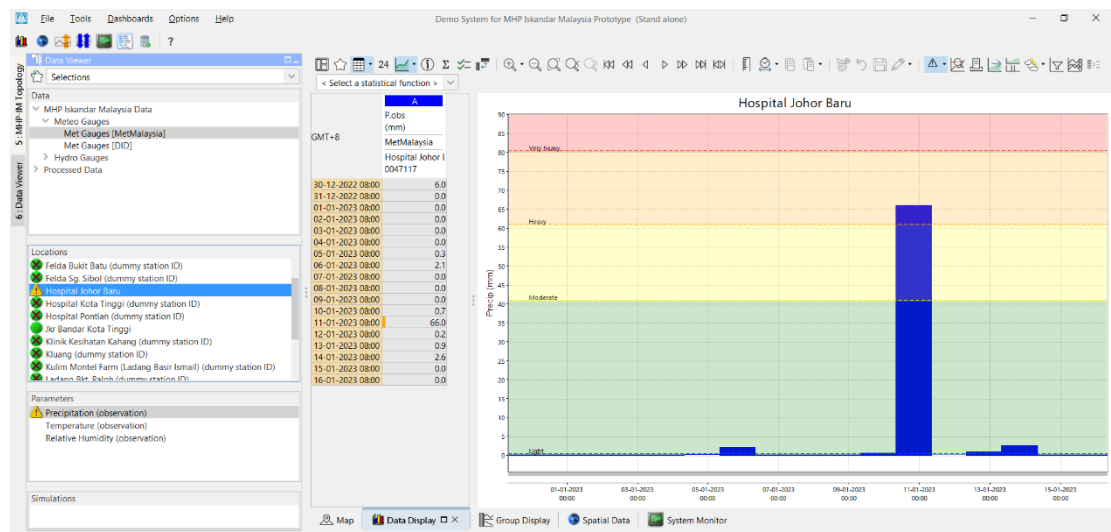



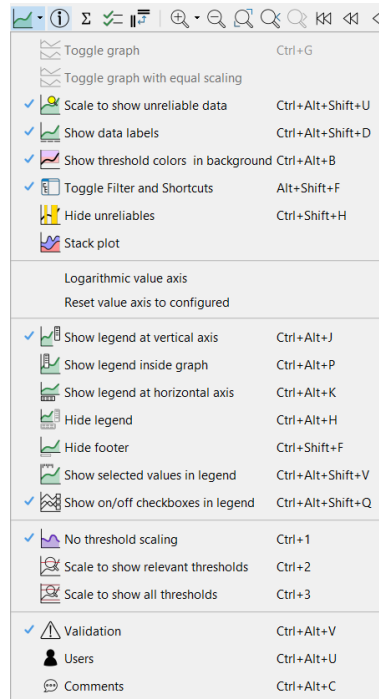
Figure 4.3 Data Display Using A Combination of the Data Viewer and Data Display Tab

From the figure it can also be seen that some of the locations in the Data Viewer list box (2) has a dark red cross next to it. This indicates that these locations do not have any data at all.

This helps the user understand which locations contain specific types of data. As explained earlier, it is also possible to alter this behavior by right clicking in the Data Viewer list box and change the filter (Figure 3.8).

- Currently Available : if no data is available for the current view period, removed from list (instead of grey display)
- Somewhere Available : if no data is available for any view period, removed from list (instead of grey display)

Using the graph options (click the small arrow on the  icon), the user can control how certain aspects of the graph are displayed (see **Figure 4.4**).












**Figure 4.4** Graph Options



#### 4.2.1 Data Display Button Bar

The following contains a description of the buttons in Timeseries Display. Notice that hovering over the button will also show a description.

**Table 4.3** The Buttons in the Data Display

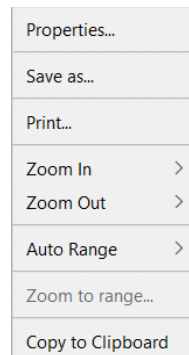
Icon	Name	Description
	Table	By clicking this button the time series in the graph is also displayed in tabular format. By clicking on the small triangle, a menu opens that allows additional columns and headers to be shown.
	Graph	This button can be used to hide or show the graph. If the graph was not yet selected, it will show up. By clicking on the small triangle, a

Icon	Name	Description
		menu will open with additional options.
	Descriptive statistics	This button will add a table to the display with descriptive statistical information. The statistics only appear if a column in the table is selected. Use the right mouse button to copy this table to the clipboard for pasting in Excel.
	Rotate Split	With this button the splitter between table and graph can be placed in a horizontal position. Clicking the same button again returns the splitter to its default vertical position.
	Zooming	In order of appearance: <ul style="list-style-type: none"> <li>• Zoom in</li> <li>• Zoom out</li> <li>• Return to original view period</li> <li>• Go back to previous view period</li> <li>• Go forward to next view period (only available if previous button was clicked earlier)</li> </ul>
	Change the view period	In order of appearance: <ul style="list-style-type: none"> <li>• Move one full view period back</li> <li>• Move a half view period back</li> <li>• Move a half view period forward</li> <li>• Move a whole view period forward</li> <li>• Zoom out to show the whole timeseries</li> </ul>
	Display time	To change the view period in the graph, the field Display time in the Status Bar below the graph should be double clicked. The display time can now be changed with help of the menu. Press [OK ] to accept the changed view period. The next time the chart is opened the original configured display time will be used again.
	Edit/modify values	Timeseries values can be edited (when not configured read-only) in the timeseries table. The save button allows for intermediate saving of changes.
	Show scroller	By pressing this button a panel opens that shows the same

Icon	Name	Description
		timeseries but in a larger view period, allowing to quickly focus on other parts of the timeseries.
	Search and Select Forecast	Displays in FEWS by default only show current approved forecasts. Previous forecasts can be shown if you approve them in the Forecast Management Display, or by using this “search and select forecasts” option.
	Visibility of timeseries	This button opens a panel in which the user can make time series (in)visible by (de)selecting the checkboxes. When there are any series marked invisible the button icon will change so the user is attended that some series are made invisible, also when the visibility dialog has already been closed.

#### 4.2.2 Context Menu

When clicking the right mouse button in a graph, the dropdown menu presented below appears. The menu gives you some additional options.




**Figure 4.5** Drop Down Menu in Graph

- Save as : You can save the graph to file with this option.
- Print : This option allows you to print the graph.
- Zoom in/out : You can select to zoom in and out along one or both axis with this option.
- Allow Vertical / Horizontal Axis Zoom : You can select to allow for zooming in and out along one of the axis with this option.
- Auto Range : This feature allows you the set automatic scaling along one or both axis.

- Copy to clipboard : Copy the graph as image to the clipboard.

### 4.2.3 Shortcut and Group Display

Pressing the Shortcuts button  or [Shift+F6] in Data Display window, will reveal a list of expandable folders on the left-hand side of the screen. The structure of these folders is as follows:

- HydroMet Stations at : Displaying water level and rainfall parameters for all hydro-meteorological stations in Johor Bahru State
- HydroMet Stations at : Displaying water level and rainfall parameters for all hydro-meteorological stations in Kulai State
- HydroMet Stations at : Displaying water level and rainfall parameters for all hydro-meteorological stations in Pontian State

In contrast with the Data Viewer, where the user has to create his own graph using a number of filters, the plots from the Shortcuts are pre-configured to directly show all relevant information.

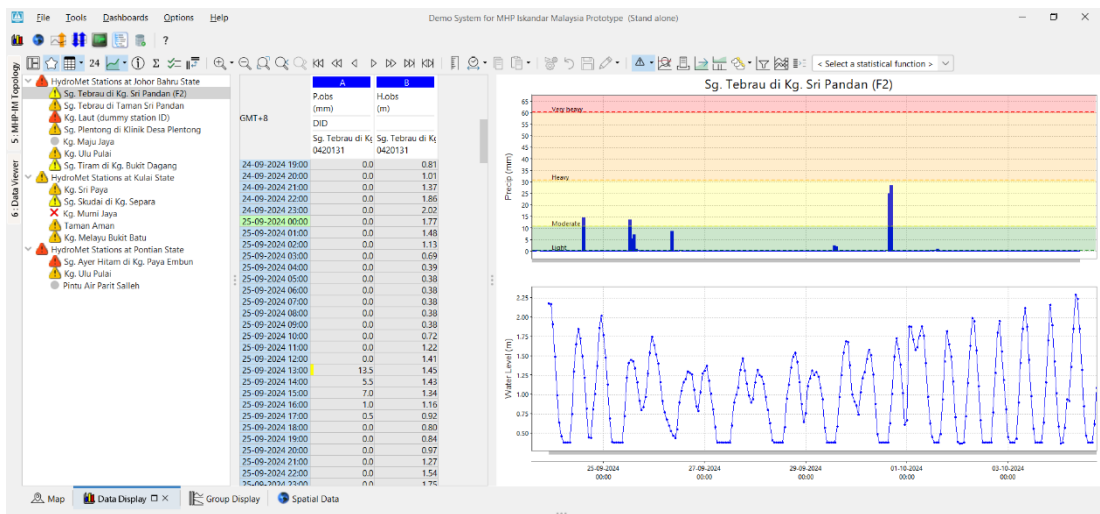


Figure 4.6 Shortcut View of HydroMet Stations at Johor Bahru State Layer

### 4.2.4 Data Flags and Data Labels

Both the graphical and tabular display of data can show data flags or labels.

#### Data Flags

The background colour in the data records is used to indicate the quality of the data (is it deemed reliable or not) or edited (if a value has been overwritten by a user).


The meaning of the background colours in the data fields is:

- White: reliable, editable
- Light yellow: doubtful
- Bright yellow: unreliable
- Gray: not editable

The font colour in the data fields indicates the data origin. The following colours are used:

- Black: original data
- Blue: corrected (original data flagged "Unreliable" and interpolated)
- Magenta: completed (original data missing and interpolated)

## Data Labels

Clicking the 'Show data labels'  button allows you to display quality flags for the data you are presenting. The information is shown at the bottom of the screen.

The following colour codes have been used:

The upper line indicates the origin of the data:

- Original data: no line is displayed
- Automatically corrected data (original data flagged as unreliable and automatically interpolated): blue line
- Automatically completed data (original data is missing and interpolated by system): magenta line
- Manual corrected data (original data edited by a user): dark blue line
- Manual completed data (filled up by a user): dark magenta line

The middle line indicates the quality of the data:

- Reliable data: no line is displayed
- Doubtful data: orange
- Unreliable data: yellow

The lower line indicates where comments have been added to the data:

- No comment: no line is displayed
- Comment available: dark red

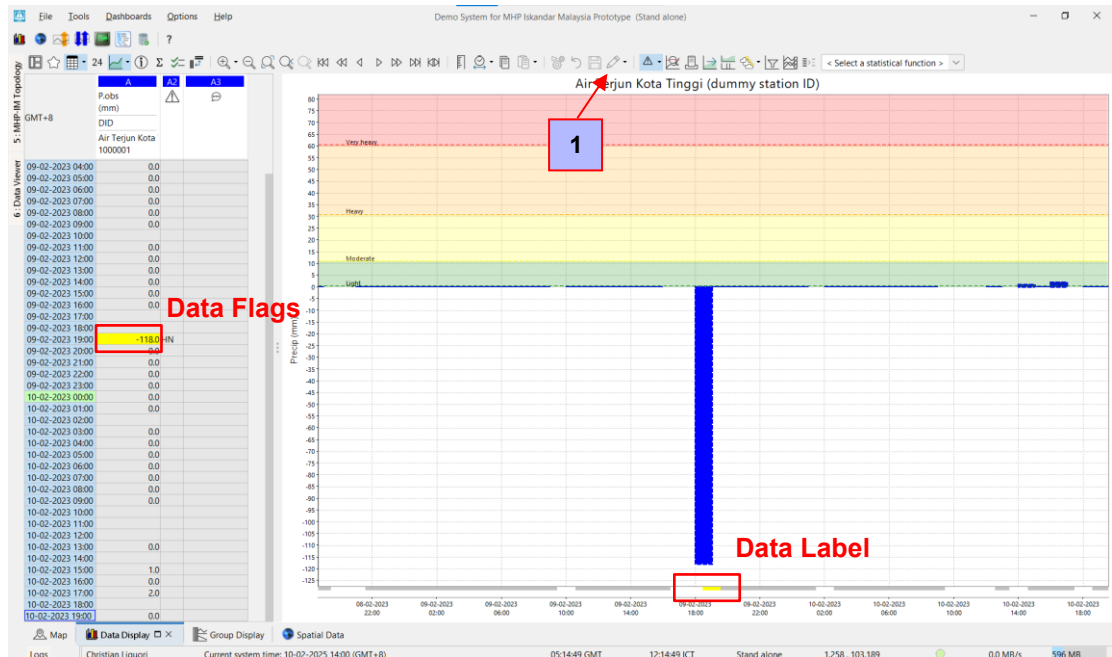


Figure 4.7 Example of Data Flags and Data Labels Indicating Unreliable Data

### 4.2.5 Data Validation


Imported data is automatically validated by checking it against extreme values. When the so-called soft limit of extreme values is exceeded the data is marked as doubtful but retained. When the hard limit of extreme values and/or the rate of change limit is exceeded the data is marked as unreliable. The table below provides an overview of the validation rules used to check extreme values for parameters imported into MHP-IM.

**Table 4.4** Validation Rules for Parameters in MHP-IM

Parameter	Time Step	Hard Min	Soft Min	Soft Max	Hard Max	Rate of Change
Precipitation [mm]	1 day	0	-	350	500	-
Precipitation [mm]	1 hour	0	-	350	500	-


The purpose of automatic validation is to warn the user about potential data-errors (by marking it as doubtful) or to prevent these altogether (by marking it as unreliable). Unreliable data will not be used in the processes which rely on that data. Within the system, the forecaster also has the opportunity to ‘flag’ data as unreliable or to check and adjust data-values, which is explained in the next two sections.


#### 4.2.6 Editing Data

The edit mode can be enabled from the toolbar with the  **Switch to Edit mode** button (see (1) in **Figure 4.7**). Only records where the background colour turns white after pressing the Switch to Edit mode button can be edited. Editing can be done in the table directly. The result of an edit action is directly displayed in the corresponding graph. Manually corrected data will be saved to the database by disabling the Edit mode again from the toolbar. A pop-up will ask to save the edited data to the database. With **OK** the data is saved, **NO** the data is not saved and with **Cancel** changes will be undone.

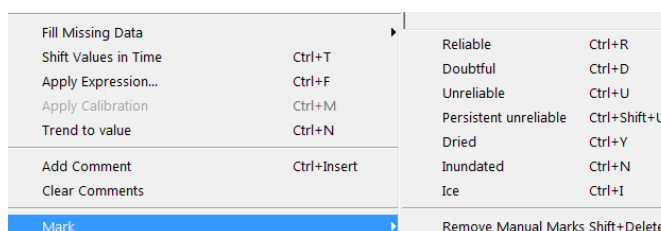
Through manual editing of data, the source of the data changes from original to corrected. The font colour used for edited data is blue to indicate that it is completed data. The background colour remains white, as the data has not yet been validated. If however, after pressing **Apply** validation indicates that the value exceeds certain validation limits, the background colour will be set accordingly.

#### 4.2.7 Editing Data Labels

Data labels can be shown on the x-axis of the graphs. By selecting **Show data Labels** in the graph options  (see also **Figure 4.4**) the appearance of the colours of data labels on the x-axis of the graphs can be toggled on/off.

Data labels can also be edited from the table when the  editing mode is active. Press the right mouse button when selecting one or multiple cells in the table and select the Mark option (**Figure 4.8**). It is now possible to change the data label of a value to reliable, doubtful, etc. or remove the Manual Data Label Marks.


**Note:** It is not possible to change the data label of a missing value.



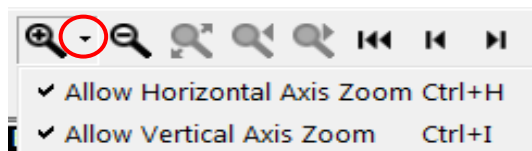
**Figure 4.8** Menu for Marking Data

#### 4.2.8 Commenting on Data

Comments can be made on data when the  editing mode is active. By pressing the right-mouse button on a data-record and clicking on **Add comment** a comment can be added to a data-record. Here the operator can e.g. express why a certain value is edited and or labelled. A commented data record is marked with red colour in the right-up corner of the data cell.

Comments can be shown within the graphical display. By selecting **Comments** in the graph options  the appearance of comments can be toggled on/off (**Figure 4.4**)

**Note:** Comments may be outside the domain of the y-axis. Toggling allow vertical axis zoom allows zooming on this axis (**Figure 4.9**).



**Figure 4.9** Option to Allow Vertical Axis Zoom

#### 4.2.9 History

By pressing the right-mouse button on a data-record and clicking on **Show History...** the history of the selected data-record can be shown. Here you can find an overview of who changed the data and to which value.

History 0047117 P.obs (mm) MetMalaysia day Import_Rainfall 15-07-2016 08:00... X					
Modified at	Workflow/User	Value	Flag	Validation	Comments
18-11-2024 01:24:28	Import_Rainfall	71.4	original	reliable	




**Figure 4.10** History Table









### 4.3 Accessing Data via Spatial Data

#### 4.3.1 Control Toolbar

The toolbar provides controls for displaying spatial information through the following buttons:

**Table 4.5** Buttons on the Control Toolbar of the Spatial Data Display






Button	Description
	<b>Add to Dashboard.</b> This button is used to add the current view to a dashboard. For more information, see <a href="https://publicwiki.deltares.nl/display/FEWSDOC/33+Dashboard+Display">https://publicwiki.deltares.nl/display/FEWSDOC/33+Dashboard+Display</a>
	<b>Contours Button.</b> To turn on/off contour lines (regular grids configured with contour lines only). Numbers appear when the animation has stopped or paused. The colours which indicate the values corresponding to the legend will remain visible.
	<b>Grid Lines.</b> Toggles grid or polygon lines on or off

Button	Description
	<b>Labels.</b> Toggles labels on or off (drop down options include turning on/off locations, values and/or units in the labels and increasing /decreasing the number of decimals shown in the labels and tooltips)
	<b>Flags.</b> Switches to flags for selected time series / grid plot (quality, modifiers or thresholds)
	<b>Search and Select Forecasts.</b> Switches to (previous) forecasts.
	<b>Show Spatial Thumbnails.</b> Toggles thumbnails of each time step below the main spatial display on or off.
	<b>Show Spatial Ensemble Thumbnails.</b> Displays the ensemble thumbnails panel.
	<b>Sketch Mode Buttons.</b> Switches the sketch mode between drawing points, adding points, drawing longitudinal profiles and drawing areas when the map is clicked. Contains additional options to save/load sketches and delete the current sketch.
	<b>Show a Graph Based on Current Sketch.</b> Drop-down menu with options to extract scalar time series, vertical profiles, longitudinal profiles, 2D longitudinal profiles, calculate budget and calculating the mean max min time series (for sketched areas).
	<b>Display Time.</b> Choose display time (period)


### 4.3.2 Time Slider Toolbar

The time slider is an important element in the display, since it allows the user to define the timestep for which data are presented. The following table (**Table 4.6**) describes the function of each button. Notice that the name of the button appears as tooltip when hovering with the mouse over the button.

**Table 4.6** Buttons on the Control Toolbar of the Spatial Data Display

Button	Description
	<b>Play.</b> Starts continuous play mode. The slider will indicate the time slice being shown.
	<b>Pause.</b> Stops play mode. The time slider remains at the time display at the moment.
	<b>Step backwards.</b> Moves the time slider back one time step.
	<b>Step forwards.</b> Moves the time slider forwards one time step.
	<b>Record.</b> Creates an AVI (Audio Video Interleave) or animated gif (Graphics Interchange Format) movie file. The AVI format is used by default unless the filename ends with '.gif'. After opening the file, the display will start playing from the current time position, until the stop button is clicked.
Time slider	The time slider can be dragged to a specific time slice.
Data availability	The data availability indicator provides a visual clue as to where you can find data. For those time slices where data is available, the colour of the data availability indicator will be set to the maximum value found in the data for that time, according to the scale used in the legend.

### 4.3.3 Individual Frame Selection

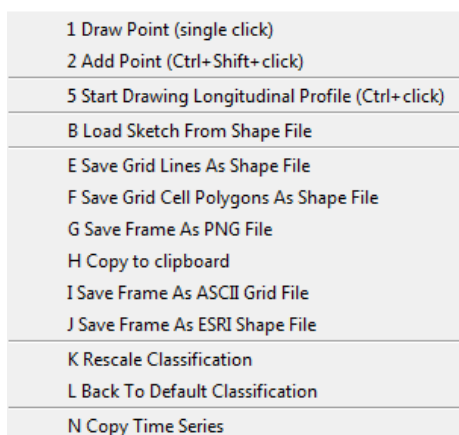
The frame selection panel is only shown by default for the Weather Predictions. It can be toggled on/off for any data source by clicking the  button on the toolbar. It allows the selection of a specific frame of the selected data and, for NWP data only, also allows this for a frame from up to two previous forecasts. The latter gives a quick overview of how the weather forecast has changed with subsequent forecasts.

### 4.3.4 Accumulation or Moving Average Slider

The type of slider can be different for each type of data. For example, precipitation data has an accumulation slider, while temperature data has a moving average slider. Both types of sliders can be used to select a timespan, depending on the time step of the selected data. The data shown on the map is then recalculated based on this timespan and the type of slider. For example, when the accumulation slider is set to 6 hours the step of the time slider on top is changed updated to match this and the data shown on the map is recalculated to show the accumulated values over the 6 hour window. When the same is done with a moving average slider, the step of the time slider on top remains unchanged from its default, but for each time step a moving average is calculated over the 6 hour window.

### 4.3.5 Legend

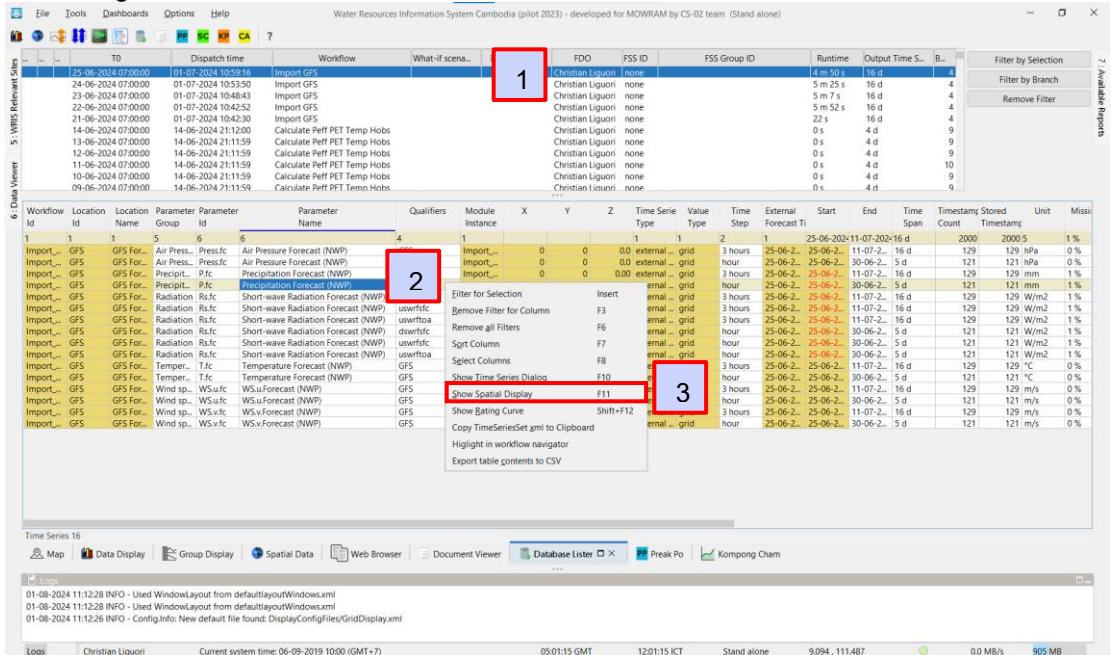
The legend identifies the colour used for each range of values. The range of values used for each colour can be rescaled by right clicking on the display and selecting 'Rescale Classification' from the pop-up menu (**Figure 4.11**). The display colours will be updated to reflect the new classification. After rescaling, the lowest and highest values in the legend will correspond to the minimum and maximum values of the data in the current zoom extent of the display. When the display is zoomed in on an area where all data points or grid cells have similar colours, rescaling can be used to see more clearly the differences in the data values. To return to the default classification, right click on the display and select Back To Default Classification from the pop-up menu. When selecting a different source of data, the classification always changes back to its default classification.



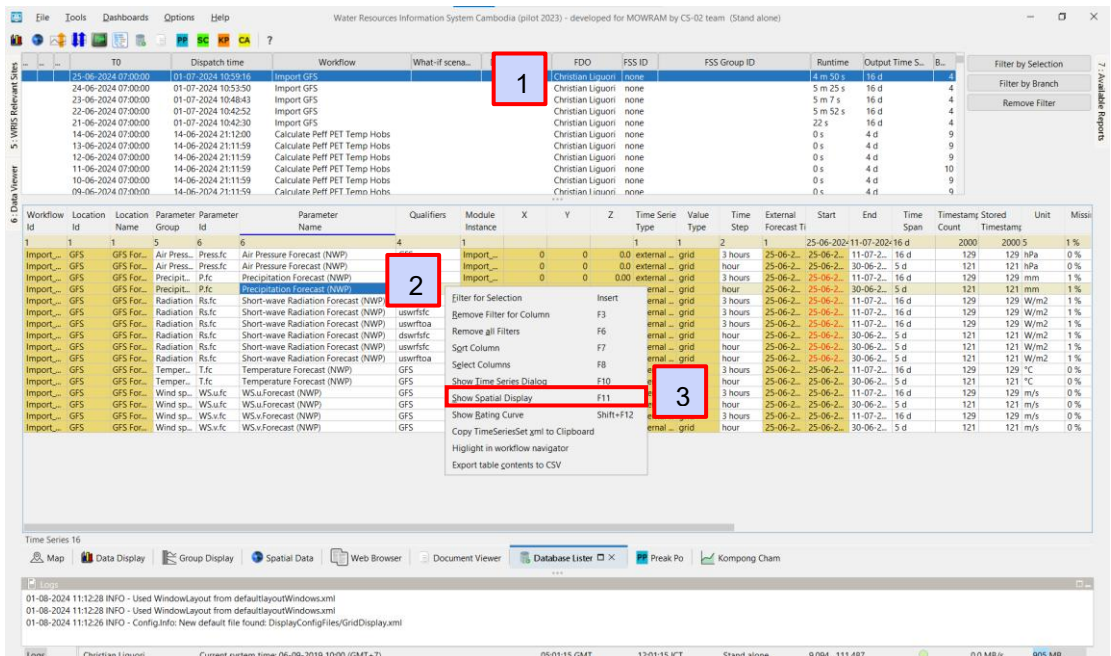
**Figure 4.11** Right-Click Menu of the Grid Display

## 4.4 Accessing Data via Database Lister

The Database Lister can be accessed by clicking the button. Generally, this Database Lister is used to check whether the workflow executed by the user/operator has resulted in new data being added to MHP-IM.



**Figure 4.12** illustrates the steps to display data in grid format on the spatial display. This procedure also applies if the user wants to display data in scalar format. After the data is displayed on the Spatial Data Display, users can click on grid cells or point data to view the data in table or graph form. It is important to note that the legend used for displaying data via Database Lister may differs from the legend set in the Spatial Data windows.



**Figure 4.12** Viewing Data from Database Lister



## 5 Retrieving Data from MHP-IM

There are various methods to export data from MHP-IM. In this section, the consultant will outline some of the most commonly used methods by users for exporting data from MHP-IM.


### 5.1 From Data Display

After the user selects the data to be exported, whether from the Data Viewer or Spatial Data, they first need to display the data in the Data Display, either in table or graph form. The following explains two methods that can be used to retrieve data from the table or graph in the Data Display window.

#### 1. Copy and Paste

The first method to retrieve data from MHP-IM is by copying the table or graph from the Data Display. Here are the steps the user needs to follow to obtain all data from a specific location.

##### o Tabel Data

**Step 1:** Click  button to show all the data available for a location in the table.

**Step 2:** Left click on cell 'GMT+8' to select all the rows in the table. (Figure 5.1 Figure 5.2)

**Step 3:** Right click on any selected rows and choose Copy > Copy or press Ctrl+C (Figure 5.2)

**Step 4:** User can now paste the copied data in Ms. Excel for further analysis.

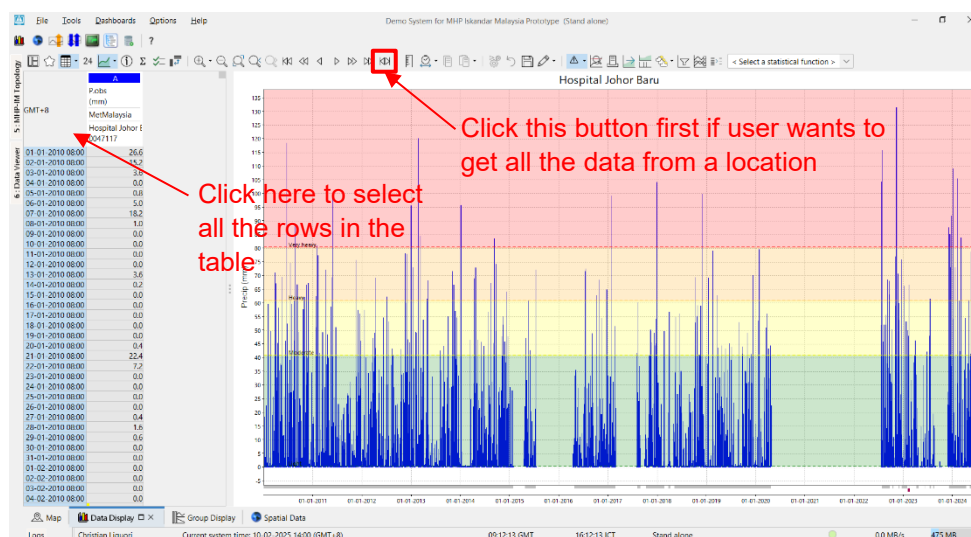


Figure 5.1 Step 1 & 2 for Getting All Tabular Data from a Specific Location

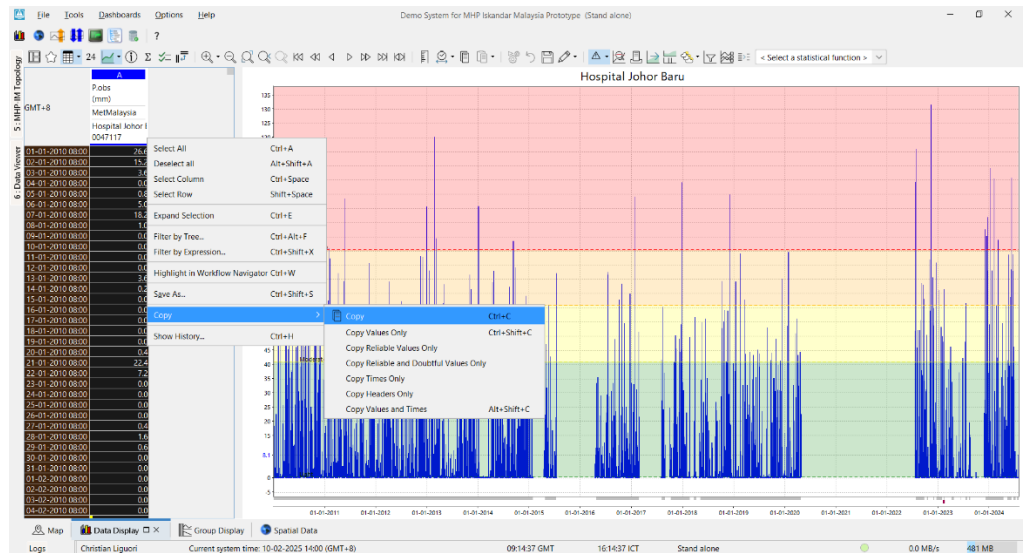



Figure 5.2 Copying Tabular Data from a Specific Location

○ **Graph Data**

- Step 1:** Click  button to show all the data available for a location in the table.
- Step 2:** Right click on any area of the graph and choose 'Copy to Clipboard' (Figure 5.3).
- Step 3:** Users can now paste the copied data into any preferred application for further reporting.

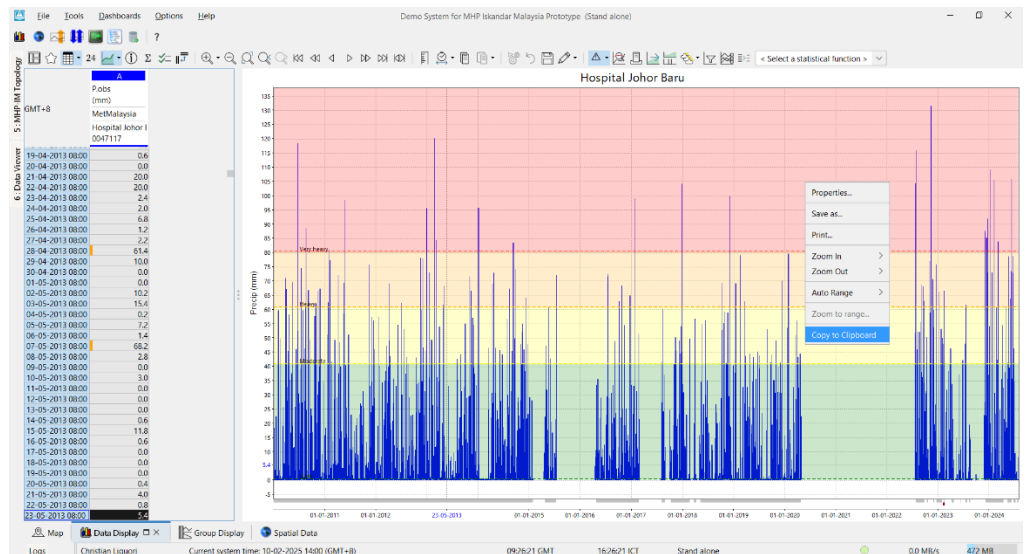



Figure 5.3 Copying Graph Data from a Specific Location

**2. Save As**

The second method to retrieve data from MHP-IM is by using 'Save As' button. Here are the steps the user needs to follow to obtain all data from a specific location.

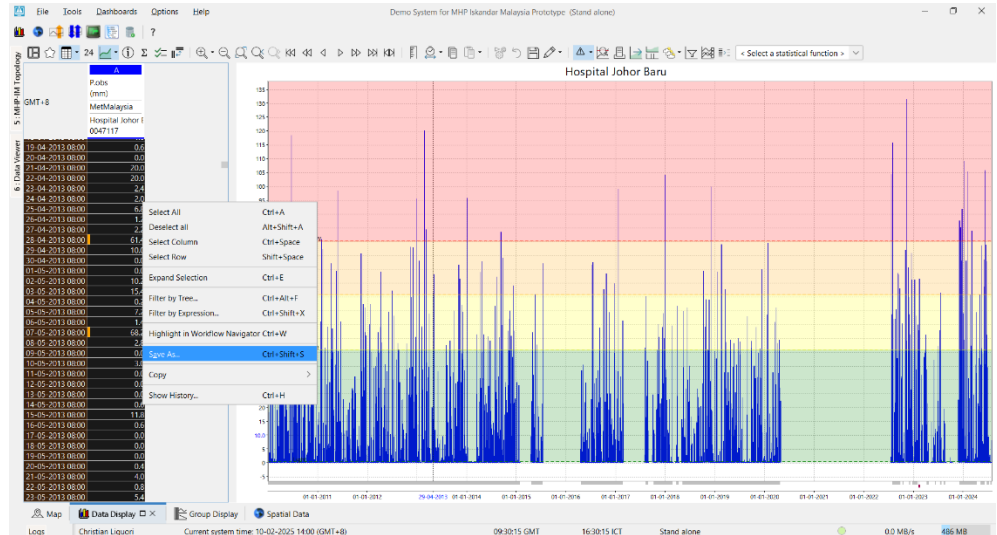
○ **Tabel Data**

**Step 1:** Click  button to show all the data available for a location in the table.

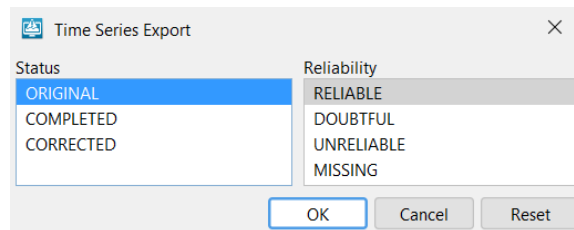
**Step 2:** Left click on cell 'GMT+8' to select all the rows in the table.

**Step 3:** Right click on any selected rows and choose 'Save As' option (**Figure 5.4**).

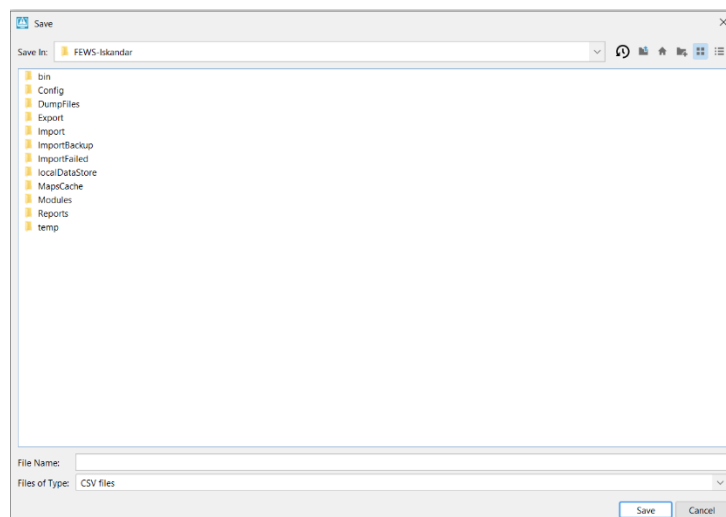
**Step 4:** A new window will pop up, prompting the user to select data based on the desired status and reliability for export. Once the user has specified the data criteria, a save window will appear, allowing the user to save the data in various formats (commonly in CSV format) to a chosen location (**Figure 5.6**).



**Figure 5.4** Save As Option




**Figure 5.5** Data Export Options

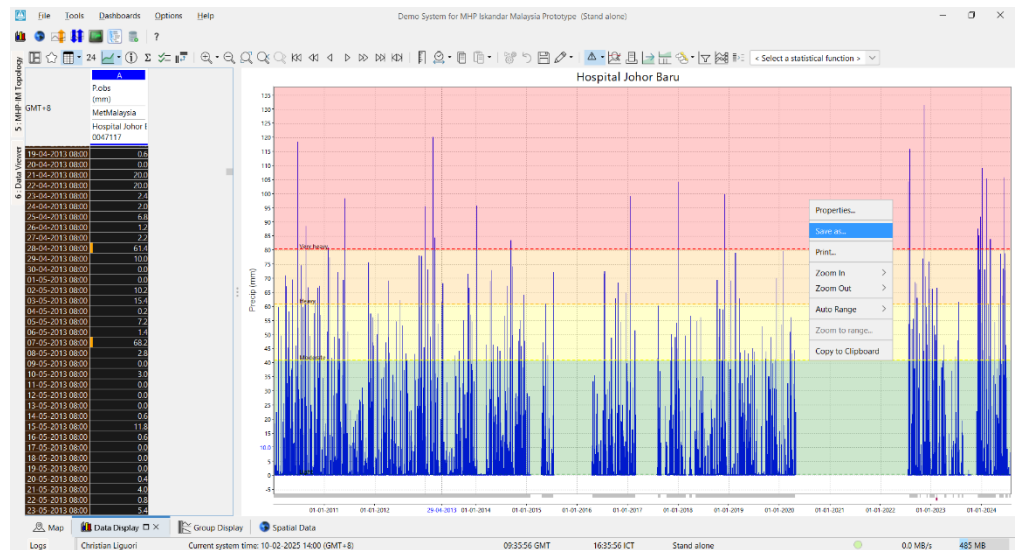


**Figure 5.6** Save Window Interface for Table Data

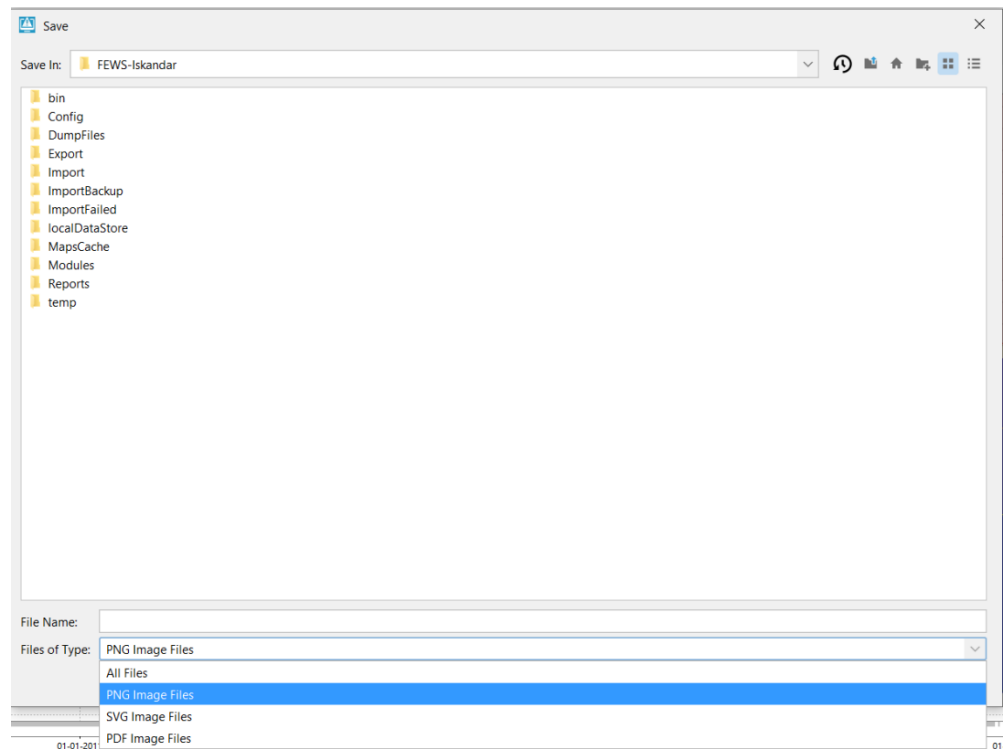
- **Graph Data**

**Step 1:** Click  button to show all the data available for a location in the table.

**Step 2:** Right click on any area of the graph and choose 'Save as..' (**Figure 5.7**). A Save window will appear where users can choose the format and location for saving the graph.



**Figure 5.7** Saving Graph Data from a Specific Location



**Figure 5.8** Save Window Interface for Graph Data

## 5.2 From Spatial Data Display

Scalar time series can be extracted from the Spatial Data Display by double-clicking the point of interest. Depending on the type of data displayed, the scalar time series will be relevant to a point, polygon, or grid cell. To obtain scalar time series from these various types of data, the user can double-click the point, polygon, or grid cell to be exported, followed by the procedure described in the previous sub-chapter.

Grid data can also be exported into ASCII format, which can be used for further analysis outside of MHP-IM. Below is an explanation of how grid data can be exported into ASCII format.

- **Export Time Step Data in ASCII Grid-File**

**Step 1:** Select the desirable time step with the control toolbar.

**Step 2:** Right click on any area of the Spatial Data display and click on 'Save Frame As ASCII Grid File'. A Save window will appear where users can choose where to save the raster data.

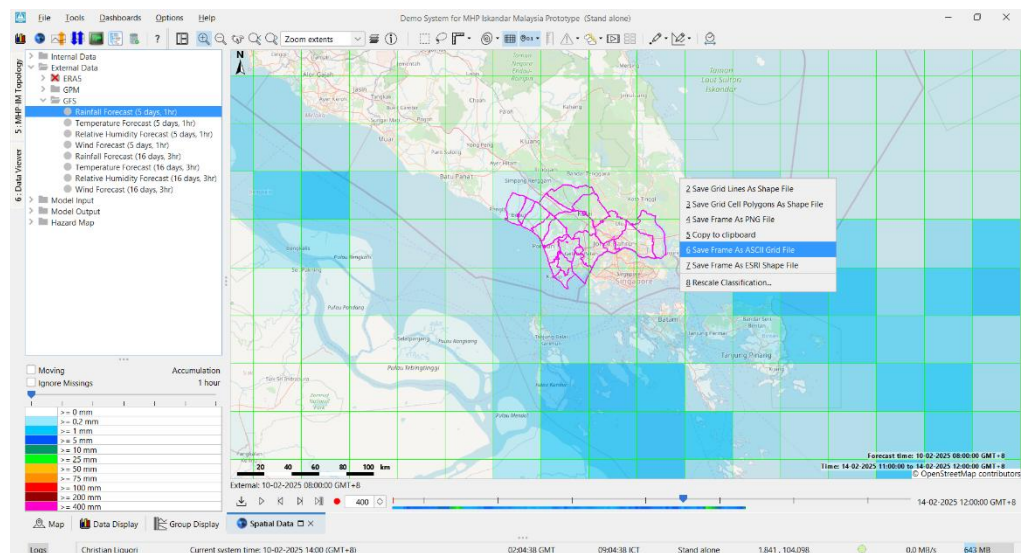


Figure 5.9 Exporting Spatial Data as ASCII Grid File

## 5.3 Running Export Workflow

In addition to the steps previously described, there is another method for exporting data from MHP-IM. This method involves using the export workflow. Unlike the previous methods, the export workflow allows users to export data for all locations simultaneously and save it as a CSV file.

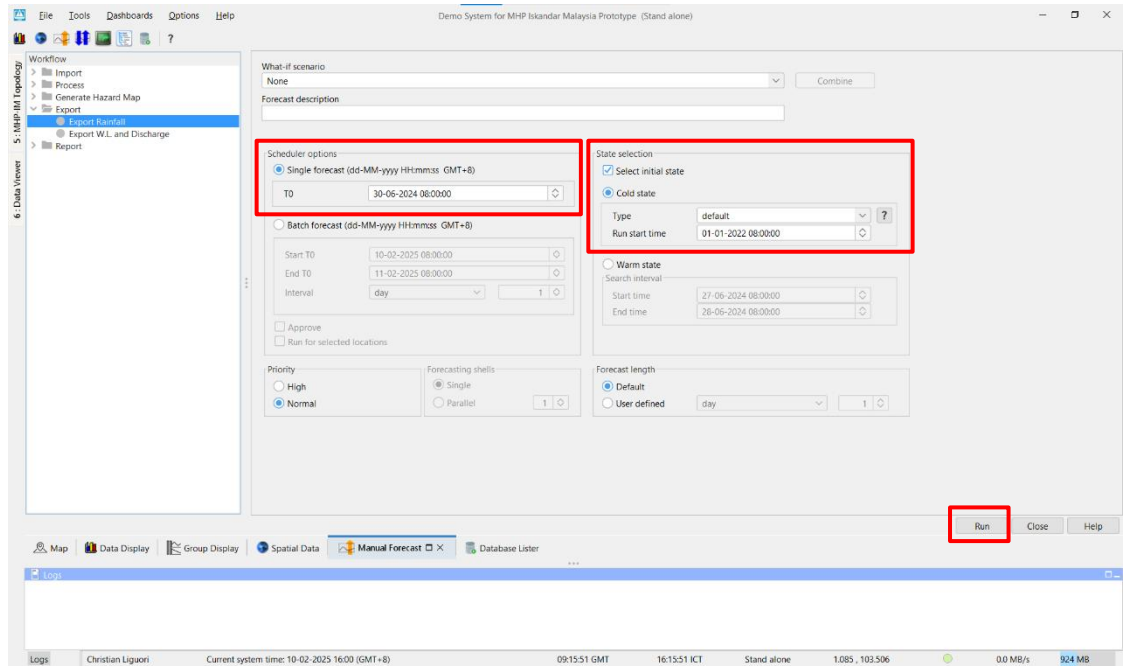
To run the workflow, users must first open the Manual Forecast tab, select the workflow to be executed, and specify T0. By default, the export process will be performed for a period of 1 day backward from T0. This setting was intentionally configured by the consultant in order to export data in the system every day. If the user wants to export data for a period other than the default setting, user must check "Select Initial State," choose the "Cold state" option, and fill in the desired Run start time. For example, if the user wants to export data from 1<sup>st</sup> January 2022 to 30<sup>th</sup> June 2024, the user should set T0 to 30-06-2024 08:00:00 and the Run

start time to 01-01-2022 08:00:00. **Figure 5.10** illustrates an example of how an Export Workflow is executed.

**Table 5.1** Export Workflows T0 Rules

No	Export Workflow	T0 (GMT+8)
1	Export Rainfall	DD-MM-YYYY 08:00:00
2	Export W.L. and Discharge	DD-MM-YYYY 08:00:00

Note: Dates are formatted as day-month-year (DD-MM-YYYY).



**Figure 5.10** Running Export Rainfall Workflow

The export results are saved in CSV format and can be found at %REGION\_HOME%/Export/. The consultant has verified the values in these CSV files against those in the Data Viewer. Verification of the export files was also performed for hydro parameters (W.L. and Discharge), confirming that the exported data aligns with what is present in MHP-IM.

## 5.4 MHP-IM WebOC

To retrieve data from MHP-IM WebOC, users must first start the embedded Tomcat service in MHP-IM SA. This is done by pressing **F12** in the Log window, selecting 'Embedded Servers', clicking 'Start Embedded Tomcat Webservice', and then opening the provided URL (default: <http://localhost:8080>) in a browser to access WebOC. This step is necessary as MHP-IM is not yet hosted on a server. If hosted, users could directly access WebOC via a designated URL on any device without opening MHP-IM SA.

Once WebOC is open, users can export data by selecting a location and parameter, then saving it as a CSV file. **Figure 5.11** and **Figure 5.12** illustrate the steps for exporting both scalar and grid-based data.

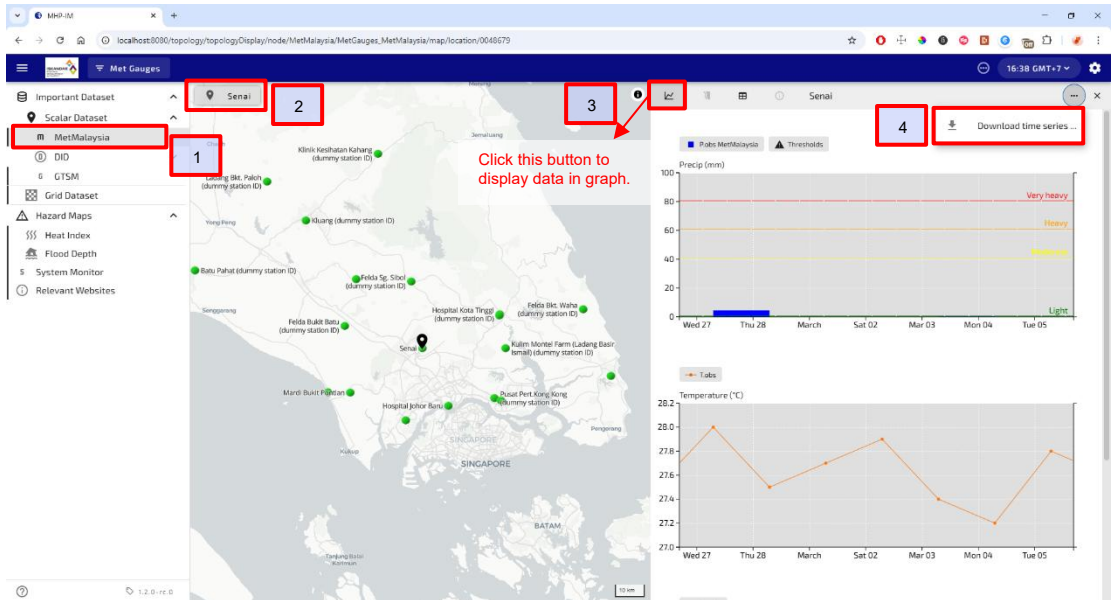


Figure 5.11 Scalar Data Display on the Web OC and Steps for Exporting Data to CSV

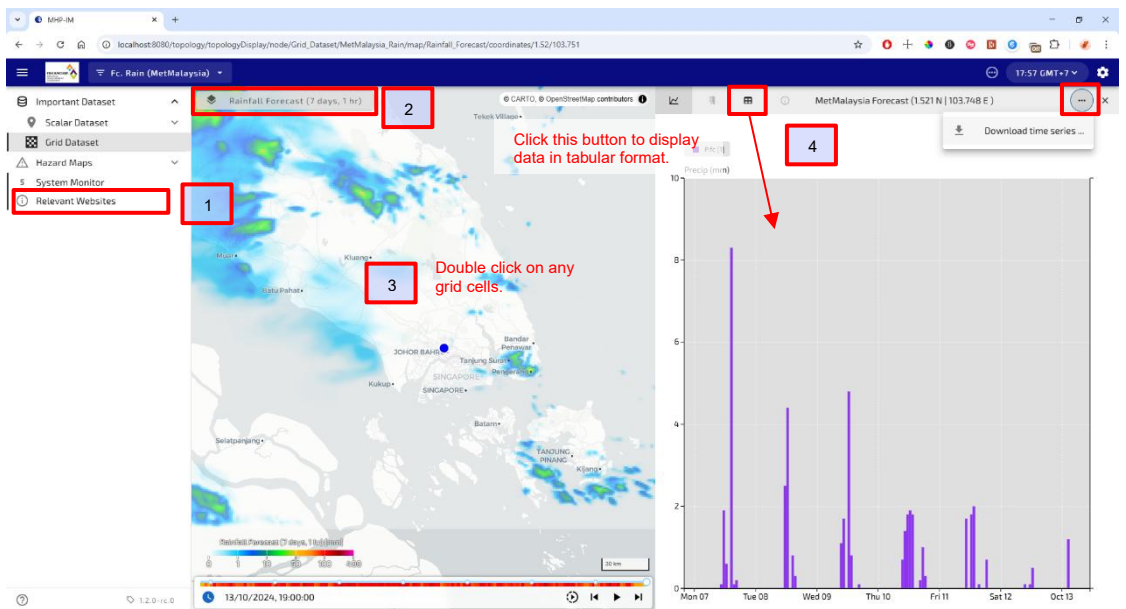
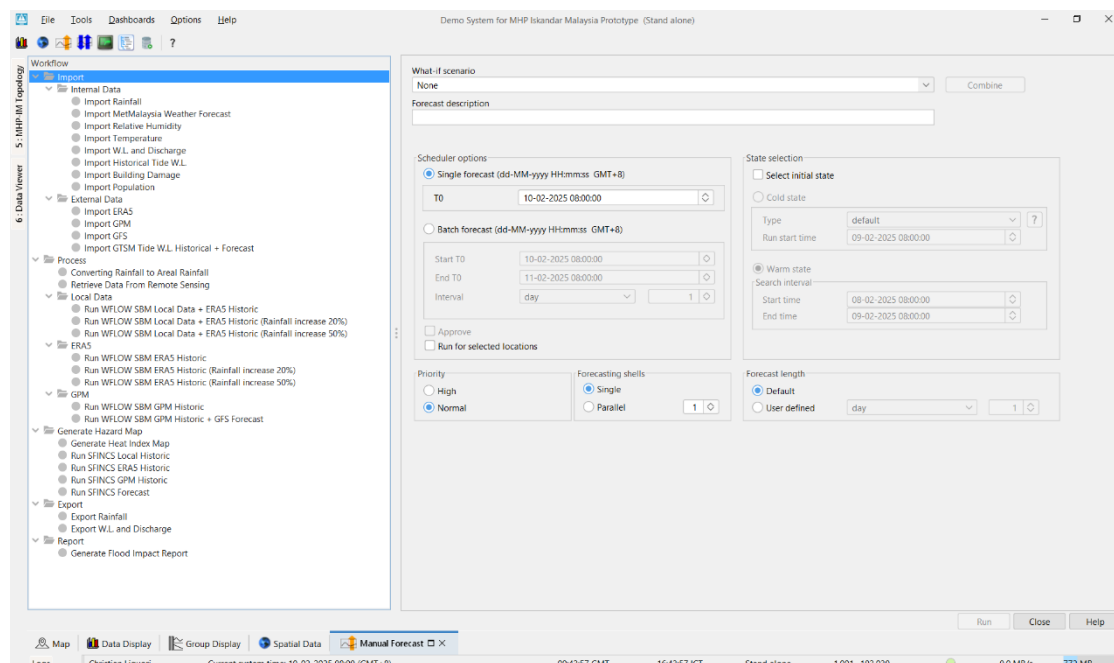


Figure 5.12 Grid Data Display on the Web OC and Steps for Exporting Data to CSV

## 6 Running MHP IM Workflow

This chapter describes the procedure to run the preconfigured workflows of MHP-IM. The Manual Forecast tab allows the user to define which workflow should be run. The contents of the pre-configured workflow in MHP-IM SA can be seen in **Figure 6.1**.



**Figure 6.1** Manual Forecast Display

### 6.1 Import Workflows

This section will discuss the import workflows that have been pre-configured by the consultant to demonstrate the flexibility of the Delft-FEWS application, which MHP-IM utilizes to import various types of data into a single platform. The import workflow is further classified based on the source of the data being imported—whether the data comes from measurements (internal) or global datasets (external).

#### 6.1.1 Import Rainfall

- Introduction** : This workflow is used to import rainfall data into MHP-IM. To run this workflow, the user needs to prepare a CSV file(s) following a specific convention and place the file in %REGION\_HOME%/Import/Rainfall\_Data/MetMalaysia or %REGION\_HOME%/Import/Rainfall\_Data/DID. Examples of the required CSV files can be found in the import folders mentioned above.
- Purpose** : These measurement data are essential as they will be used as input for hydrological modelling using the wflow model and flood modelling with SFINCS. This workflow imports rainfall datasets from rain gauges MetMalaysia data in daily timesteps and DID data in hourly timesteps into MHP-IM.

- **The following are the steps for importing internal rainfall data obtained from MetMalaysia and DID to MHP-IM**
  - Step 01:** Put the CSV file to be imported to the right import folder
  - Step 02:** Open MHP-IM application
  - Step 03:** Open Manual Forecast
  - Step 04:** Select Import Rainfall workflow
  - Step 05:** Set the T0 to DD-MM-YYYY 08:00:00
  - Step 06:** Click run button to start the workflow
  - Step 07:** Check if the data has been imported to MHP-IM by checking at the Database Lister and Data Viewer.

### 6.1.2 Import MetMalaysia Weather Forecast

- Introduction** : This workflow is used to import hourly weather forecast obtained from MetMalaysia into MHP-IM. To run this workflow, the user needs to obtain the netCDF file with the same format as the sample file provided by MetMalaysia and store it in %REGION\_HOME%/Import/Rainfall\_Data/MetMalaysia\_Forecast. Examples of the required netCDF file can be found in the import folders mentioned above.
- Purpose** : These measurement data are used to showcase the flexibility of Delft-FEWS, which is the core of MHP-IM, in importing data from different formats.

- **The following are the steps for importing internal weather forecast data obtained from MetMalaysia to MHP-IM**
  - Step 01:** Put the netCDF file to be imported to the right import folder
  - Step 02:** Open MHP-IM application
  - Step 03:** Open Manual Forecast
  - Step 04:** Select Import MetMalaysia Weather Forecast workflow
  - Step 05:** Set the T0 to DD-MM-YYYY **20:00:00** (T0 to import sample data is 06-10-2024 20:00:00 GMT+8)
  - Step 06:** Click run button to start the workflow
  - Step 07:** Check if the data has been imported to MHP-IM by checking at the Database Lister and Spatial Data.
  - Note:** The T0 value must be set to 20:00:00, as the obtained weather forecast data indicates that the data is stored starting from 12:00:00 GMT+0, which corresponds to 20:00:00 GMT+8.

### 6.1.3 Import Relative Humidity

- Introduction** : This workflow is used to import daily relative humidity data obtained from MetMalaysia into MHP-IM. To run this workflow, the user needs to prepare a CSV file(s) following a specific convention and place the file in %REGION\_HOME%/Import/Relative\_Humidity\_Data. Examples of the required CSV file can be found in the import folders mentioned above.
- Purpose** : This workflow is added to MHP-IM to showcase that Delft-FEWS, which is the core of MHP-IM, can easily import various parameters using a rather simple CSV file that adheres to a specific convention format.

- **The following are the steps for importing internal relative humidity data obtained from MetMalaysia to MHP-IM**
  - Step 01:** Put the CSV file to be imported to the right import folder
  - Step 02:** Open MHP-IM application
  - Step 03:** Open Manual Forecast
  - Step 04:** Select Import Relative Humidity workflow
  - Step 05:** Set the T0 to DD-MM-YYYY 08:00:00

**Step 06:** Click run button to start the workflow

**Step 07:** Check if the data has been imported to MHP-IM by checking at the Database Lister and Data Viewer.

#### 6.1.4 Import Temperature

**Introduction** : This workflow is used to import daily temperature data obtained from MetMalaysia into MHP-IM. To run this workflow, the user needs to prepare a CSV file(s) following a specific convention and place the file in %REGION\_HOME%/Import/Temperature\_Data. Examples of the required CSV file can be found in the import folders mentioned above.

**Purpose** : This workflow is added to MHP-IM to showcase that Delft-FEWS, which is the core of MHP-IM, can easily import various parameters using a rather simple CSV file that adheres to a specific convention format.

- **The following are the steps for importing internal temperature data obtained from MetMalaysia to MHP-IM**

**Step 01:** Put the CSV file to be imported to the right import folder

**Step 02:** Open MHP-IM application

**Step 03:** Open Manual Forecast

**Step 04:** Select Import Temperature workflow

**Step 05:** Set the T0 to DD-MM-YYYY 08:00:00

**Step 06:** Click run button to start the workflow

**Step 07:** Check if the data has been imported to MHP-IM by checking at the Database Lister and Data Viewer.

#### 6.1.5 Import W.L. and Discharge

**Introduction** : This workflow is used to import hourly water level and discharge data obtained from DID into MHP-IM. To run this workflow, the user needs to prepare a CSV file(s) following a specific convention and place the file in %REGION\_HOME%/Import/Water\_Level\_and\_Discharge\_Data. Examples of the required CSV file can be found in the import folders mentioned above.

**Purpose** : This workflow is added to MHP-IM to showcase that Delft-FEWS, which is the core of MHP-IM, can easily import various parameters using a rather simple CSV file that adheres to a specific convention format.

- **The following are the steps for importing internal water level and discharge data obtained from DID to MHP-IM**

**Step 01:** Put the CSV file to be imported to the right import folder

**Step 02:** Open MHP-IM application

**Step 03:** Open Manual Forecast

**Step 04:** Select Import W.L. and Discharge workflow

**Step 05:** Set the T0 to DD-MM-YYYY 08:00:00

**Step 06:** Click run button to start the workflow

**Step 07:** Check if the data has been imported to MHP-IM by checking at the Database Lister and Data Viewer.

#### 6.1.6 Import Historical Tide W.L.

**Introduction** : This workflow is used to import hourly sea water level obtained from JUPEM into MHP-IM. To run this workflow, the user needs to prepare a CSV file(s) following a specific convention and place the file in %REGION\_HOME%/Import/Tide\_Data/Local.

Examples of the required CSV file can be found in the import folders mentioned above.

**Purpose** : This workflow is added to MHP-IM to showcase that Delft-FEWS, which is the core of MHP-IM, can easily import various parameters using a rather simple CSV file that adheres to a specific convention format.

- **The following are the steps for importing internal sea water level obtained from JUPEM to MHP-IM**

**Step 01:** Put the CSV file to be imported to the right import folder

**Step 02:** Open MHP-IM application

**Step 03:** Open Manual Forecast

**Step 04:** Select Import Historical Tide W.L. workflow

**Step 05:** Set the T0 to DD-MM-YYYY 08:00:00

**Step 06:** Click run button to start the workflow

**Step 07:** Check if the data has been imported to MHP-IM by checking at the Database Lister and Data Viewer.

### 6.1.7 Import Building Damage

**Introduction** : This workflow is used to import the estimated maximum building damage in TIFF format into MHP-IM. To run this workflow, the user needs to prepare the estimated maximum building damage file and store it in %REGION\_HOME%/Import/Building\_Damage.

Examples of the required TIFF file can be found in the import folders mentioned above. The estimated maximum building damage map is stored as a constant value over time in MHP-IM.

**Purpose** : The imported estimated maximum building damage will later be used to calculate the flood impact metrics.

- **The following are the steps for importing estimated maximum building damage data to MHP-IM**

**Step 01:** Put the TIFF file to be imported to the right import folder

**Step 02:** Open MHP-IM application

**Step 03:** Open Manual Forecast

**Step 04:** Select Import Building Damage workflow

**Step 05:** Set the T0 to DD-MM-YYYY 08:00:00

**Step 06:** Click run button to start the workflow

**Step 07:** Check if the data has been imported to MHP-IM by checking at the Database Lister and Spatial Data.

### 6.1.8 Import Population

**Introduction** : This workflow is used to import population data in TIFF format into MHP-IM. To run this workflow, the user needs to prepare the population data and store it in %REGION\_HOME%/Import/Population.

Examples of the required TIFF file can be found in the import folders mentioned above. The population data is stored as a constant value over time in MHP-IM.

**Purpose** : The imported population data will later be used to calculate the flood impact metrics.

- **The following are the steps for importing population data to MHP-IM**

**Step 01:** Put the TIFF file to be imported to the right import folder

**Step 02:** Open MHP-IM application

**Step 03:** Open Manual Forecast

**Step 04:** Select Import Population workflow

**Step 05:** Set the T0 to DD-MM-YYYY 08:00:00

- Step 06:** Click run button to start the workflow
- Step 07:** Check if the data has been imported to MHP-IM by checking at the Database Lister and Spatial Data.

### 6.1.9 Import ERA5

**Introduction** : This workflow is used to import ERA5 reanalysis weather data into MHP-IM. To run this workflow, the user needs to prepare the netCDF file that can be downloaded from ERA5 website that has the same format as the sample file provided and store it in %REGION\_HOME%/Import/ERA5. Examples of the required netCDF file can be found in the import folders mentioned above.

**Purpose** : This workflow is used to import daily rainfall, PET, and temperature parameters from ERA5. ERA5 data is also imported into MHP-IM for hydrological modeling using the wflow model and flood modeling using the SFINCS model. ERA5 is utilized due to its ease of access and its long, continuous data availability up to near real-time.

- **The following are the steps for importing ERA5 data to MHP-IM**

**Step 01:** Put the netCDF file to be imported to the right import folder

**Step 02:** Open MHP-IM application

**Step 03:** Open Manual Forecast

**Step 04:** Select Import ERA5 workflow

**Step 05:** Set the T0 to DD-MM-YYYY 08:00:00

**Step 06:** Click run button to start the workflow

**Step 07:** Check if the data has been imported to MHP-IM by checking at the Database Lister and Spatial Data.

### 6.1.10 Import GPM

**Introduction** : This workflow is used to import GPM early rainfall data into MHP-IM. To run this workflow, the user needs internet connection to download the file directly from OPeNDap repository where GPM data is stored.

**Purpose** : Importing GPM data helps users gain a spatial overview of weather conditions and serves as a backup when rain data from telemetry or manual stations is unavailable. While ERA5 also provides spatial weather data, it has a significant delay between real-time and data availability. In contrast, GPM Early data has a much shorter delay of just a few hours. Additionally, GPM data is imported into MHP-IM for hydrological modeling with the wflow model and flood modeling with the SFINCS model.

- **The following are the steps for importing GPM Early data to MHP-IM**

**Step 01:** Open MHP-IM application

**Step 02:** Open Manual Forecast

**Step 03:** Select Import GPM workflow

**Step 04:** Set the T0 to DD-MM-YYYY HH:00:00.

Where HH can only be 08/11/14/17/20/23/02/05

**Step 05:** Click run button to start the workflow

**Step 06:** Check if the data has been imported to MHP-IM by checking at the Database Lister and Spatial Data.

### 6.1.11 Import GFS

**Introduction** : This workflow is used to add weather forecast product generated by the National Centers for Environmental Prediction (NCEP) weather forecast model to MHP-IM. Global Forecast System (GFS) is a global model with

a base horizontal resolution of 18 miles (28 kilometers) between grid points and has a forecast horizon up to 16 days. To run this workflow, user only needs to have an internet connection (no need to download the data itself from the source). Only the last 10 days of GFS weather forecasts are stored on the GrADS Data Server, limiting imported weather data to this period.

**Purpose** : This workflow is used to import short term weather forecast from GrADS Data Server. There are two forecasts that are imported to MHP-IM, namely the 5 days forecast with hourly timestep and the 16 days forecast with 3 hourly timestep. This workflow is important for the MHP-IM because the imported weather forecast data is needed to do hydrological and flood simulation using WFLOW and SFINCS model. Additionally, the imported weather forecast is also processed to generate near real-time PET, which is used as input for hydrological modeling with wflow, where PET data from ERA5 is not available.

- **The following are the steps for importing GFS data to MHP-IM**

**Step 01:** Open MHP-IM application

**Step 02:** Open Manual Forecast

**Step 03:** Select Import GFS workflow

**Step 04:** Set the T0 to DD-MM-YYYY HH:00:00. Where HH can only be 08/20.

Additionally, T0 here can only be set to a date within the last 10 days from the current time.

**Step 05:** Click run button to start the workflow

**Step 06:** Check if the data has been imported to MHP-IM by checking at the Database Lister and Spatial Data.

#### 6.1.12 Import GTSM Tide W.L. Historical + Forecast

**Introduction** : This workflow is used to import sea water level, corrected sea water level (setelah di cek dengan data pengamatan dari JUPEM) and forecast from GTSM model. To run this workflow, the user needs to prepare a CSV file(s) following a specific convention and place the file either in %REGION\_HOME%/Import/Tide\_Data/GTSM or %REGION\_HOME%/Import/Tide\_Data/GTSM\_Corrected or %REGION\_HOME%/Import/Tide\_Data/GTSM\_Forecast\_Corrected. Examples of the required CSV file can be found in the import folders mentioned above.

**Purpose** : This workflow is used to import long-term sea water level data from the GTSM model for both historical and forecast periods. This data is used in MHP-IM as input for the downstream boundary of the SFINCS flood model.

- **The following are the steps for importing GTSM data to MHP-IM**

**Step 01:** Put the CSV file to be imported to the right import folder

**Step 02:** Open MHP-IM application

**Step 03:** Open Manual Forecast

**Step 04:** Select Import GTSM Tide W.L. Historical + Forecast workflow

**Step 05:** Set the T0 to DD-MM-YYYY 08:00:00

**Step 06:** Click run button to start the workflow

**Step 07:** Check if the data has been imported to MHP-IM by checking at the Database Lister and Data Viewer.

## 6.2 Process Workflows

This section will discuss the process workflows that have been pre-configured by the consultant. These process workflows are designed to preprocess data before it is used in

subsequent processes. For example, the consultant has prepared several workflows for running the wflow hydrological model, where the output will later be used for flood modelling. Additionally, there are workflows such as "Converting Rainfall to Areal Rainfall," which process point-based rainfall data into areal rainfall data for visualization purposes.

### 6.2.1 Converting Rainfall to Areal Rainfall

**Introduction** : This workflow is used to convert point-based daily and hourly rainfall data into daily areal rainfall per mukim. To run this workflow, the user must ensure that the rainfall data has been successfully imported into MHP-IM. By default, the data to be converted starts from one week before T0. If the user wants to change the data for a specific time period, they need to set the start time in the Cold State section and the end time at T0.

**Purpose** : This workflow is used to show the capability of Delft-FEWS as the main core of MHP-IM that can be used to transform scalar data into spatial data.

- **The following are the steps for converting to scalar rainfall into areal rainfall in MHP-IM**
  - Step 01:** Open MHP-IM application
  - Step 02:** Open Manual Forecast
  - Step 03:** Select Converting Rainfall to Areal Rainfall workflow
  - Step 04:** Set the T0 to DD-MM-YYYY 08:00:00
  - Step 05:** Click run button to start the workflow
  - Step 06:** Check if new data has been added into the MHP-IM by checking at the Database Lister and Spatial Data.

### 6.2.2 Retrieve Data from Remote Sensing

**Introduction** : This workflow is used to store IMERG GPM Early time series values, which are in grid format, at meteorological station locations. To run this workflow, the user must ensure that IMERG GPM Early data has been successfully imported into MHP-IM. By default, the data to be converted starts from 4 days before T0. If the user wants to modify the data for a specific time period, they need to set the start time in the Cold State section and the end time at T0.

**Purpose** : This workflow is used to store IMERG GPM Early time series values, which are in grid format, at meteorological station locations. It allows users to directly compare measured rainfall data at a meteorological station with global rainfall estimates from IMERG GPM Early.

- **The following are the steps for retrieving data from remote sensing product in MHP-IM**
  - Step 01:** Open MHP-IM application
  - Step 02:** Open Manual Forecast
  - Step 03:** Select Retrieve Data From Remote Sensing workflow
  - Step 04:** Set the T0 to DD-MM-YYYY 08:00:00
  - Step 05:** Click run button to start the workflow
  - Step 06:** Check if new data has been added into the MHP-IM by checking at the Database Lister and Data Viewer.

### 6.2.3 Run WFLOW SBM Local Data + ERA5 Historic

**Introduction** : This workflow is used to run the wflow hydrological model using local rainfall data, as well as PET and temperature data from ERA5. However, it is important to note that the wflow simulation can only be performed for periods where local rainfall data overlaps with PET and temperature data from ERA5. By default, this workflow runs

simulations from T0-2 days up to T0. If the user wants to modify the data for a specific time period, they need to set the start time in the Cold State section and the end time at T0.

**Purpose** : This workflow is used to run the wflow hydrological model using local rainfall data, as well as PET and temperature data from ERA5. The simulation results can then be used as input for the "Run SFINCS Local Historic" workflow.

- **The following are the steps for running the wflow SBM model using local rainfall data, along with PET and temperature data from ERA5 in MHP-IM**

**Step 01:** Open MHP-IM application

**Step 02:** Open Manual Forecast

**Step 03:** Select Run WFLOW SBM Local Data + ERA5 Historic workflow

**Step 04:** Set the T0 to DD-MM-YYYY 08:00:00

**Step 05:** Click run button to start the workflow

**Step 06:** Check if new data has been added into the MHP-IM by checking at the Database Lister and Spatial Data.

#### 6.2.4 Run WFLOW SBM Local Data + ERA5 Historic (Rainfall increase 20%)

**Introduction** : This workflow is used to run the wflow hydrological model using local rainfall data with a 20% increase in rainfall, as well as PET and temperature data from ERA5. However, it is important to note that the wflow simulation can only be performed for periods where local rainfall data overlaps with PET and temperature data from ERA5. By default, this workflow runs simulations from T0-2 days up to T0. If the user wants to modify the data for a specific time period, they need to set the start time in the Cold State section and the end time at T0.

**Purpose** : This workflow is used to run the wflow hydrological model using local rainfall data with a 20% increase in rainfall, as well as PET and temperature data from ERA5. The results of this simulation allow users to understand the flow discharge if there is a 20% increase in rainfall input.

- **The following are the steps for running the wflow SBM model using local rainfall data with a 20% increase, along with PET and temperature data from ERA5 in MHP-IM**

**Step 01:** Open MHP-IM application

**Step 02:** Open Manual Forecast

**Step 03:** Select Run WFLOW SBM Local Data + ERA5 Historic (Rainfall increase 20%) workflow

**Step 04:** Set the T0 to DD-MM-YYYY 08:00:00

**Step 05:** Click run button to start the workflow

**Step 06:** Check if new data has been added into the MHP-IM by checking at the Database Lister and Spatial Data.

#### 6.2.5 Run WFLOW SBM Local Data + ERA5 Historic (Rainfall increase 50%)

**Introduction** : This workflow is used to run the wflow hydrological model using local rainfall data with a 50% increase in rainfall, as well as PET and temperature data from ERA5. However, it is important to note that the wflow simulation can only be performed for periods where local rainfall data overlaps with PET and temperature data from ERA5. By default, this workflow runs simulations from T0-2 days up to T0. If the user wants to modify the data for a specific time period, they need to set the start time in the Cold State section and the end time at T0.

**Purpose** : This workflow is used to run the wflow hydrological model using local rainfall data with a 50% increase in rainfall, as well as PET and temperature data from ERA5. The results of this simulation allow users to understand the flow discharge if there is a 50% increase in rainfall input.

- **The following are the steps for running the wflow SBM model using local rainfall data with a 50% increase, along with PET and temperature data from ERA5 in MHP-IM**

**Step 01:** Open MHP-IM application

**Step 02:** Open Manual Forecast

**Step 03:** Select Run WFLOW SBM Local Data + ERA5 Historic (Rainfall increase 50%) workflow

**Step 04:** Set the T0 to DD-MM-YYYY 08:00:00

**Step 05:** Click run button to start the workflow

**Step 06:** Check if new data has been added into the MHP-IM by checking at the Database Lister and Spatial Data.

### 6.2.6 Run WFLOW SBM ERA5 Historic

**Introduction** : This workflow is used to run the wflow hydrological model using ERA5 data. However, it is important to note that the wflow simulation can only be performed for periods where ERA5 data is available. By default, this workflow runs simulations from T0-2 days up to T0. If the user wants to modify the data for a specific time period, they need to set the start time in the Cold State section and the end time at T0.

**Purpose** : This workflow is used to run the wflow hydrological model using ERA5 data. The simulation results can then be used as input for the "Run SFINCS ERA5 Historic" workflow.

- **The following are the steps for running the wflow SBM model using ERA5 data in MHP-IM**

**Step 01:** Open MHP-IM application

**Step 02:** Open Manual Forecast

**Step 03:** Select Run WFLOW SBM ERA5 Historic workflow

**Step 04:** Set the T0 to DD-MM-YYYY 08:00:00

**Step 05:** Click run button to start the workflow

**Step 06:** Check if new data has been added into the MHP-IM by checking at the Database Lister and Spatial Data.

### 6.2.7 Run WFLOW SBM ERA5 Historic (Rainfall increase 20%)

**Introduction** : This workflow is used to run the wflow hydrological model using ERA5 data with a 20% increase in rainfall. However, it is important to note that the wflow simulation can only be performed for periods where ERA5 data is available. By default, this workflow runs simulations from T0-2 days up to T0. If the user wants to modify the data for a specific time period, they need to set the start time in the Cold State section and the end time at T0.

**Purpose** : This workflow is used to run the wflow hydrological model using ERA5 data with a 20% increase in rainfall. The results of this simulation allow users to understand the flow discharge if there is a 20% increase in rainfall input.

- **The following are the steps for running the wflow SBM model using ERA5 data with a 20% increase in rainfall in MHP-IM**

**Step 01:** Open MHP-IM application

- Step 02:** Open Manual Forecast
- Step 03:** Select Run WFLOW SBM ERA5 Historic workflow (Rainfall increase 20%)
- Step 04:** Set the T0 to DD-MM-YYYY 08:00:00
- Step 05:** Click run button to start the workflow
- Step 06:** Check if new data has been added into the MHP-IM by checking at the Database Lister and Spatial Data.

### 6.2.8 Run WFLOW SBM ERA5 Historic (Rainfall increase 50%)

**Introduction** : This workflow is used to run the wflow hydrological model using ERA5 data with a 50% increase in rainfall. However, it is important to note that the wflow simulation can only be performed for periods where ERA5 data is available. By default, this workflow runs simulations from T0-2 days up to T0. If the user wants to modify the data for a specific time period, they need to set the start time in the Cold State section and the end time at T0.

**Purpose** : This workflow is used to run the wflow hydrological model using ERA5 data with a 50% increase in rainfall. The results of this simulation allow users to understand the flow discharge if there is a 50% increase in rainfall input.

- **The following are the steps for running the wflow SBM model using ERA5 data with a 50% increase in rainfall in MHP-IM**

- Step 01:** Open MHP-IM application
- Step 02:** Open Manual Forecast
- Step 03:** Select Run WFLOW SBM ERA5 Historic workflow (Rainfall increase 50%)
- Step 04:** Set the T0 to DD-MM-YYYY 08:00:00
- Step 05:** Click run button to start the workflow
- Step 06:** Check if new data has been added into the MHP-IM by checking at the Database Lister and Spatial Data.

### 6.2.9 Run WFLOW SBM GPM Historic

**Introduction** : This workflow is used to run the wflow hydrological model using GPM early rainfall data, as well as PET and temperature that is obtained from GFS weather forecast. However, it is important to note that the wflow simulation can only be performed for periods where GPM early rainfall data overlaps with PET and temperature data which are derived from GFS. By default, this workflow runs simulations from T0-2 days up to T0. If the user wants to modify the data for a specific time period, they need to set the start time in the Cold State section and the end time at T0.

**Purpose** : This workflow is used to run the wflow hydrological model using GPM early rainfall data, as well as PET and temperature that is obtained from GFS weather forecast. The simulation results can then be used as input for conducting hydrological forecast by running the "Run WFLOW SBM GPM Historic + GFS Forecast" workflow and for flood modelling by running "Run SFINCS GPM Historic" workflow.

- **The following are the steps for running the wflow SBM model using GPM Early data in MHP-IM**

- Step 01:** Open MHP-IM application
- Step 02:** Open Manual Forecast
- Step 03:** Select Run WFLOW SBM GPM Historic workflow
- Step 04:** Set the T0 to DD-MM-YYYY 08:00:00
- Step 05:** Click run button to start the workflow
- Step 06:** Check if new data has been added into the MHP-IM by checking at the Database Lister and Spatial Data.

### 6.2.10 Run WFLOW SBM GPM Historic + GFS Forecast

**Introduction** : This workflow is used to conduct a hydrological forecast using the wflow model with merged rainfall input data from GPM and GFS. By default, this workflow runs simulations from T0 up to T0+5 days.

**Purpose** : This workflow is used to conduct a hydrological forecast using the wflow model with merged rainfall input from GPM and GFS. The simulation results can then be used as input for flood forecasting by running the "Run SFINCS Forecast" workflow.

- **The following are the steps for conducting a hydrological forecast using GPM and GFS input data.**

**Step 01:** Open MHP-IM application

**Step 02:** Open Manual Forecast

**Step 03:** Select Run WFLOW SBM Historic + GFS Forecast workflow

**Step 04:** Set the T0 to DD-MM-YYYY 08:00:00

**Step 05:** Click run button to start the workflow

**Step 06:** Check if new data has been added into the MHP-IM by checking at the Database Lister and Spatial Data.

## 6.3 Generate Hazard Map Workflows

This section will discuss all workflows that have been pre-configured by the consultant to generate hazard maps. In MHP-IM, there are two types of hazard maps produced: the Heat Index Map and the Flood Hazard Map.

### 6.3.1 Generate Heat Index Map

**Introduction** : This workflow is used to produce hourly heat index predictions for the next five days using weather forecasts from GFS. To run this workflow, the user must ensure that GFS weather forecast data has been successfully imported into MHP-IM.

**Purpose** : This workflow is used to produce hourly heat index prediction for the next five days using weather forecast from GFS.

- **The following are the steps for generating heat index map using MHP-IM**

**Step 01:** Open MHP-IM application

**Step 02:** Open Manual Forecast

**Step 03:** Select Generate Heat Index Map workflow

**Step 04:** Set the T0 to DD-MM-YYYY 08:00:00

**Step 05:** Click run button to start the workflow

**Step 06:** Check if new data has been added into the MHP-IM by checking at the Database Lister and Spatial Data.

### 6.3.2 Run SFINCS Local + ERA5 Historic

**Introduction** : This workflow is used to simulate flooding using the SFINCS model with daily observed (local) rainfall input, corrected GTSM sea water level and hydrological simulation results obtained from the "Run WFLOW SBM Local Data + ERA5 Historic" workflow. By default, this workflow runs simulations from T0-2 days up to T0. If the user wants to modify the data for a specific time period, they need to set the start time in the Cold State section and the end time at T0. Since the flood simulation uses historical data and does not include near real-time data like GPM, the flood simulation with this workflow can only be run for past events. However, if local rainfall data is continuously

transmitted to MHP-IM via telemetry, the output of this workflow can be used as an initial condition for flood forecasting.

**Purpose** : This workflow is used to simulate flooding using the SFINCS model with daily observed (local) rainfall input, corrected GTSM sea water level and hydrological simulation results obtained from the “Run WFLOW SBM Local Data + ERA5 Historic” workflow. The output of this workflow includes water level information and potential flood depths in the Iskandar Malaysia region.

- **The following are the steps for running the SFINCS Local + ERA5 Historic in MHP-IM**

**Step 01:** Open MHP-IM application

**Step 02:** Open Manual Forecast

**Step 03:** Select Run SFINCS Local + ERA5 Historic workflow

**Step 04:** Set the T0 to DD-MM-YYYY 08:00:00

**Step 05:** Click run button to start the workflow

**Step 06:** Check if new data has been added into the MHP-IM by checking at the Database Lister and Spatial Data.

### 6.3.3 Run SFINCS ERA5 Historic

**Introduction** : This workflow is used to simulate flooding using the SFINCS model with daily ERA5 rainfall input, corrected GTSM sea water level and hydrological simulation results obtained from the “Run WFLOW SBM ERA5 Historic” workflow. By default, this workflow runs simulations from T0-2 days up to T0. If the user wants to modify the data for a specific time period, they need to set the start time in the Cold State section and the end time at T0. Since the flood simulation uses historical data and does not include near real-time data like GPM, the flood simulation with this workflow can only be run for past events.

**Purpose** : This workflow is used to simulate flooding using the SFINCS model with daily ERA5 rainfall input, corrected GTSM sea water level and hydrological simulation results obtained from the “Run WFLOW SBM ERA5 Historic” workflow. The output of this workflow includes water level information and potential flood depths in the Iskandar Malaysia region.

- **The following are the steps for running the SFINCS ERA5 in MHP-IM**

**Step 01:** Open MHP-IM application

**Step 02:** Open Manual Forecast

**Step 03:** Select Run SFINCS ERA5 Historic workflow

**Step 04:** Set the T0 to DD-MM-YYYY 08:00:00

**Step 05:** Click run button to start the workflow

**Step 06:** Check if new data has been added into the MHP-IM by checking at the Database Lister and Spatial Data.

### 6.3.4 Run SFINCS GPM Historic

**Introduction** : This workflow is used to simulate flooding using the SFINCS model with daily GPM early rainfall input, corrected GTSM sea water level and hydrological simulation results obtained from the “Run WFLOW SBM GPM Historic” workflow. By default, this workflow runs simulations from T0-2 days up to T0. If the user wants to modify the data for a specific time period, they need to set the start time in the Cold State section and the end time at T0.

**Purpose** : This workflow is used to simulate flooding using the SFINCS model with daily GPM early rainfall input, corrected GTSM sea water level and

hydrological simulation results obtained from the “Run WFLOW SBM GPM Historic” workflow. The output of this workflow includes water level information and potential flood depths in the Iskandar Malaysia region, which are then also used as an initial condition for doing flood forecasting by running “Rin SFINCS Forecast” workflow.

- **The following are the steps for running the SFINCS GPM in MHP-IM**
  - Step 01:** Open MHP-IM application
  - Step 02:** Open Manual Forecast
  - Step 03:** Select Run SFINCS GPM Historic workflow
  - Step 04:** Set the T0 to DD-MM-YYYY 08:00:00
  - Step 05:** Click run button to start the workflow
  - Step 06:** Check if new data has been added into the MHP-IM by checking at the Database Lister and Spatial Data.

### 6.3.5 Run SFINCS Forecast

**Introduction** : This workflow is used to provide information of potential flooding for the coming five days using the SFINCS model with daily GFS rainfall input, GTSM forecasted sea water levels, and hydrological simulation results from the “Run WFLOW SBM GPM Historic + GFS Forecast” workflow.

**Purpose** : This workflow is used to provide information of potential flooding for the coming five days using the SFINCS model with daily GFS rainfall input, GTSM forecasted sea water levels, and hydrological simulation results from the “Run WFLOW SBM GPM Historic + GFS Forecast” workflow. The output includes forecasted water levels and flood depths in the Iskandar Malaysia region, which are then used to calculate flood impact metrics and producing flood impact report.

- **The following are the steps for running the SFINCS Forecast in MHP-IM**
  - Step 01:** Open MHP-IM application
  - Step 02:** Open Manual Forecast
  - Step 03:** Select Run SFINCS Forecast workflow
  - Step 04:** Set the T0 to DD-MM-YYYY 08:00:00
  - Step 05:** Click run button to start the workflow
  - Step 06:** Check if new data has been added into the MHP-IM by checking at the Database Lister and Spatial Data.

## 6.4 Export Workflows

The explanation of the export workflow has been covered in the previous chapter and can be found in chapter 5.3.

## 6.5 Report Workflow

This section will discuss the report workflow that has been pre-configured by the consultant to generate a report document from the MHP-IM application. In other systems, such reports are often created to summarize the simulation/forecast results conducted in the previous steps within the Delft-FEWS application.

### 6.5.1 Generate Flood Impact Report

**Introduction** : This workflow is used to calculate flood impact metrics based on the forecasted flood depth and to generate a flood forecast report in HTML format. To run this workflow, the user must ensure that the forecast

simulation using the SFINCS hydrodynamic model has been successfully executed and has produced the forecasted flood depth.

**Purpose** : This workflow is designed to demonstrate the capability of Delft-FEWS in generating reports by utilizing simulation results stored in the MHP-IM local database.

- **The following is the steps for producing flood impact report using MHP-IM**

**Step 01:** Open MHP-IM application

**Step 02:** Open Manual Forecast

**Step 03:** Select Generate Flood Impact Report workflow

**Step 04:** Set the T0 to DD-MM-YYYY 08:00:00

**Step 05:** Click run button to start the workflow

**Step 06:** Check if the report has been produced in  
%REGION\_CONFIG%/Reports/Flood\_Impact\_Report.

## 7 System Monitor

The System Monitor can be accessed through the 'Tools' drop-down menu, through the button bar of the Explorer or through the Ctrl+S shortcut.

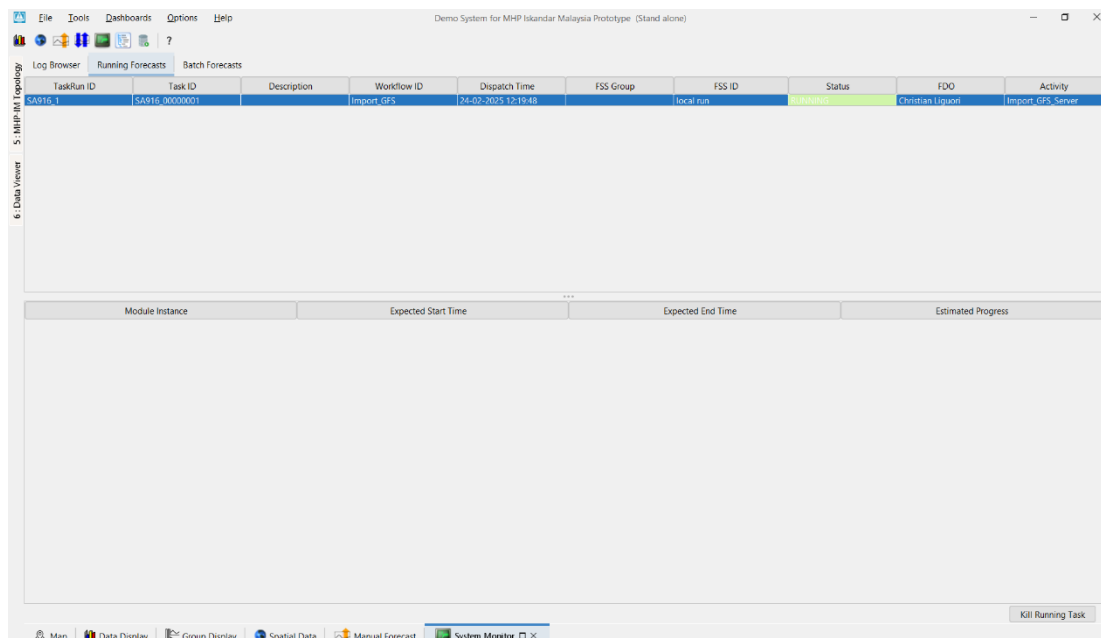


Figure 7.1 System Monitor with Live System Status tab shown

The System Monitor contains many useful tabs for monitoring different aspects of the system:

- **Log Browser:** this allows the user to view, search and filter through all the log messages. Log messages can be filtered on creation time and level, and/or searched by the code or text they contain.
- **Live System Status:** this gives an overview of the current status of the live system in the Operator Client version (OC), for example how many tasks are currently running, which Forecasting Shells are active and which users are logged.
- **Scheduled Forecasts:** this gives an overview of all scheduled workflows in GMT+8, with the next time they will be run by the system.
- **Running Forecasts:** this gives an overview of all currently running workflows, showing, amongst other things their ID, dispatch time and on which FSS they are running.
- **Import Status:** this gives an overview of the different data sets that are being imported by the system, such as the directory from which they are imported and the last time a file was successfully imported. The time of the last import is also colour coded to give an indication of how recent the last imported data is. Details of the latter are shown in the table below.

A more detailed information about System Monitor can be found at Deltares Public Wiki: <https://publicwiki.deltares.nl/display/FEWSDOC/08+System+Monitor>

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