Decision Support System – Planning and Management

User Manual

Contents

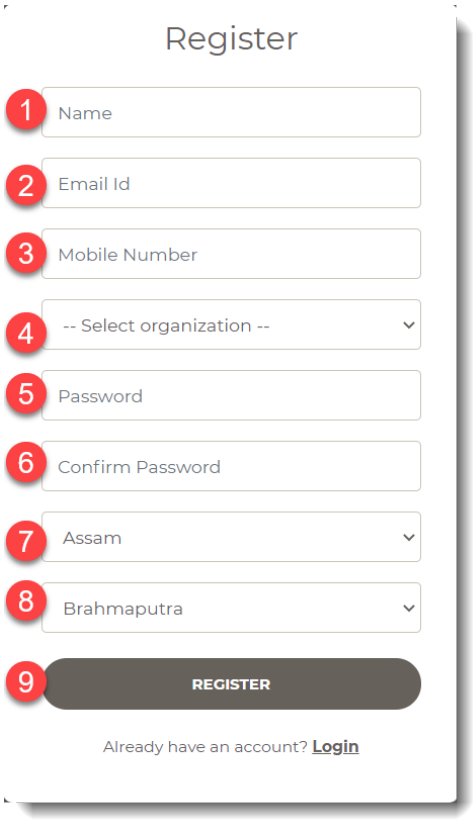
1. Getting Started

This section describes how a new user can register themselves into the database and create their login credentials. The registration process comprises of the following two steps:

- Register
- Login

1.1 Register

This section is used for registration of a new user in the database.



1.1.1 Name

The user needs to enter their name.

1.1.2 Email ID

The user needs to enter their email id. The email id entered by the user will be shown as the User Id for the user.

1.1.3 Mobile Number

The user needs to enter their mobile number.

1.1.4 Select Organization

The user needs to select their organization from the listed organizations in the 'Select Organization' dropdown menu.

1.1.5 Password

The user needs to enter a password that will be used for logging into the portal once the user is registered.

1.1.6 Confirm Password

The user needs to re-enter the password entered in the above field for confirmation.

1.1.7 State

The user needs to select the state in which the project/study is to be undertaken from the dropdown menu. (e.g., Maharashtra, Assam etc.) The state selected by the user will be used to identify the corresponding basin.

1.1.8 Basin

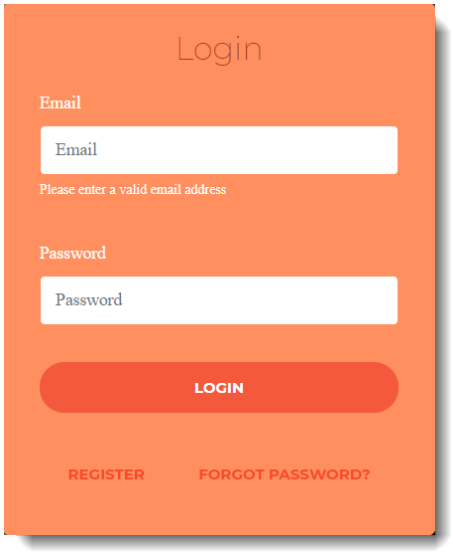
The user needs to select the basin in which the project/study is to be undertaken. The dropdown menu consists of a list of basins that lie within the state selected by the user. Note that a particular basin can contribute drainage to more than one state.

1.1.9 Register

The user can click on this button after all the details have been entered to successfully register their account.

1.11.2 Login

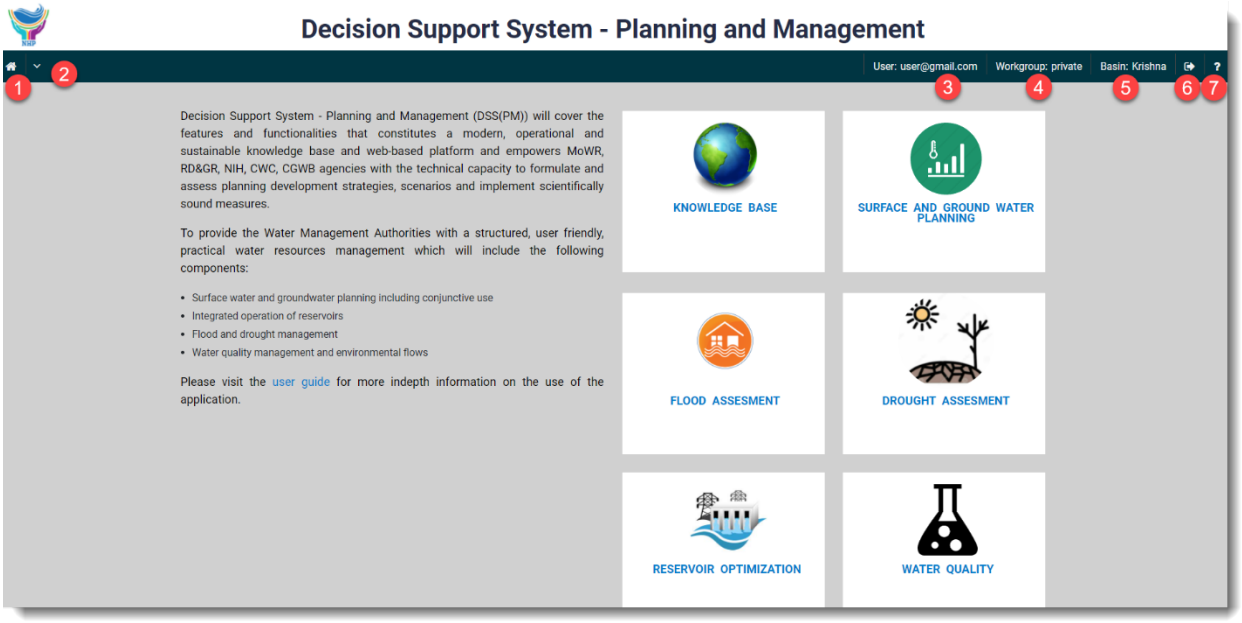
This section is used by the user to login the database using the login credentials.



The Login dialog box consists of fields for entering the email address and password created by the user while registering themselves. Additionally, the options for 'Register' and 'Forgot Password' are also present. The 'Register' option will redirect the user to the Register page and the 'Forgot Password' option can be used to set up a new password for the registered user ID.

2. Dashboard

The Dashboard appears when the user successfully logs in the portal using the credentials created in the previous steps. This section displays the user account specifications and the different modules available within the portal. There is also a dropdown menu through which the different modules can be accessed.



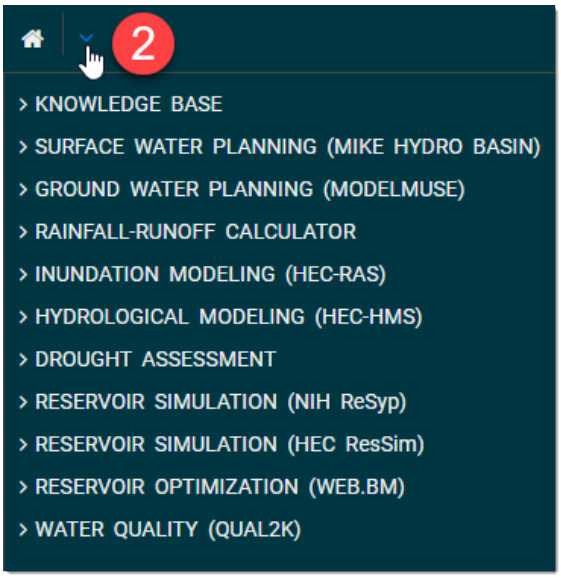
The Dashboard comprises of the following entities which are explained in detail below:

2.1 Home Button

The Home Button will make the user fall back to the Dashboard from any page within the portal. It is present on the top left section of the Dashboard. It works similar to the **Home** button provided on a regular smartphone or a tablet.

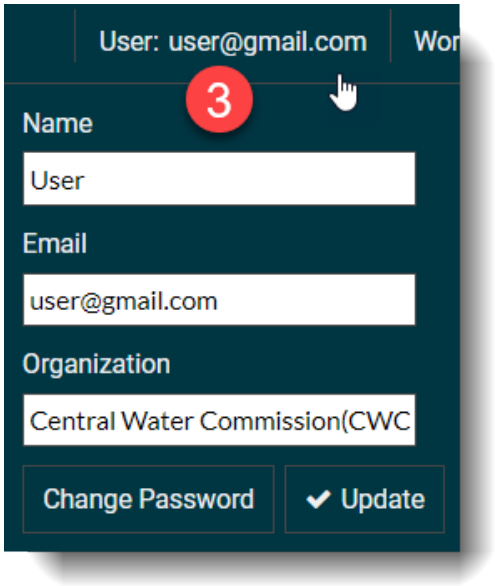
2.2 Module Dropdown Menu

This dropdown enlists all the modules and their components available in the portal. The user can navigate to any of the components through this dropdown menu. This menu is present on the top left section of the Dashboard next to the **Home** button.



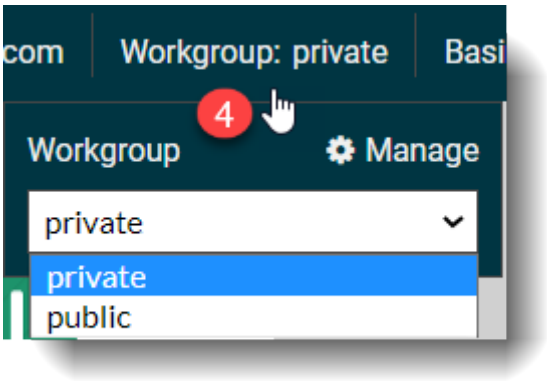
2.3 User ID

The User ID is displayed on the top right section of the Dashboard. The user can also edit the user credentials on the Dashboard by clicking on the displayed User ID.



2.4 Workgroup

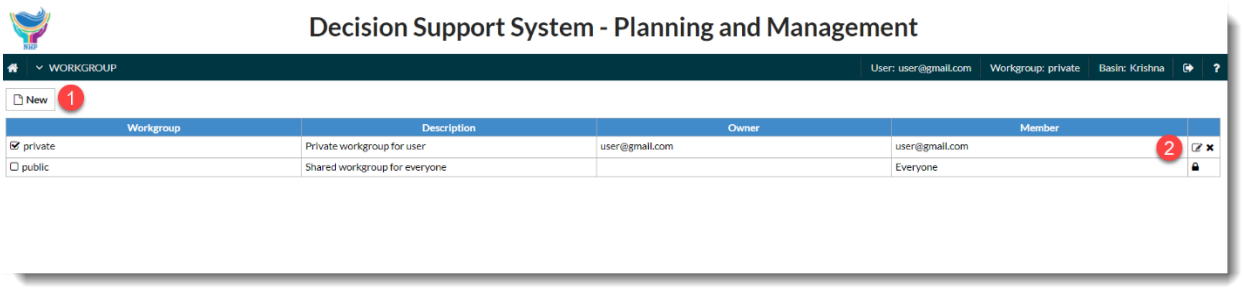
The workgroup selected by the user while registering is also displayed next to the User ID on the Dashboard. The user can change the workgroup selected initially by clicking on the displayed workgroup name.



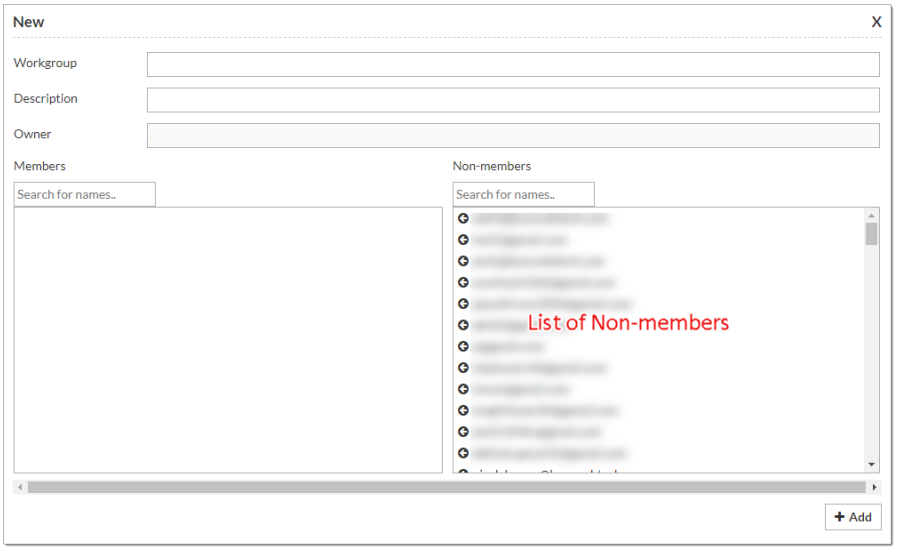
Additionally, the user also has the option to manage the workgroup wherein the user can create new workgroups and can also modify the accessibility settings for the different members in the workgroup. The user can enter the Workgroup interface by clicking on the Manage button.

2.4.1 Manage Workgroup

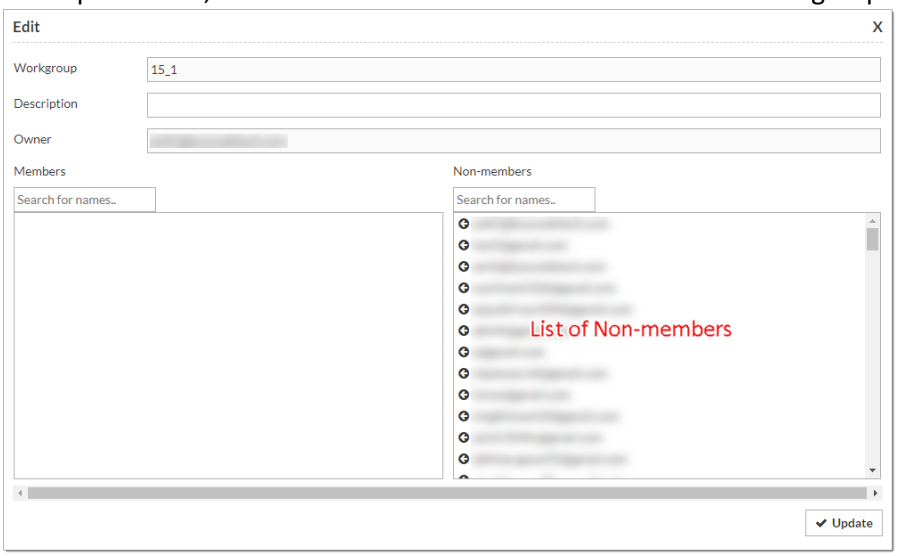
In the Manage Workgroup section, the user(owner) can:



1. Create a new workgroup.

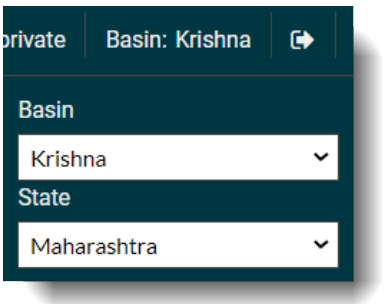


2. The user also has the option to edit a created workgroup wherein the user can edit the Description. Also, the user can add or remove members to the workgroup.



2.5 Basin

The name of the basin selected by the user while registering is also displayed on the Dashboard next to the Workgroup section. The user can also change the selected basin and the corresponding state by clicking on the basin name.

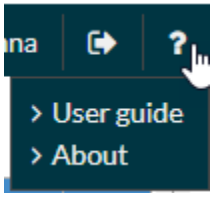


2.6 Log out Button

This button allows the user to log out from the portal.

2.7 Help Button

The user can access the User Guide, Knowledge Portal and the About page by using the **Help** button.



3. Modules

This section will cover in detail all the different modules available in the portal.

3.1 Knowledge Base

3.1.1 Data

The Data panel of the Knowledge Base section can be specified as the collection of the quantitative values or numbers of a particular variable such as rainfall, temperature, vegetation, etc. Using the **Data** panel, the user can either download the data in the opted format or can view the data itself on the portal.

[Status]: The status button allows the user to see the last time step for which the data was updated or available.

[GIS Layer]: This button allow user to download the GIS layer associated with the basin.

3.1.1.1 Rainfall (CHIRPS)

Climate Hazards Group Infrared Precipitation with Station data (CHIRPS) is a 30+ year quasi-global rainfall dataset. Spanning 50°S-50°N (and all longitudes), starting in 1981 to near-present, CHIRPS incorporates 0.05° resolution satellite imagery with in-situ station data to create gridded rainfall time series for trend analysis and seasonal drought monitoring. As of February 12th, 2015, version 2.0 of CHIRPS is complete and available to the public.

Spatial resolution: 0.05 degrees

Temporal resolution: daily

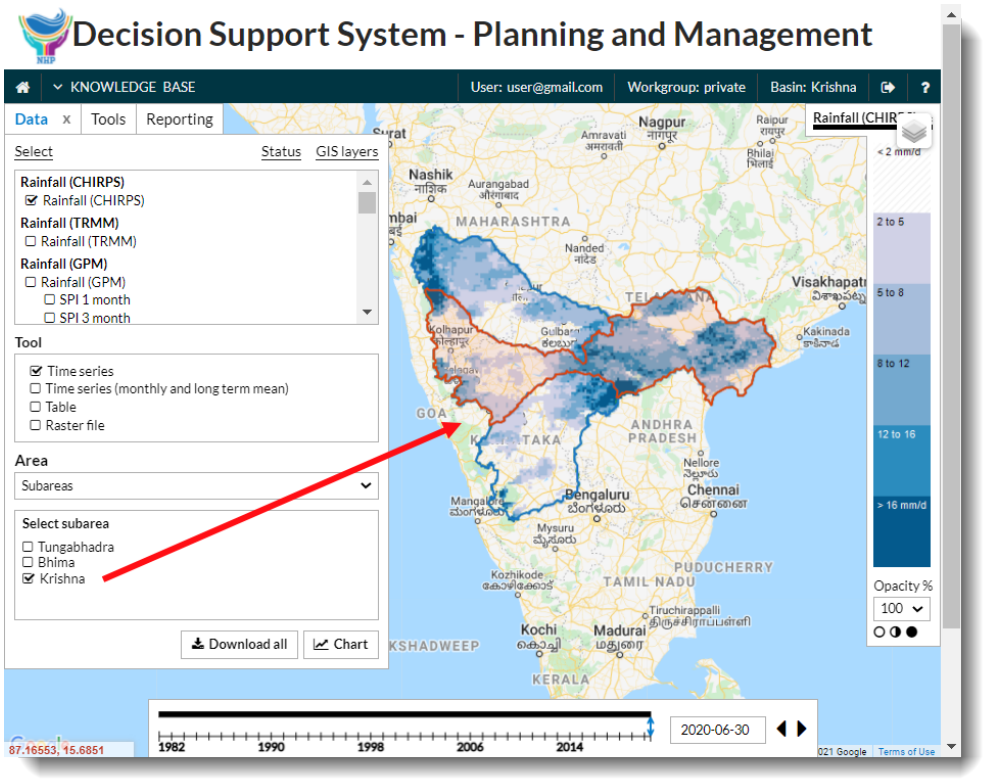
Source: http://chg.geog.ucsb.edu/data/chirps/

A. Time series

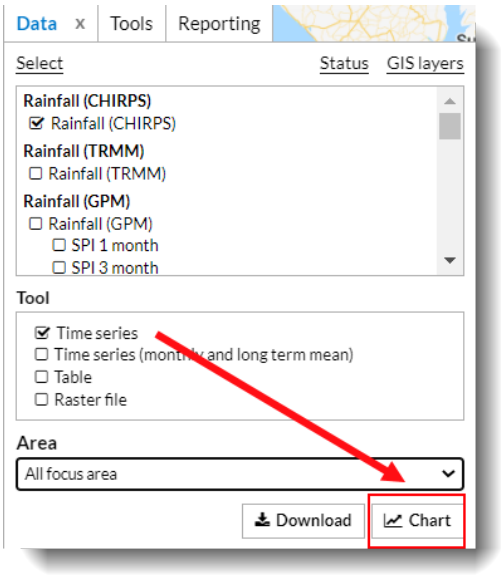
View area weighted time series for the whole area or for selected subareas. Time series for point locations and user defined locations are available for some data types only.

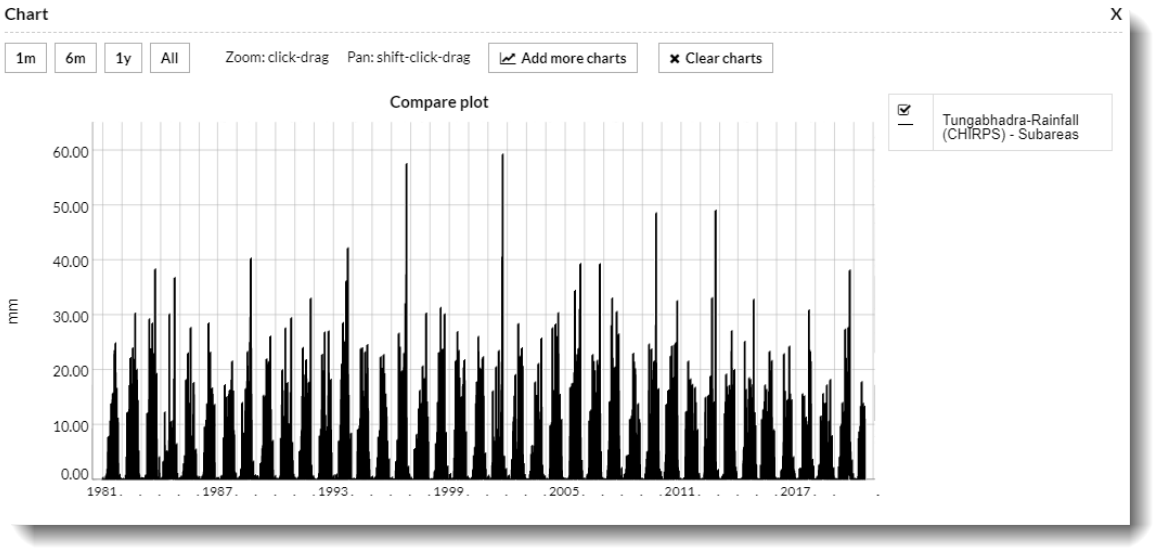
This tool displays the data in the original temporal resolution.

- All focus Area
- Subareas
- Station
- User Location



The Time Series data for the selected extent can be either downloaded by clicking on the **[Download]** button provided or can be viewed as a graphical representation by clicking on the **[Chart]** button.





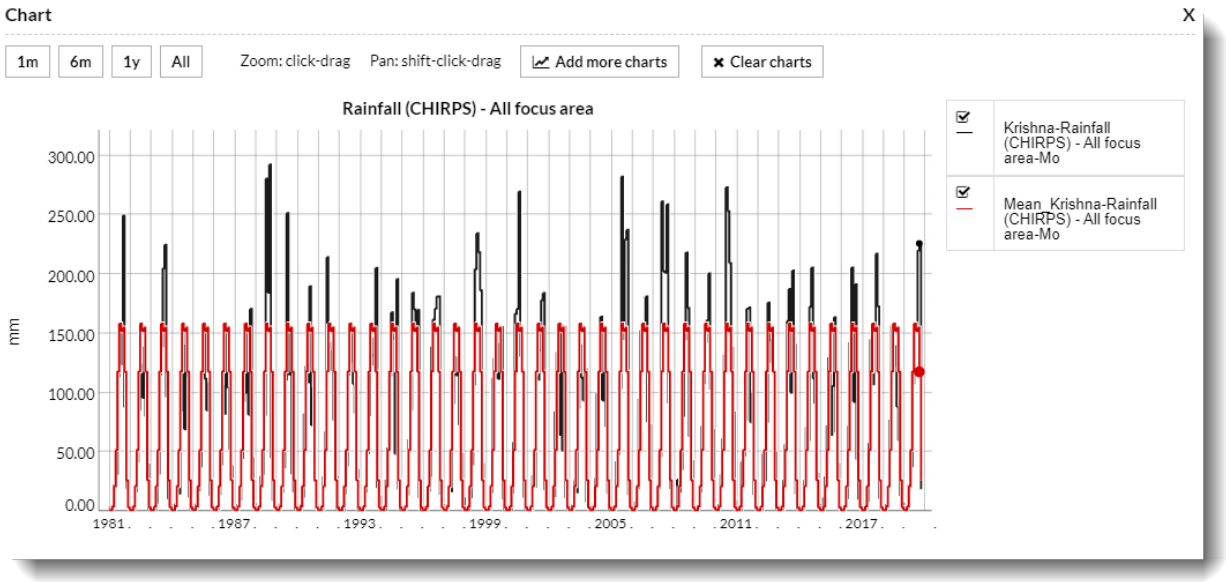
B. Time series (monthly and long-term mean)

View area weighted time series for the whole area or for selected subareas. Time series for point locations and user defined locations are available for some data types only.

This tool displays the data in a monthly temporal resolution.

- All focus Area
- Subareas
- Station

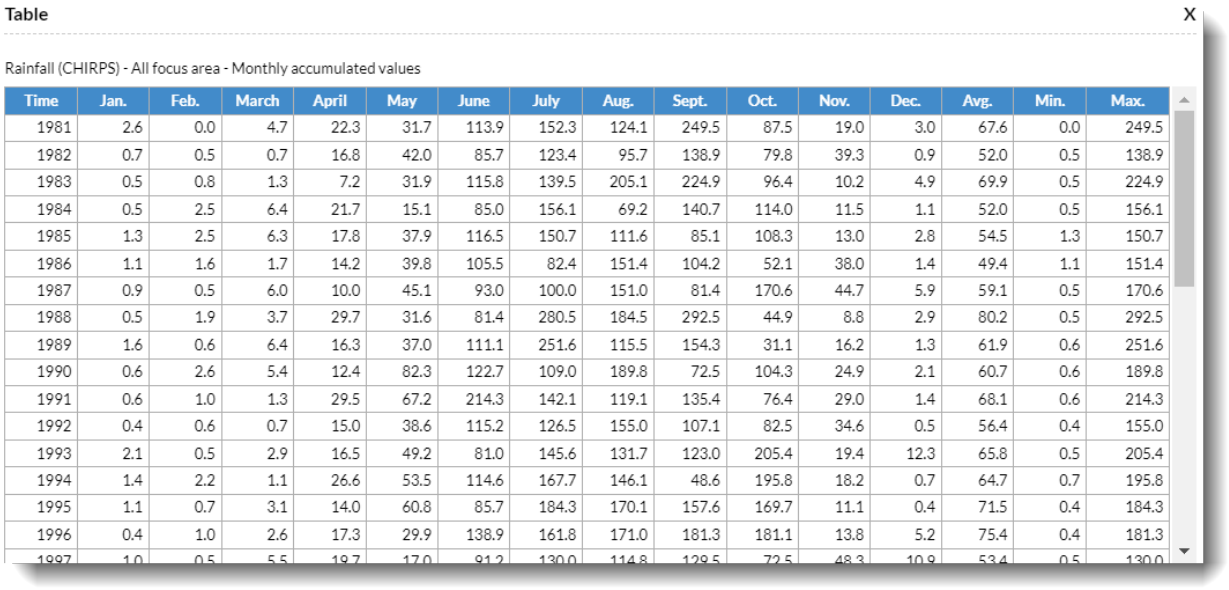
The time series data (monthly and long-term mean) for the selected extent can be either downloaded by clicking on the **[Download]** button provided or can be viewed as a graphical representation by clicking on the **[Chart]** button.



C. Table

- All focus Area
- Subareas
- Station

The tabular data for the selected extent can be either downloaded by clicking on the **[Download]** button provided or can be viewed as a tabular representation by clicking on the **[Table]** button.



Table

Rainfall (CHIRPS) - All focus area - Monthly accumulated values

Time	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Avg.	Min.	Max.
1981	2.6	0.0	4.7	22.3	31.7	113.9	152.3	124.1	249.5	87.5	19.0	3.0	67.6	0.0	249.5
1982	0.7	0.5	0.7	16.8	42.0	85.7	123.4	95.7	138.9	79.8	39.3	0.9	52.0	0.5	138.9
1983	0.5	0.8	1.3	7.2	31.9	115.8	139.5	205.1	224.9	96.4	10.2	4.9	69.9	0.5	224.9
1984	0.5	2.5	6.4	21.7	15.1	85.0	156.1	69.2	140.7	114.0	11.5	1.1	52.0	0.5	156.1
1985	1.3	2.5	6.3	17.8	37.9	116.5	150.7	111.6	85.1	108.3	13.0	2.8	54.5	1.3	150.7
1986	1.1	1.6	1.7	14.2	39.8	105.5	82.4	151.4	104.2	52.1	38.0	1.4	49.4	1.1	151.4
1987	0.9	0.5	6.0	10.0	45.1	93.0	100.0	151.0	81.4	170.6	44.7	5.9	59.1	0.5	170.6
1988	0.5	1.9	3.7	29.7	31.6	81.4	280.5	184.5	292.5	44.9	8.8	2.9	80.2	0.5	292.5
1989	1.6	0.6	6.4	16.3	37.0	111.1	251.6	115.5	154.3	31.1	16.2	1.3	61.9	0.6	251.6
1990	0.6	2.6	5.4	12.4	82.3	122.7	109.0	189.8	72.5	104.3	24.9	2.1	60.7	0.6	189.8
1991	0.6	1.0	1.3	29.5	67.2	214.3	142.1	119.1	135.4	76.4	29.0	1.4	68.1	0.6	214.3
1992	0.4	0.6	0.7	15.0	38.6	115.2	126.5	155.0	107.1	82.5	34.6	0.5	56.4	0.4	155.0
1993	2.1	0.5	2.9	16.5	49.2	81.0	145.6	131.7	123.0	205.4	19.4	12.3	65.8	0.5	205.4
1994	1.4	2.2	1.1	26.6	53.5	114.6	167.7	146.1	48.6	195.8	18.2	0.7	64.7	0.7	195.8
1995	1.1	0.7	3.1	14.0	60.8	85.7	184.3	170.1	157.6	169.7	11.1	0.4	71.5	0.4	184.3
1996	0.4	1.0	2.6	17.3	29.9	138.9	161.8	171.0	181.3	181.1	13.8	5.2	75.4	0.4	181.3
1997	1.0	0.5	5.5	19.7	17.0	91.2	130.0	114.8	129.5	72.5	48.3	10.9	53.4	0.5	130.0

D. Raster File

This tool is used to download the data file in the format of a NC file (NetCDF). The start and end date have to be specified for the data file, and then requested data is extracted and made available for download as a zip file.

The legend file (qml file) for viewing the data file in QGIS is also attached to the zip file.

- Time span (Start yyyy-mm-dd to End yyyy-mm-dd)

3.1.1.2 Rainfall (TRMM)

The Tropical Rainfall Measuring Mission (TRMM) is the first Earth Science mission dedicated to studying tropical and subtropical rainfall. It measures precipitation that falls within 35 degrees north and 35 degrees south of the equator.

Spatial resolution: 0.25 degree

Temporal resolution: resampled to daily rainfall product from 2000 to 2019

Source: http://trmm.gsfc.nasa.gov

A. Time Series

- All focus Area
- Subareas
- Station
- User Location

B. Raster File

- Time span (Start yyyy-mm-dd to End yyyy-mm-dd)

3.1.1.3 Rainfall (GPM)

The Global Precipitation Measurement (GPM) mission is an international network of satellites that provide the next-generation global observations of rain and snow. Building upon the success of the Tropical Rainfall Measuring Mission (TRMM), the GPM concept centers on the deployment of a 'Core' satellite carrying an advanced radar / radiometer system to measure precipitation from space and serve as a reference standard to unify precipitation measurements from a constellation of research and operational satellites. Through improved measurements of precipitation globally, the GPM mission is helping to advance our understanding of Earth's water and energy cycle, improve forecasting of extreme events that cause natural hazards and disasters, and extend current capabilities in using accurate and timely information of precipitation to directly benefit society. GPM, initiated by NASA and the Japan Aerospace Exploration Agency (JAXA) as a global successor to TRMM, comprises a consortium of international space agencies, including the Centre National D'Etudes Spatiales (CNES), the Indian Space Research Organization (ISRO), the National Oceanic and Atmospheric Administration (NOAA), the European Organization for the Exploitation of Meteorological Satellites (EUMETSAT), and others.

Spatial resolution: 0.1 degree

Temporal resolution: resampled to daily rainfall product from March 2014 to present

Source: https://pmm.nasa.gov/GPM

A. Time Series

- All focus Area
- Subareas
- Station
- User Location

B. Raster file

- Time span (Start yyyy-mm-dd to End yyyy-mm-dd)

3.1.1.4 Rainfall (GPM) - SPI 1 month

A one-month SPI map is very similar to a map displaying the percent of normal precipitation for a month. It is actually a more accurate representation of monthly precipitation because the distribution has been normalized.

Because the 1-month SPI reflects relatively short-term conditions, its application can be related closely with short-term soil moisture and crop stress, especially during the growing season.

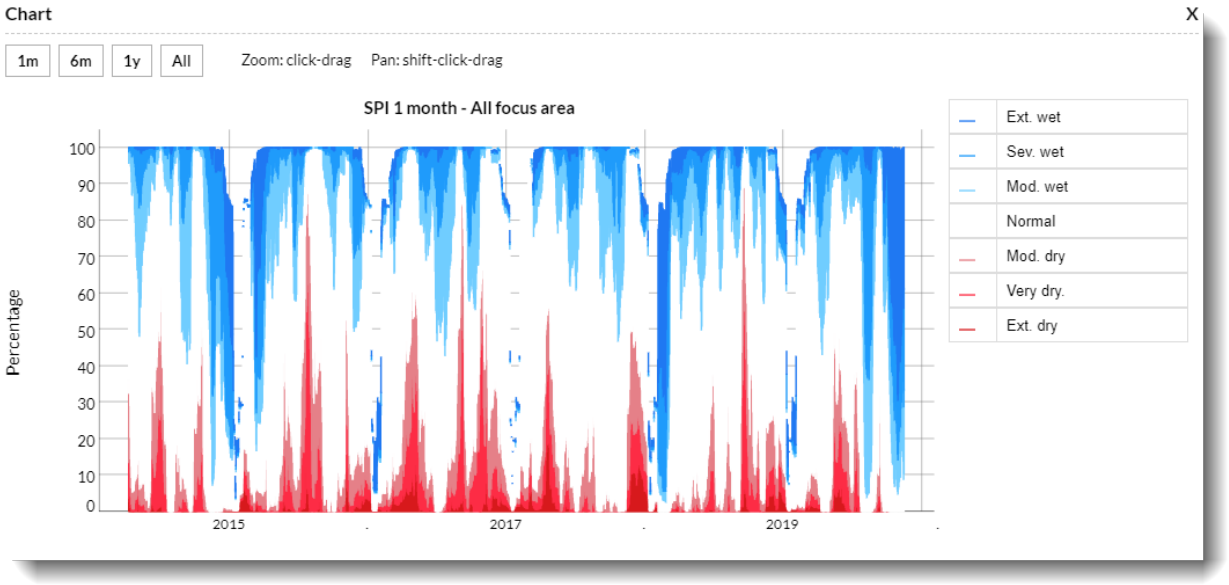
A. Time Series

- All focus Area
- Subareas
- Station
- User Location

B. Column chart

- All focus Area
- Subareas

The data for the selected extent in the columned chart format can be either downloaded by clicking on the **[Download]** button provided or can be viewed by clicking on the **[Chart]** button.



C. Raster file

- Time span (Start yyyy-mm-dd to End yyyy-mm-dd)

3.1.1.5 Rainfall (GPM) - SPI 3 month

The three-month SPI provides a comparison of the precipitation over a specific 3-month period with the precipitation totals from the same 3-month period for all the years included in the historical record. In other words, a 3-month SPI at the end of February compares the December–January–February precipitation total in that particular year with the December–February precipitation totals of all the years.

A 3-month SPI reflects short- and medium-term moisture conditions and provides a seasonal estimation of precipitation.

A. Time Series

- All focus Area
- Subareas
- Station
- User Location

B. Column chart

- All focus Area
- Subareas

C. Raster file

- Time span (Start yyyy-mm-dd to End yyyy-mm-dd)

3.1.1.6 Rainfall (GPM) - SPI 6 month

The 6-month SPI compares the precipitation for that period with the same 6-month period over the historical record. For example, a 6-month SPI at the end of September compares the precipitation total for the April–September period with all the past totals for that same period.

The 6-month SPI indicates medium-term trends in precipitation.

A. Time Series
- All focus Area
- Subareas
- Station
- User Location

B. Column chart
- All focus Area
- Subareas

C. Raster file
- Time span (Start yyyy-mm-dd to End yyyy-mm-dd)

3.1.1.7 Rainfall (IMD)

Daily Gridded Rainfall Data Set Over India. This data product is a very high spatial resolution daily gridded rainfall data (0.25 x 0.25 degree).

The unit of rainfall is in millimeter (mm). Data available for 118 years, 1901 to 2018.

Data is arranged in 135x129 grid points. The first data in the record is at 6.5N & 66.5E, the second is at 6.5N & 66.75E, and so on. The last data record corresponds to 38.5N & 100.0E.

A. Time Series
- All focus Area
- Subareas
- Station
- User Location

B. Raster file
- Time span (Start yyyy-mm-dd to End yyyy-mm-dd)

3.1.1.8 SPI 1 month

A one-month SPI map is very similar to a map displaying the percent of normal precipitation for a month. It is actually a more accurate representation of monthly precipitation because the distribution has been normalized.

Because the 1-month SPI reflects relatively short-term conditions, its application can be related closely with short-term soil moisture and crop stress, especially during the growing season.

A. Time Series
- All focus Area
- Subareas
- Station
- User Location

B. Raster file
- Time span (Start yyyy-mm-dd to End yyyy-mm-dd)

3.1.1.9 SPI 3 month

The three-month SPI provides a comparison of the precipitation over a specific 3-month period with the precipitation totals from the same 3-month period for all the years included in the historical record. In other words, a 3-month SPI at the end of February compares the December–January–February precipitation total in that particular year with the December–February precipitation totals of all the years.

A 3-month SPI reflects short- and medium-term moisture conditions and provides a seasonal estimation of precipitation.

A. Time Series

- All focus Area
- Subareas
- Station
- User Location

B. Raster file

- Time span (Start yyyy-mm-dd to End yyyy-mm-dd)

3.1.1.10SPI 6 month

The 6-month SPI compares the precipitation for that period with the same 6-month period over the historical record. For example, a 6-month SPI at the end of September compares the precipitation total for the April–September period with all the past totals for that same period.

The 6-month SPI indicates medium-term trends in precipitation.

A. Time Series

- All focus Area
- Subareas
- Station
- User Location

B. Raster file

- Time span (Start yyyy-mm-dd to End yyyy-mm-dd)

3.1.1.11CLIMWAT

Climate Hazards Group Infrared Precipitation with Station data (CHIRPS) is a 30+ year quasi-global rainfall dataset. Spanning 50°S-50°N (and all longitudes), starting in 1981 to near-present, CHIRPS incorporates 0.05° resolution satellite imagery with in-situ station data to create gridded rainfall time series for trend analysis and seasonal drought monitoring. As of February 12th, 2015, version 2.0 of CHIRPS is complete and available to the public.

Spatial resolution: 0.05 degrees

Temporal resolution: daily

Source: http://chg.geog.ucsb.edu/data/chirps/

A. Time Series

- All focus Area
- Subareas
- Station
- User Location

B. Raster file

- Time span (Start yyyy-mm-dd to End yyyy-mm-dd)

3.1.1.12CLIMWAT (ET)

Climate Hazards Group Infrared Precipitation with Station data (CHIRPS) is a 30+ year quasi-global rainfall dataset. Spanning 50°S-50°N (and all longitudes), starting in 1981 to near-present, CHIRPS incorporates 0.05° resolution satellite imagery with in-situ station data to create gridded rainfall time series for trend analysis and seasonal drought monitoring. As of February 12th, 2015, version 2.0 of CHIRPS is complete and available to the public.

Spatial resolution: 0.05 degrees

Temporal resolution: daily

Source: http://chg.geog.ucsb.edu/data/chirps/

A. Time Series
- All focus Area
- Subareas
- Station
- User Location

B. Raster file
- Time span (Start yyyy-mm-dd to End yyyy-mm-dd)

3.1.1.13CLIMWAT (MAX TEMPERATURE)

Climate Hazards Group InfraRed Precipitation with Station data (CHIRPS) is a 30+ year quasi-global rainfall dataset. Spanning 50°S-50°N (and all longitudes), starting in 1981 to near-present, CHIRPS incorporates 0.05° resolution satellite imagery with in-situ station data to create gridded rainfall time series for trend analysis and seasonal drought monitoring. As of February 12th, 2015, version 2.0 of CHIRPS is complete and available to the public.

Spatial resolution: 0.05 degrees

Temporal resolution: daily

Source: http://chg.geog.ucsb.edu/data/chirps/

A. Time Series
- All focus Area
- Subareas
- Station
- User Location

B. Raster file
- Time span (Start yyyy-mm-dd to End yyyy-mm-dd)

3.1.1.14CLIMWAT (MIN TEMPERATURE)

Climate Hazards Group Infrared Precipitation with Station data (CHIRPS) is a 30+ year quasi-global rainfall dataset. Spanning 50°S-50°N (and all longitudes), starting in 1981 to near-present, CHIRPS incorporates 0.05° resolution satellite imagery with in-situ station data to create gridded rainfall time series for trend analysis and seasonal drought monitoring. As of February 12th, 2015, version 2.0 of CHIRPS is complete and available to the public.

Spatial resolution: 0.05 degrees

Temporal resolution: daily

Source: http://chg.geog.ucsb.edu/data/chirps/

A. Time Series
- All focus Area
- Subareas
- Station
- User Location

B. Raster file
- Time span (Start yyyy-mm-dd to End yyyy-mm-dd)

3.1.1.15CLIMWAT (PRECIPITATION)

Climate Hazards Group Infrared Precipitation with Station data (CHIRPS) is a 30+ year quasi-global rainfall dataset. Spanning 50°S-50°N (and all longitudes), starting in 1981 to near-present, CHIRPS incorporates 0.05° resolution

satellite imagery with in-situ station data to create gridded rainfall time series for trend analysis and seasonal drought monitoring. As of February 12th, 2015, version 2.0 of CHIRPS is complete and available to the public.

Spatial resolution: 0.05 degrees

Temporal resolution: daily

Source: http://chg.geog.ucsb.edu/data/chirps/

A. Time Series
- All focus Area
- Subareas
- Station
- User Location

B. Raster file
- Time span (Start yyyy-mm-dd to End yyyy-mm-dd)

3.1.1.16CLIMWAT (RELATIVE HUMIDITY)

Climate Hazards Group InfraRed Precipitation with Station data (CHIRPS) is a 30+ year quasi-global rainfall dataset. Spanning 50°S-50°N (and all longitudes), starting in 1981 to near-present, CHIRPS incorporates 0.05° resolution satellite imagery with in-situ station data to create gridded rainfall time series for trend analysis and seasonal drought monitoring. As of February 12th, 2015, version 2.0 of CHIRPS is complete and available to the public.

Spatial resolution: 0.05 degrees

Temporal resolution: daily

Source: http://chg.geog.ucsb.edu/data/chirps/

A. Time Series
- All focus Area
- Subareas
- Station
- User Location

B. Raster file
- Time span (Start yyyy-mm-dd to End yyyy-mm-dd)

3.1.1.17CLIMWAT (SOLAR RADIATION)

Climate Hazards Group InfraRed Precipitation with Station data (CHIRPS) is a 30+ year quasi-global rainfall dataset. Spanning 50°S-50°N (and all longitudes), starting in 1981 to near-present, CHIRPS incorporates 0.05° resolution satellite imagery with in-situ station data to create gridded rainfall time series for trend analysis and seasonal drought monitoring. As of February 12th, 2015, version 2.0 of CHIRPS is complete and available to the public.

Spatial resolution: 0.05 degrees

Temporal resolution: daily

Source: http://chg.geog.ucsb.edu/data/chirps/

A. Time Series
- All focus Area
- Subareas
- Station
- User Location

B. Raster file

- Time span (Start yyyy-mm-dd to End yyyy-mm-dd)

3.1.1.18CLIMWAT (SUNSHINE HOURS)

Climate Hazards Group InfraRed Precipitation with Station data (CHIRPS) is a 30+ year quasi-global rainfall dataset. Spanning 50°S-50°N (and all longitudes), starting in 1981 to near-present, CHIRPS incorporates 0.05° resolution satellite imagery with in-situ station data to create gridded rainfall time series for trend analysis and seasonal drought monitoring. As of February 12th, 2015, version 2.0 of CHIRPS is complete and available to the public.

Spatial resolution: 0.05 degrees

Temporal resolution: daily

Source: http://chg.geog.ucsb.edu/data/chirps/

A. Time Series

- All focus Area
- Subareas
- Station
- User Location

B. Raster file

- Time span (Start yyyy-mm-dd to End yyyy-mm-dd)

3.1.1.16CLIMWAT (WIND SPEED)

Climate Hazards Group InfraRed Precipitation with Station data (CHIRPS) is a 30+ year quasi-global rainfall dataset. Spanning 50°S-50°N (and all longitudes), starting in 1981 to near-present, CHIRPS incorporates 0.05° resolution satellite imagery with in-situ station data to create gridded rainfall time series for trend analysis and seasonal drought monitoring. As of February 12th, 2015, version 2.0 of CHIRPS is complete and available to the public.

Spatial resolution: 0.05 degrees

Temporal resolution: daily

Source: http://chg.geog.ucsb.edu/data/chirps/

A. Time Series

- All focus Area
- Subareas
- Station
- User Location

B. Raster file

- Time span (Start yyyy-mm-dd to End yyyy-mm-dd)

3.1.1.17GFS025 (Medium Range Rainfall Forecast)

GFS 0.25 degree 16 day deterministic forecast.

NCEP Global Forecast System Model, previously called AVN/MRF (Medium Range Forecast). Forecasts grids starting from the 0 hour forecast every 3 hours out to 10 days, then 12 hour forecasts for days 10-16.

Coverage: Global, Longitude: 0.0 to 360.0 Resolution=0.25 degrees east, Latitude: -90.0 to 90.0 Resolution=-0.25 degrees north.

See: http://www.nco.ncep.noaa.gov/pmb/products/gfs/

A. Time Series

- All focus Area
- Subareas
- Station
- User Location

B. Raster file

- Time span (Start yyyy-mm-dd to End yyyy-mm-dd)

3.1.1.18NDVI (5600 m) (Vegetation)

The Normalized difference vegetation index (NDVI) is a MODIS vegetation index produced on 16-day intervals and at multiple spatial resolutions. It provides consistent spatial and temporal comparisons of vegetation canopy greenness, a composite property of leaf area, chlorophyll and canopy structure.

Spatial resolution: 5600 m

Temporal resolution: 16 days composite

Satellite: MODIS (Terra), Data from 2000 – present, Global coverage

Source: http://modis.gsfc.nasa.gov/data/dataprod/mod13.php

A. Time Series

- All focus Area
- Subareas
- Station
- User Location

B. Raster file

- Time span (Start yyyy-mm-dd to End yyyy-mm-dd)

3.1.1.19NDVI deviation (5600 m)

The NDVI deviation is used as a drought index and describes the deviation from the long term mean. The values are transformed into drought categories related to the values of the deviation.

This product is normalized by the long term mean and expresses the deviation in relation to the mean NDVI value.

NDVI deviation is used to express changes in the vegetation and location of areas where the vegetation potentially might be impacted by drought.

The Normalized difference vegetation index (NDVI) is a MODIS vegetation index produced on 16-day intervals and at multiple spatial resolutions. It provides consistent spatial and temporal comparisons of vegetation canopy greenness, a composite property of leaf area, chlorophyll and canopy structure.

Spatial resolution: 5600 m

Temporal resolution: 16 days composite

Satellite: MODIS (Terra), Data from 2000 – present, Global coverage

Source: http://modis.gsfc.nasa.gov/data/dataprod/mod13.php

- Issue with loading data.

3.1.1.20Vegetation Condition Index (VCI)

The Vegetation Condition Index (VCI) compares the current NDVI to the range of values observed in the same period in previous years. The VCI is expressed in % and gives an idea where the observed value is situated between

the extreme values (minimum and maximum) in the previous years. Lower and higher values indicate bad and good vegetation state conditions, respectively.

$$VCI\ (\%) = 100 \times \frac{NDVI - NDVI_{min}}{NDVI_{max} - NDVI_{min}}$$

The Normalized difference vegetation index (NDVI) is a MODIS vegetation index produced on 16-day intervals and at multiple spatial resolutions. It provides consistent spatial and temporal comparisons of vegetation canopy greenness, a composite property of leaf area, chlorophyll and canopy structure.

Spatial resolution: 5600 m

Temporal resolution: 16 days composite

Satellite: MODIS (Terra), Data from 2000 – present, Global coverage

Source: http://modis.gsfc.nasa.gov/data/dataprod/mod13.php

A. Time Series
- All focus Area
- Subareas
- Station
- User Location

B. Column Chart
- All Focus Area
- Subareas

C. Raster File
- Time span (Start yyyy-mm-dd to End yyyy-mm-dd)

3.1.1.21SWI Soil Water Index (SWI)

The Soil Water index (SWI) product of the Copernicus Global Land service provides global daily information about moisture conditions in different soil depths. It is cloud insensitive.

Spatial: 0.1 degree, Temporal: 10-daily

Satellite: METOP-ASCAT satellite, Data from 2007 – present, Global coverage

Source: http://land.copernicus.eu/global/products/swi

A. Time Series
- All focus Area
- Subareas
- Station
- User Location

B. Raster file
- Time span (Start yyyy-mm-dd to End yyyy-mm-dd)

3.1.1.22SWI percentile

SWI percentile is calculated as the percentile value in the same period for each year of the entire record. A drought or water scarcity is often defined when the soil moisture percentile drops below 30 or 20 %.

- Issue with loading data

3.1.1.23SWI percentile change (10-day)

10-day change of the SWI percentile value.

Change in soil moisture percentile is used to evaluate the trend over a given period and locate areas where the soil moisture is increasing or decreasing. Positive values indicate an increase in soil moisture across the period while negative values indicate a decrease in soil moisture across the period.

- Issue with loading data

3.1.1.24SWI percentile change (20-day)

20-day change of the SWI percentile value.

Change in soil moisture percentile is used to evaluate the trend over a given period and locate areas where the soil moisture is increasing or decreasing. Positive values indicate an increase in soil moisture across the period while negative values indicate a decrease in soil moisture across the period.

- Issue with loading data

3.1.1.25SWI percentile change (30-day)

30-day change of the SWI percentile value.

Change in soil moisture percentile is used to evaluate the trend over a given period and locate areas where the soil moisture is increasing or decreasing. Positive values indicate an increase in soil moisture across the period while negative values indicate a decrease in soil moisture across the period.

- Issue with loading data

3.1.1.26Evapotranspiration – PET (10mm/8day)

MOD16 Global Terrestrial Evapotranspiration Data Set

This project is part of NASA/EOS project to estimate global terrestrial evapotranspiration from earth land surface by using satellite remote sensing data. With long-term ET data, the effects of changes in climate, land use, and ecosystems disturbances (e.g. wildfires and insect outbreaks) on regional water resources and land surface energy change can be quantified.

The MOD16 ET datasets are estimated using Mu et al.'s improved ET algorithm (2011) over previous Mu et al.'s paper (2007a). The ET algorithm is based on the Penman-Monteith equation (Monteith, 1965).

Unit: The users should multiply 0.1 to get the real ET/PET values in mm/8day

Spatial resolution: 5000 m (original 1000 m)

Temporal resolution: 8 days

Satellite: MODIS (Terra), Data from 2000 – 2014, Global coverage

Source: http://www.ntsg.umt.edu/project/mod16

A. Time Series

- All focus Area
- Subareas
- Station
- User Location

B. Table

- All focus Area
- Subareas
- Station

C. Raster file

- Time span (Start yyyy-mm-dd to End yyyy-mm-dd)

3.1.1.27Evapotranspiration - ET (0.1mm/8day)

MOD16 Global Terrestrial Evapotranspiration Data Set

This project is part of NASA/EOS project to estimate global terrestrial evapotranspiration from earth land surface by using satellite remote sensing data. With long-term ET data, the effects of changes in climate, land use, and ecosystems disturbances (e.g. wildfires and insect outbreaks) on regional water resources and land surface energy change can be quantified.

The MOD16 ET datasets are estimated using Mu et al.'s improved ET algorithm (2011) over previous Mu et al.'s paper (2007a). The ET algorithm is based on the Penman-Monteith equation (Monteith, 1965).

Unit: The users should multiply 0.1 to get the real ET/PET values in mm/8day

Spatial resolution: 5000 m (original 1000 m)

Temporal resolution: 8 days

Satellite: MODIS (Terra), Data from 2000 – 2014, Global coverage

Source: http://www.ntsg.umt.edu/project/mod16

A. Time Series

- All focus Area
- Subareas
- Station
- User Location

B. Table

- All focus Area
- Subareas
- Station

C. Raster file

- Time span (Start yyyy-mm-dd to End yyyy-mm-dd)

3.1.1.28Evapotranspiration - PET (10mm/8day)

MOD16 Global Terrestrial Evapotranspiration Data Set

This project is part of NASA/EOS project to estimate global terrestrial evapotranspiration from earth land surface by using satellite remote sensing data. With long-term ET data, the effects of changes in climate, land use, and ecosystems disturbances (e.g. wildfires and insect outbreaks) on regional water resources and land surface energy change can be quantified.

The MOD16 ET datasets are estimated using Mu et al.'s improved ET algorithm (2011) over previous Mu et al.'s paper (2007a). The ET algorithm is based on the Penman-Monteith equation (Monteith, 1965).

Unit: The users should multiply 0.1 to get the real ET/PET values in mm/8day

Spatial resolution: 5000 m (original 1000 m)

Temporal resolution: 8 days

Satellite: MODIS (Terra), Data from 2000 – 2014, Global coverage

Source: http://www.ntsg.umt.edu/project/mod16

A. Issue with loading data

3.1.1.29Temperature

Daytime land surface temperature based on the 1 km MOD11A1 product. The product is resampled to a 5 km resolution with an 8-day temporal resolution.

Spatial: 5 km, Temporal: 8 daily

Satellite: MODIS (MOD11C2) satellite, Data from 2000 – present, Global coverage

Source: https://ladsweb.modaps.eosdis.nasa.gov/missions-and-measurements/products/land-surface-temperature-and-emissivity/MOD11C2/

A. Time Series
- All focus Area
- Subareas
- Station
- User Location

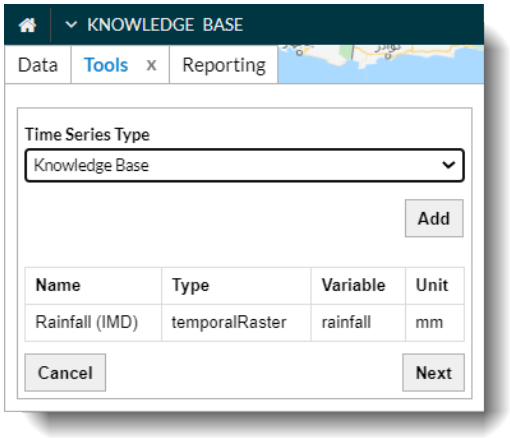
B. Table
- All focus Area
- Subareas
- Station

C. Raster file
- Time span (Start yyyy-mm-dd to End yyyy-mm-dd)

3.1.2 Tools Section.

The Tools section of the Knowledge Base module consist of a collection of different tools which can be used on the data as specified in the previous section to perform various operations.
To execute an operation using a particular tool, the user needs to perform a three-step process as follows:

1. Selecting the data
   In this section the user has to select the data on which a particular tool will act. The data can be selected either from the collection of data available in the Knowledge Base or can be specified by the user itself.

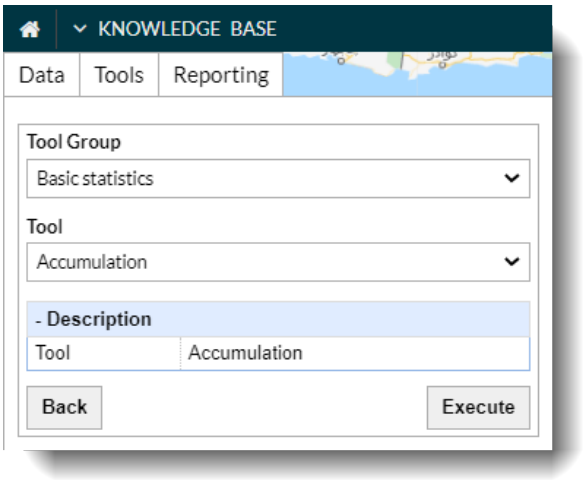


a. Time Series Type
   This dropdown allows user to select the data, either from the Knowledge Base or User Defined.

b. ADD
   On clicking the [**ADD]** button, a dialog box consisting of all the data available in the Knowledge Base module or that defined by the user will appear. The user, as per required, can select the data and clicking on [**OK]** will add the data to the module.

Clicking on the [**NEXT]** button will take the user to next section of the tool panel.

2. Selecting Tool Group and Tool
   This section of the panel is the most important part of the Tools section, this section of the panel allows the user to select the required tool from the collection of different tool group and thus execute the command.



a. Tool Group
   This dropdown allows the user to select the Tool Group under which various tools have been specified. The section consists of the following different tool groups:
   i. Basic statistic
   ii. Extreme value extraction
   iii. Time series processing
   iv. Import tools

v. Advanced statistics
vi. QA-QC
vii. Probability distribution
viii. Downscaling
ix. Ensemble
x. Weather generators
xi. Obsolete tools
xii. Data tools
xiii. Query tools
xiv. Output tools

b. Tool
Depending upon the selected tool group, this dropdown consists of combination of the tools available in the module. As per the selected Tool Group the tools available in this dropdown vary respectively.

c. Description
The description of the tool selected is specified here. This part of the panel also varies according to the tool selected.

Clicking on the **[Execute]** button will execute the command with the selected tool and takes the user to the last or the result section of the panel.

3. Results
This section of the panel shows the result after successful execution of the tool.

3.1.2.1 Tool Group

As discussed in the above sections, the Tool Group dropdown comprises of different groups of tools under which, each group consist of different tools.

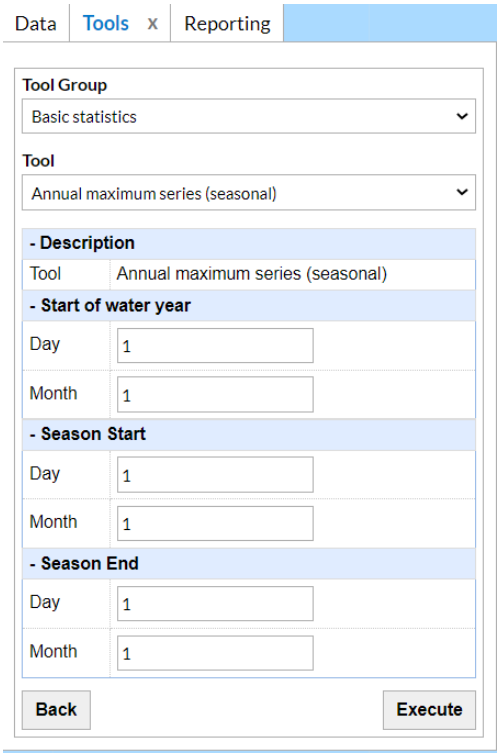
Different tool groups and the tools they comprise are explained below:

3.1.2.1.1 Basic Statistics

- Accumulation
- **Description:**
  This tool calculates the accumulation of all values in a time series. Note this is not the same as summing the values. For rates and instantaneous values, accumulation is calculated by multiplying the values by the time period they are applicable.
- **Input Items**
  One or more timeseries.
- **Output Items**
  Returns a list for each input timeseries or a table with a row for each input timeseries.

- Annual Maximum Series
- **Description:**
  In the annual maximum series (AMS) method the maximum value in each year of the record are extracted for the extreme value analysis.

- **Input Items**
  The tool requires at least one time series to be selected.
- **Tool Properties**
  The tool properties are listed below. Select a property in the property control to get a description.



- **Output Items**
  The tool one time series containing annual maximum values for each input time series.

Average

- **Description**
  The Average tool is used to calculate the simple mean and/or time weighted average of one or more time series.
- **Input Items**
  One or more time series.
- **Tool Properties**
- **Output Items**
  A table containing two columns i.e. value and unit and one row.

Count

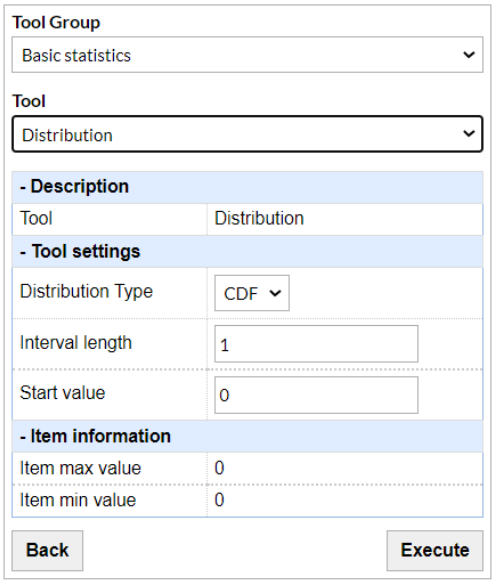
- **Description**
  The Count tool returns the number of time steps that contains values in a time series.
- **Input Items**
  One or more time series.
- **Output Items**
  A table containing one column (Count) and one row for each input items.

Count per year (average)

- **Description**
  The Count per year (average) tool returns the average number of time steps per year that contains values.
- **Input items**
  One or more time series.
- **Output items**
  A table containing one column (Count per year) and one row for each input items.

Distribution

- **Description**
  A distribution curve relates the magnitude of an observed variable to its frequency of occurrence. Integrating the distribution curve between two values yields the probability, P, of a given value, X, being inside that interval. This tool plots the probability distribution of the values in a time series. The time axis of the input time series is not taken into consideration.
- **Input Items**
  The Distribution tool requires at least one time series to be selected.
- **Tool Properties**
  The tool properties are listed below. Select a property in the property control to get a description.



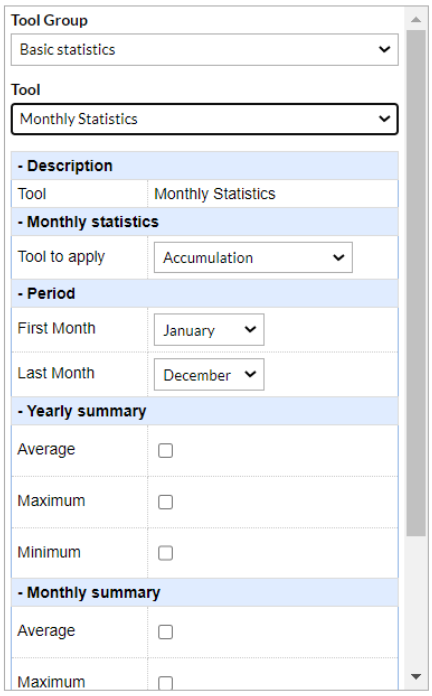
- **Output Items**
  One distribution will be produced for each input time series.

Maximum

- **Description**
  The Maximum tool is used to get the maximum value of one or more time series.
- **Input Items**
  One or more time series.

- **Output Items**
  A table containing two columns:
  a. maximum value
  b. Unit
  and one row for each input item.

- Minimum
  - **Description**
    The Minimum tool is used to get the minimum value of one or more time series.
  - **Input Items**
    One or more time series.
  - **Output Items**
    A table containing two columns:
    a. minimum value
    b. Unit
    and one row for each
- Monthly Statistics
  - **Description**
    This tool calculates statistics for each specified month. This can be a single month or a range of months. For a timeseries containing several years, a calculation is made for each month in each year. In addition to the chosen statistic, it is possible to get monthly and yearly mean, maximum, and minimum. Note that these values are also based on the chosen time series.
  - **Input Items**
    One or more time series.
  - **Tool Properties**
    The tool properties are listed below. Select a property in the property control to get a description.



- **Output Items**
  One table or list for each input time series.

- Ordinary Moments
  - **Description**
    The Ordinary moments tool calculates the ordinary moments of one or more time series.
    The ordinary moments are:

a. Mean
b. Variance
c. Skewness
d. Kurtosis

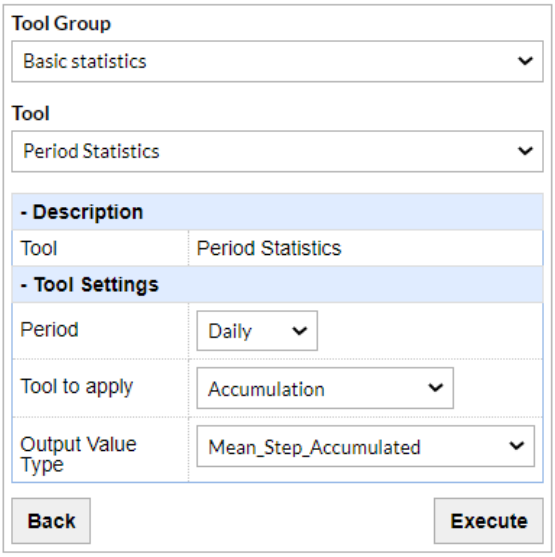
  - **Input Items**
    One or more time series.
  - **Output Items**
    A table containing five columns:

a. Name of input time series
b. Mean
c. Variance
d. Skewness
e. Kurtosis

And one row for each input item.

- Period Statistics
  - **Description**
    This tool calculates statistics for a specified period (daily, monthly etc.)
  - **Input Items**
    One or more time series.

- **Tool Properties**
  The tool properties are listed below. Select a property in the property control to get a description.



- **Output Items**
  A list for each output item or a chart or table containing a graph/column for each input timeseries.

- Standard Deviation
  - **Description**
    The Standard deviation tool calculates the standard deviation of one or more time series
  - **Input Items**
    The tool has one or more time series.
  - **Output Items**
    A table containing two columns:

  a. Standard deviation
  b. Unit

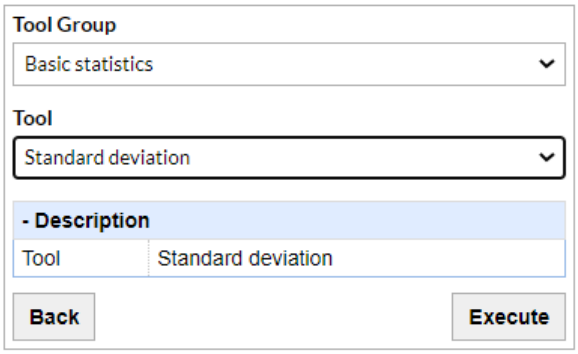
  and one row for each input item.

- Sum
  - **Description**
    This tool calculates the sum of all the values in a timeseries.
  - **Input Items**
    One or more timeseries.
  - **Output Items**
    A list for each input item or a table with a row for each input item.

3.1.2.1.2 Extreme value extraction

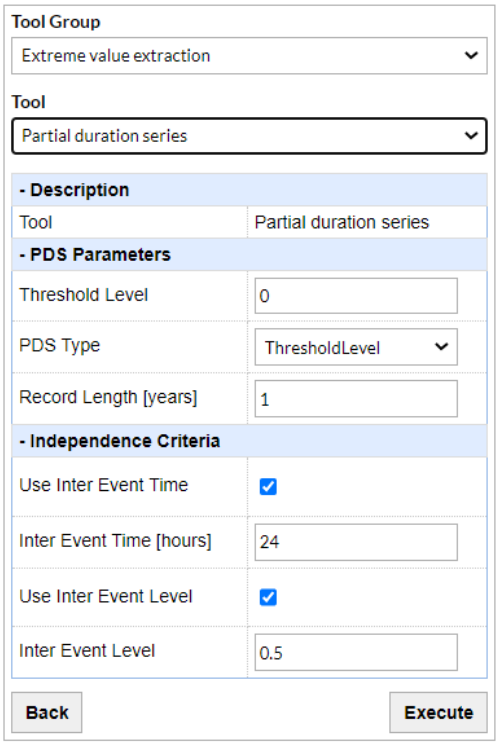
- Annual Maximum
- **Description**
  This tool extracts the annual maximum. The start of the year can be set to any day and month.

- **Input Items**
  One or more timeseries. The timeseries must cover at least one full hydrological year.
- **Tool Properties**
  The tool properties are listed below. Select a property in the property control to get a description.



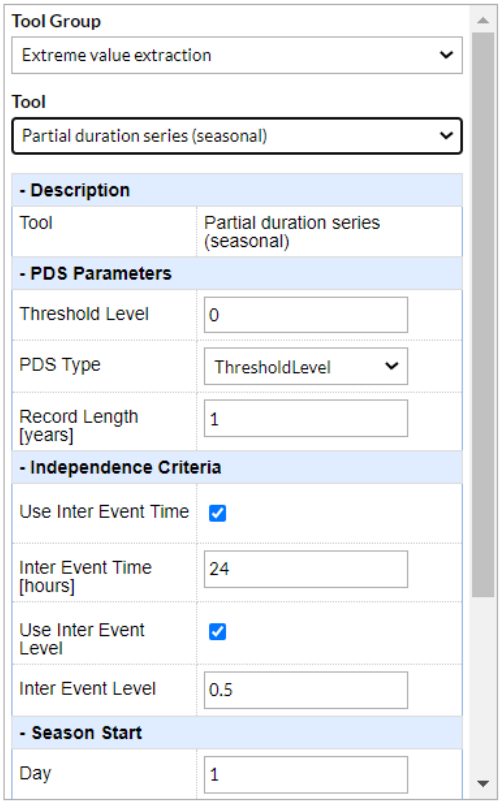
- **Output Items**
  A list or timeseries for each input item or a chart with output for both input items.

- Partial Duration Series
- **Description**
  This tool is used to extract extreme events from a time series
- **Input Items**
  One or more timeseries.
- **Tool Properties**
  The tool properties are listed below. Select a property in the property control to get a description.



- **Output Items**
  A list or time series for each input item or a chart with a graph for each input item.

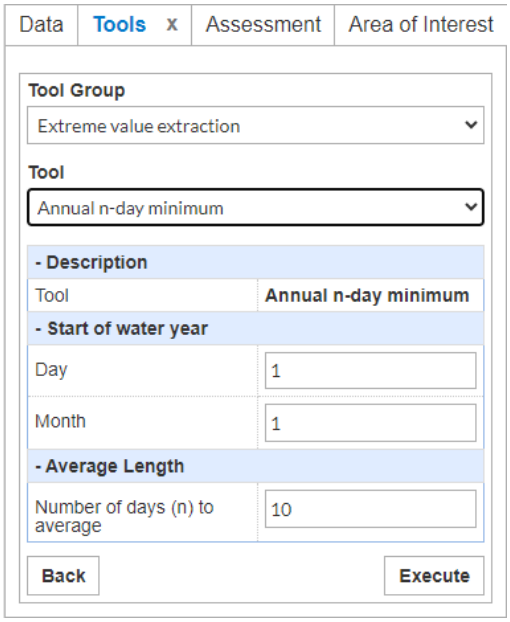
- Partial Duration Series (Seasonal)
- **Description**
  This tool is used to extract extreme events from a time series on a seasonal basis.
- **Input Items**
  One or more timeseries.
- **Tool Properties**
  The tool properties are listed below. Select a property in the property control to get a description.



- **Output Items**
  A list or time series for each input item or a chart with a graph for each input item.

- Annual n-day minimum
- **Description**
  This tool extracts the average annual minimum n-day time series.
- **Input Items**
  One or more time series

- **Tool Properties**



3.1.2.1.3 Time Series Processing

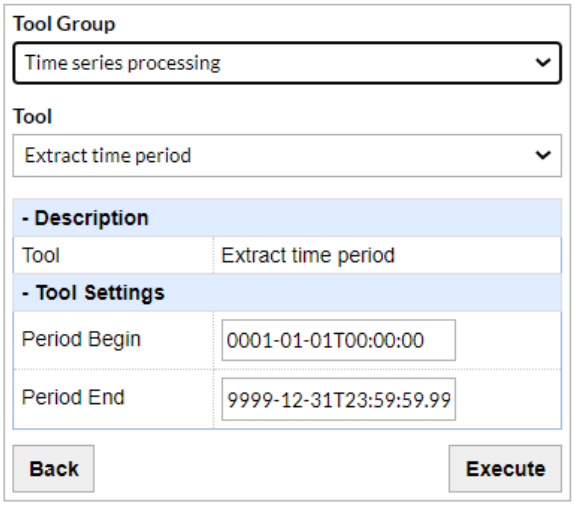
- Extract time period
- **Description**

  Extracts a specified period from the input time series. This is done at the exact start and end dates, implying that if a time series does not have a time step at the start/end times, it will be added.

  The tool returns the extracted time series. Notice that the input time series will not be modified.
- **Input Items**

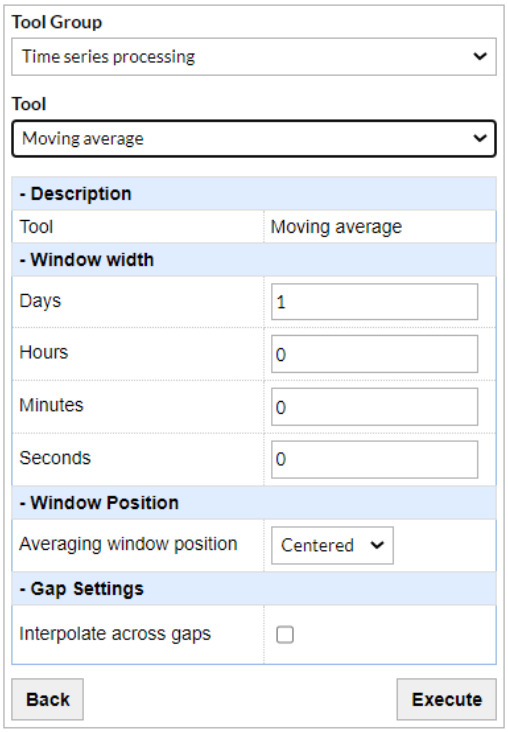
  The Extract period tool requires at least one time series to be selected
- **Tool Properties**

  The tool properties are listed below. Select a property in the property control to get a description.



- **Output Items**
  One time series will produced for each input time series.

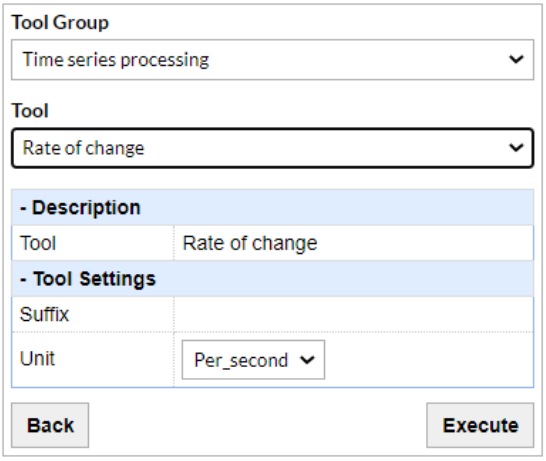
- Moving average
- **Description**
  This tool adds calculates the moving average for a user specified window width.
- **Input Items**
  The tool requires at least one time series to be selected.
- **Tool Properties**
  The tool properties are listed below. Select a property in the property control to get a description.



- **Output Items**
  One time series will produced for each input time series.

- Rate of change
- **Description**
  This tool computes the rate of change over a given time step (second, minute, hour, or day).
- **Input Items**
  One or more timeseries.

- **Tool Properties**
  The tool properties are listed below. Select a property in the property control to get a description.



- **Output Items**
  A time series or list for each input time series or a chart with a graph for each input time series.

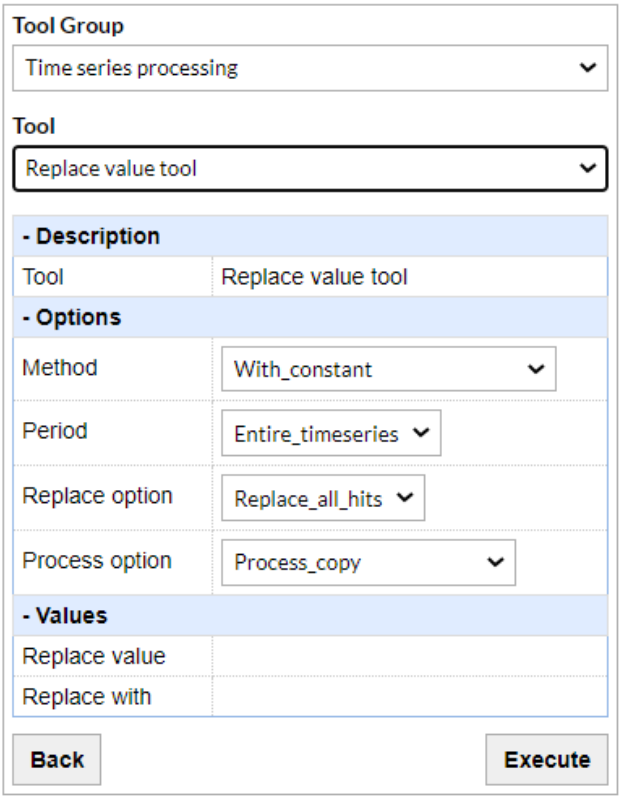
- Replace value tool

- **Description**
  The Replace values tool can be used to replace any given value ("Replace value") or range of values in a time series by a new value ("Replace with") (e.g. the user can specify that all values = 5 shall be replaced with the value 2.5).
  The tool accepts one or more time series as input. For each time series there will be produced one output time series. The name of the output time series shall be the same as the name of the input time series. The following methods are available:

a. With_constant – If this option is used, the specified Replace value shall be replaced with a user specified constant value (see "Replace with" property).
b. Replace_range_with_constant – If this option is used the user can specify a range. All values that falls within the specified range will be replaced by a constant. The specified range may be open.
c. Last_value_before – If this option is used, the last different value before the Replace value shall be inserted.
d. First_value_after – If this option is used, the specified Replace value shall be replaced by the first different value in the following time step.
e. Interpolation – If this option is selected, the Replace value shall be calculated by linear interpolation between the last and first different value before and after.
f. Limit rate of change – If this option is selected, the rate of change between two time steps shall be limited to a user specified value (+ unit: /s, /min, /hour, /day). If the max rate of change is exceeded, the value of the time step shall be adjusted such that the rate is no longer exceeded.
g. Remove_from_max_gap – If this option is selected, the time steps in a gap will be removed if the specified max gap is exceeded.

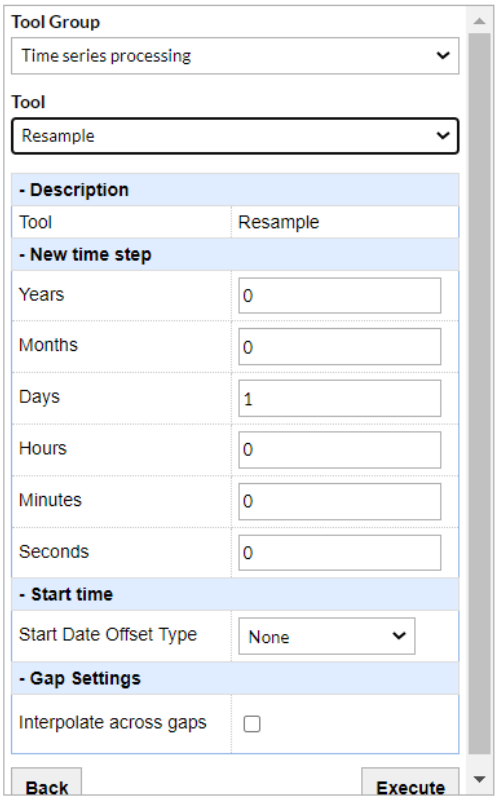
A Replace option determines if the tool should stop after changing the first value, or continue for the entire time series, or a specified period.

- **Input Items**
  The tool will accept one or more time series as input.
- **Tool Properties**
  The visible properties for the tool varies with the chosen Replace option. An example for the Replace_range_with_constant option is shown below. Select a property in the grid to get a description.



- **Output Items**
  For each input time series there will be produced one output time series. The name of the output time series will be the same as the name of the input time series.

- Resample
- **Description**
  The resample tool is used to change the time step of a time series into a user specified time step. It is possible to resample into larger and smaller time steps.
- **Input Items**
  The use of the resample tool requires that at least one time series has been selected. If more than one time series are selected, the same user specified options will be applied to all the selected time series.
- **Tool Properties**
  The tool properties are listed below. Select a property in the property control to get a description.

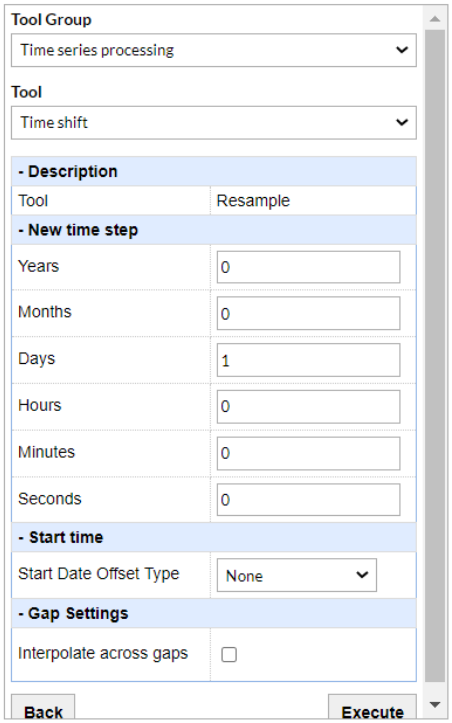


- **Output Items**
  One resampled time series for each input time series.

- Synchronize
- **Description**
  The Synchronize tool is used to resample a set of time series into a common time axis. The new common time axis is defined by combining the axes of all input time series. One synchronized time series will be produced for each time series.
- **Input Items**
  The Synchronize tool requires at least two time series to be selected.
- **Tool Properties**
  The tool properties are listed below. Select a property in the property control to get a description.
- **Output Items**
  One synchronized time series will be produced for each input time series.

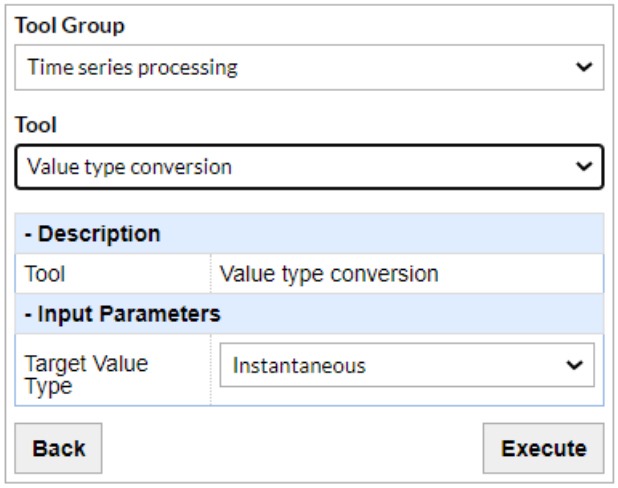
- Time shift
- **Description**
  This tool can be used to shift the values of a time series. The values can be shifted with a fixed value, or the time can be shifted with a fixed number of hours, minutes, and/or seconds.
- **Input Items**
  One or more time series.
- **Tool Properties**

The tool properties are listed below. Select a property in the property control to get a description.



- **Output Items**
  A time series or list for each input time series or a chart with a graph for each time series. Note that the time series are not saved automatically, but there is an option to overwrite the original time series.

- Value type conversion
- **Description**
  This tool converts the value type in the time series, e.g. instantaneous to step accumulated.
- **Input Items**
  One or more time series. They do not need to have the same original value type
- **Tool Properties**
  The tool properties are listed below. Select a property in the property control to get a description.

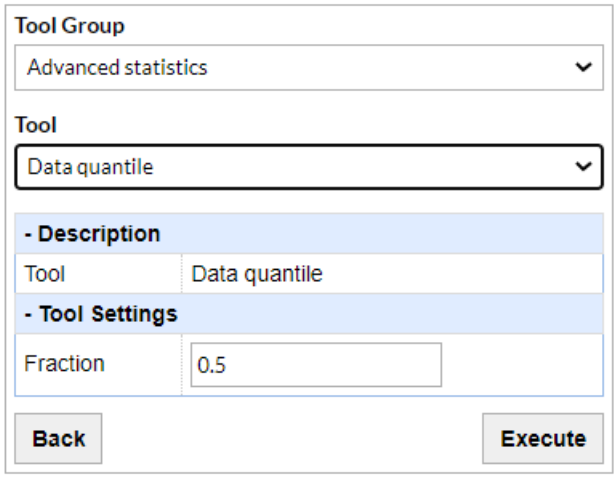


- **Output Items**
  A list or time series for each input time series or a chart with a graph for each time series, with the chosen target value type. Note that the time series are not automatically saved and that the original time series is not overwritten.

3.1.2.1.4 Advanced Statistics

- Auto-correlation
- **Description**
  This tool calculates the auto-correlation value of a time series.
- **Input Items**
  A single time series.
- **Output Items**
  The tool has a time series output.

- Data quantile
- **Description**
  The Data quantile tool calculates the data quantile. The data quantile is the value that a specified fraction of all raw data are less than.
  For a fraction of 0.5 the data quantile equals the median.
- **Input Items**
  One or more timeseries
- **Tool Properties**
  The tool properties are listed below. Select a property in the property control to get a description.



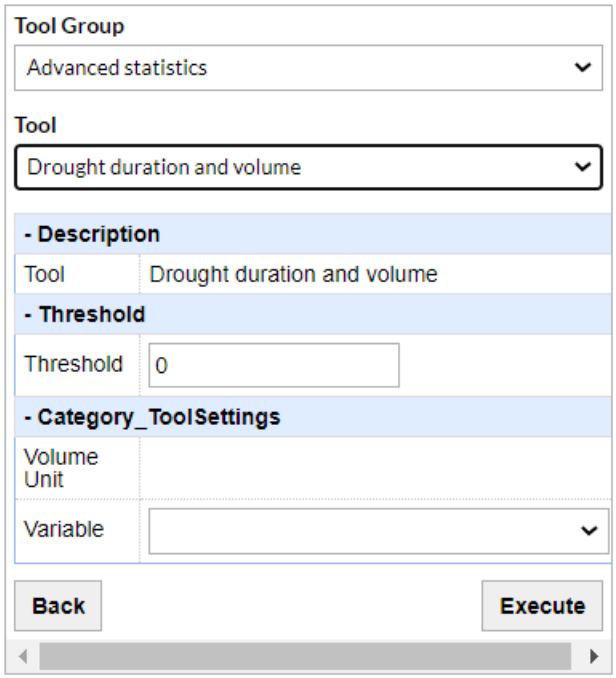
- **Output Items**
  A table containing two columns:

a. Standard deviation.

b. unit

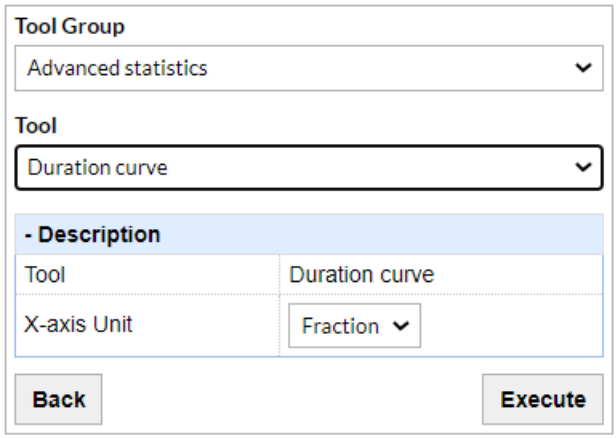
and one row for each input item.

- Draught duration and volume
- **Description**
  Drought duration and volume tool
- **Input Items**
  A single time series.
- **Tool Properties**
  The tool properties are listed below. Select a property in the property control to get a description.



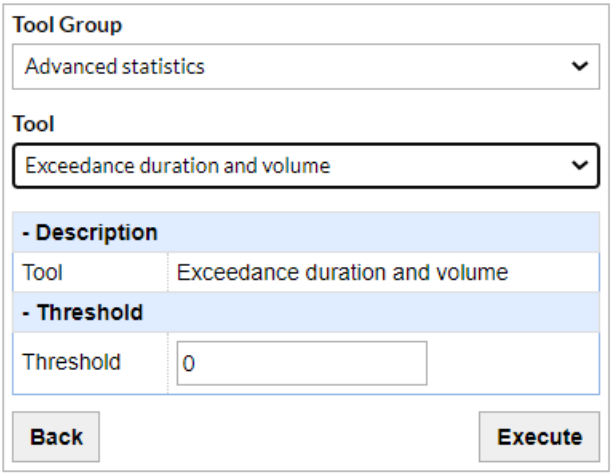
- **Output Items**
  One or more time series.

- Duration curve
- **Description**
  A duration curve is based on the calculated exceedance probability for the range of values found in the time series being analyzed.
  A duration curve shows the range of data values found in the time series as a function of the exceedance probability.
  An exceedance probability of zero means that the value is exceeded at all times and a value of one indicates that the value is not exceeded in the time span covered by the time series.
- **Input Items**
  The Duration curve tool requires at least one time series to be selected.
- **Tool Properties**
  The tool properties are listed below. Select a property in the property control to get a description.



- **Output Items**
  One duration curve will be produced for each input time series.

- Exceedance duration and volume
- **Description**
  Exceedance duration and volume
- **Input Items**
  The tool requires at least one time series to be selected.
- **Tool Properties**
  The tool properties are listed below. Select a property in the property control to get a description.



- **Output Items**
  One ordinary time series will be returned for each input time series.

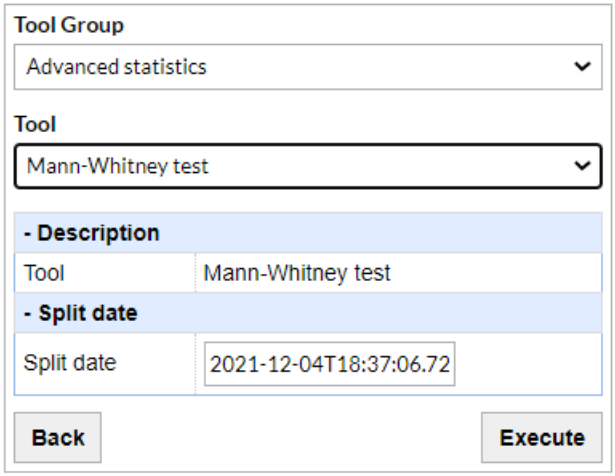
- L-Moments
- **Description**
  L-moments are statistics used to summarize the shape of a probability distribution. They are analogous to ordinary moments in that they can be used to calculate quantities analogous to standard deviation, skewness and kurtosis, termed the L-scale, L-skewness and L-kurtosis respectively (the L-mean is identical to the conventional mean).
  L-moments differ from conventional moments in that they are calculated using linear combinations of the ordered data; the "l" in "linear" is what leads to the name being "L-moments". Just as for conventional moments, a theoretical distribution has a set of population L-moments.
- **Input Items**
  One or more time series
- **Output Items**
  A table containing five columns:

a. Name of input time series.
b. L1
c. L2
d. L_Skewness
e. L_Kurtosis

and one row for each input item.

- Mann-Kendall test
- **Description**
  The Mann-Kendall test is used for testing monotonic trend of a time series.
- **Input Items**
  The tool requires at least one time series to be selected.
- **Output Items**
  The tool returns the test statistics and significance level for each input time series.

- Mann-Whitney test
- **Description**
  The Mann-Whitney test is used for testing shift in the mean between two sub-samples defined from a time series.
- **Input Items**
  The tool requires at least one time series to be selected
- **Tool Properties**
  The tool properties are listed below. Select a property in the property control to get a description



- **Output Items**
  The tool returns the test statistics and significance level for each input time series.

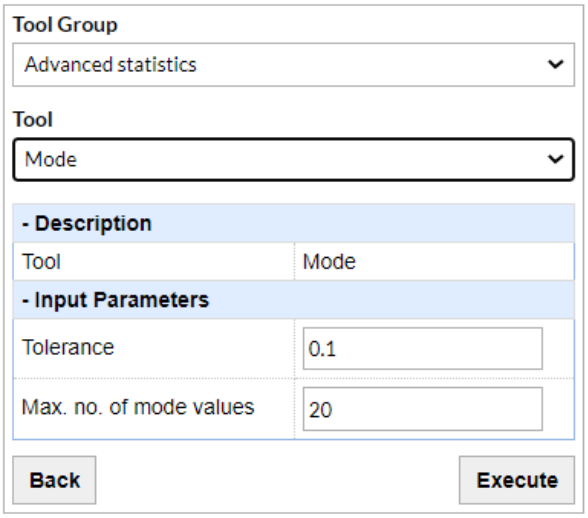
- Mode
- **Description**
  The Mode tool calculates the mode of the input series.

  The Mode is the value that occurs the most frequently in a sample. The mode is not necessarily unique, since the same maximum frequency may be attained at different values.

  The most ambiguous case occurs in uniform distributions, wherein all values are equally likely, and for samples drawn from continuous distributions where all values tend to occur only once. Since the latter is a very common, the Mode tool has been extended such that the user can specify a tolerance within which two values can be considered equal. In the case where the tolerance is set to low when mode is calculated for samples drawn from continuous distribution, the number of mode values will approach the number of values in the sample. When this happens, the concept becomes useless.

  To indicate when this happens, the user may set a limit to the number of values the tool can return. If this value is exceeded, the tool returns a single double. Nan.
- **Input Items**
  One or more time series.

- **Tool Properties**
  The tool properties are listed below. Select a property in the property control to get a description.



- **Output Items**
  A table containing two columns for each mode value:

a. Mode
b. Unit

and one row for each input item.

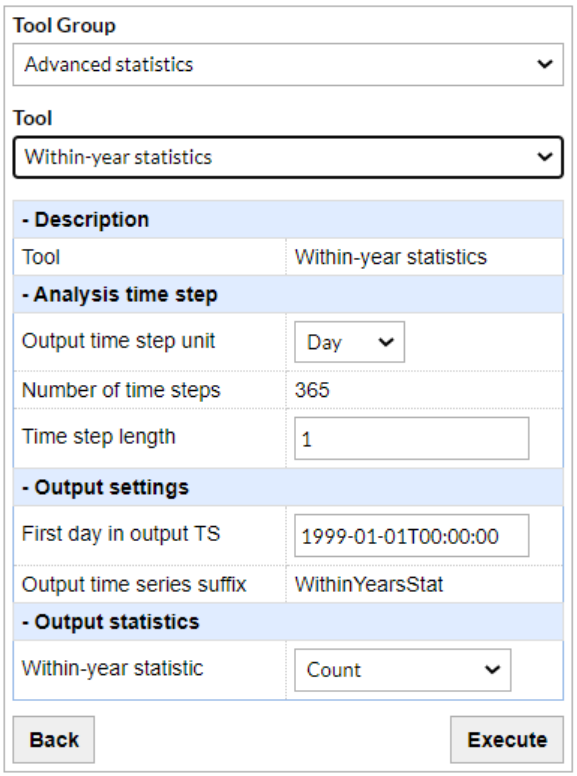
- Residual Mass
- **Description**
  Returns the calculated residual mass for the provided input time series. The residual mass for a given time step is defined as the accumulated deviations from the average value of the entire time series.
- **Input Items**
  One or more time series.
- **Output Items**
  The tool returns a time series.

- Run test
- **Description**
  The run test is used for general testing of independence and homogeneity of a time series.
- **Input Items**
  The tool requires at least one time series to be selected.
- **Output Items**
  The tool returns the test statistics and significance level for each input time series.

- Within year statistics
- **Description**
  The Within-year statistics tool calculates the specified statics for a relative time period (Analysis time step). The output is a time series that covers a single year with the

statistics calculated on the specified time step. The tool can be used to calculate e.g. the average flow for Jan, feb... Dec based on a time series that spans several years. The input series must cover at least one full year.

- **Input Items**
  One or more time series.
- **Tool Properties**
  The tool properties are listed below. Select a property in the property control to get a description.



- **Output Items**
  Returns a time series.

3.1.2.1.5 QA-QC

- Check time series tool
- **Description**
  The Check time series tool checks the values of one or more time series, according to a specified criterion, and returns back a boolean with the result of the check.

  The following check methods are available:

a. Value_exists – If this option is selected, the tool looks for a user specified value ("Value" property). If the value is found, True is returned, and otherwise False is returned. If Period = Sub_period, the tool will only look for the value in the user specified sub period.
b. Contains_gaps_larger_than – If this option is selected, the tool will look for gaps (periods with empty values) that are larger than a user specified max time span (see Max gap property below). If a gap larger than the specified max gap length is found, True is

returned. Otherwise, False is returned. If Period = Sub_period, the tool shall only check the values in the user specified sub period.

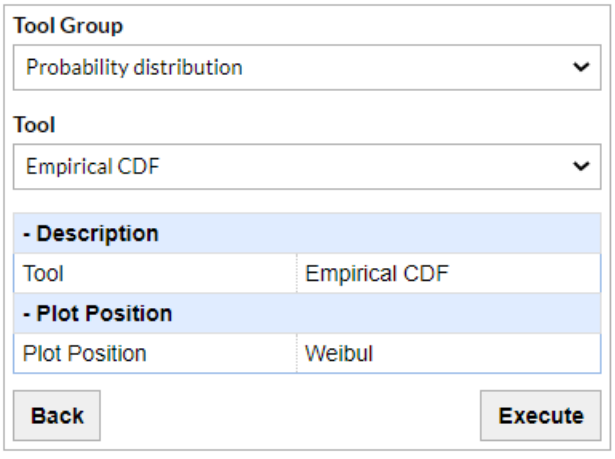
c. Within_range – If this option is selected, the tool shall check that all values in the input series are within a user specified range (see Range max/Range min properties below). If all values are within the specified range, the True is returned, otherwise False. If Period = Sub_period, the tool shall only check the values in the user specified sub period.

d. Exceeds_max_rate_of_change – If this option is selected, the tool shall look for values that have increase more than a user specified allowed max rate of change since the last time step. If the time series contain such values, True shall be returned, otherwise false. If Period = Sub_period, the tool shall only check the values in the user specified sub period. The unit of the specified rate of change is specified in a separate tool property as /sec, /min, /hour, /day

- **Input Items**
  The tool accepts one or more time series as input.
- **Tool Properties**
  The tool properties are listed below. Select a property to get a description in the property control
- **Output Items**
  For each input time series there will be produced one output boolean that can be viewed in a table.

3.1.2.1.6 Probability distribution

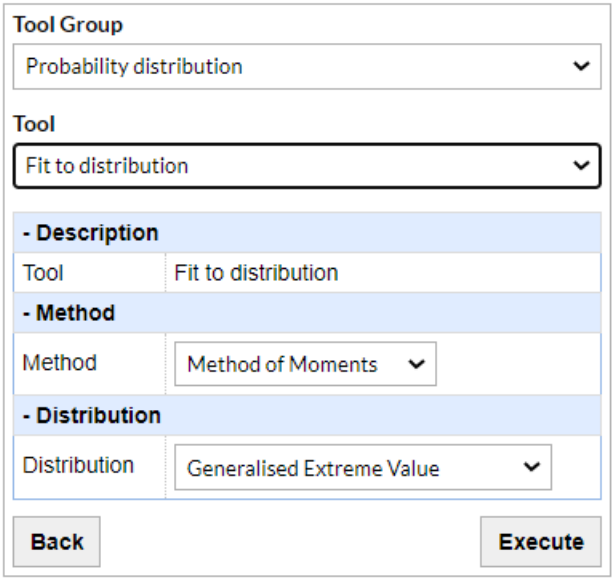
- Empirical CDF
- **Description**
  This tool derives the empirical cumulative distribution function of a given timeseries using different plotting position formulas to estimate the probabilities.
- **Input Items**
  One or more time series.
- **Tool Properties**
  The only tool property is the choice of plotting position formula:



- **Output Items**

A time series table, list, or table for each input item or a chart with a graph for each input item.

- Fit to distribution
- **Description**
  This tool aims to fit the chosen probability distribution to the given time series.
- **Input Items**
  One or more time series.
- **Tool Properties**
  The tool properties are listed below.



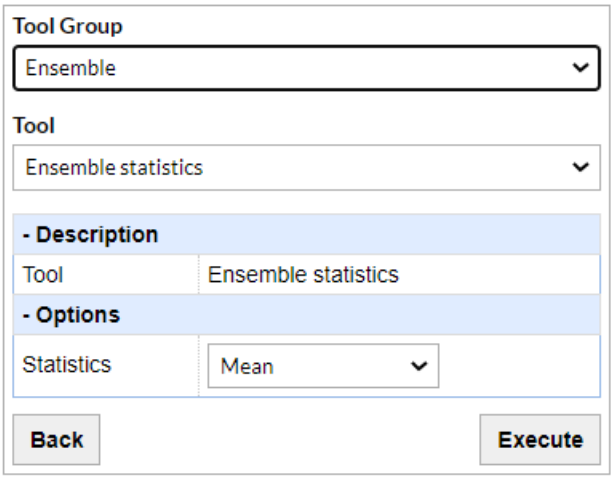
  It is necessary to select the distribution type and the method. Note that not all methods work with all distributions.
- **Output Items**
  A list for each input time series containing the distribution parameters.

- Histogram
- **Description**
- **Input Items**
- **Tool Properties**
- **Output Items**

3.1.2.1.7 Ensemble

- Ensemble statistics
- **Description**
  The ensemble statistics tool calculates a user specified statics for each input ensemble time series. The tool will return the calculated result as an ordinary time series with one value for each time step in the input ensemble time series. The tool calculates the statistics of the remaining elements once missing values are removed.
- **Input Items**
  The Ensemble statistics tool requires at least one ensemble time series to be selected.

- **Tool Properties**
  The Statistics option determines which ensemble statistics that shall be returned when the tool is executed. Some statistics, like the Quantile option, will require additional inputs when selected.
  Select any property in the property control for a description.



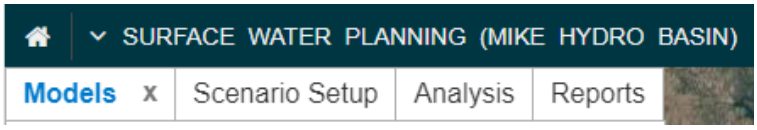
- **Output Items**
  One ordinary time series will be returned for each input time series.

3.2 Surface and Ground Water Planning

3.2.1 SURFACE WATER PLANNING (MIKE HYDRO BASIN)

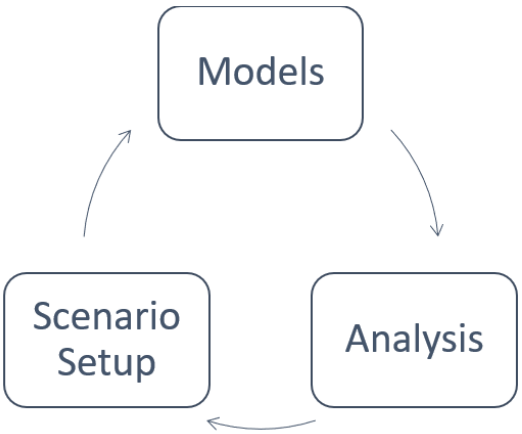
The Mike Hydro Basin module provides user to add up a MIKE model and allows different tools to act upon such as edit, clone, etc.

After clicking on the module icon, the user enters the module interface where the user can see the module tool palette with four main tabs i.e. Results, Analysis, Plan Setup and Reporting. The user can open a predefined Workgroup where it had added a model or can create a new Workgroup as discussed in previous section.

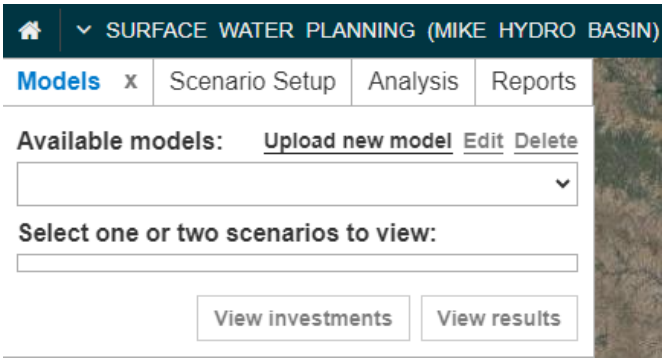


3.2.1.1 Results

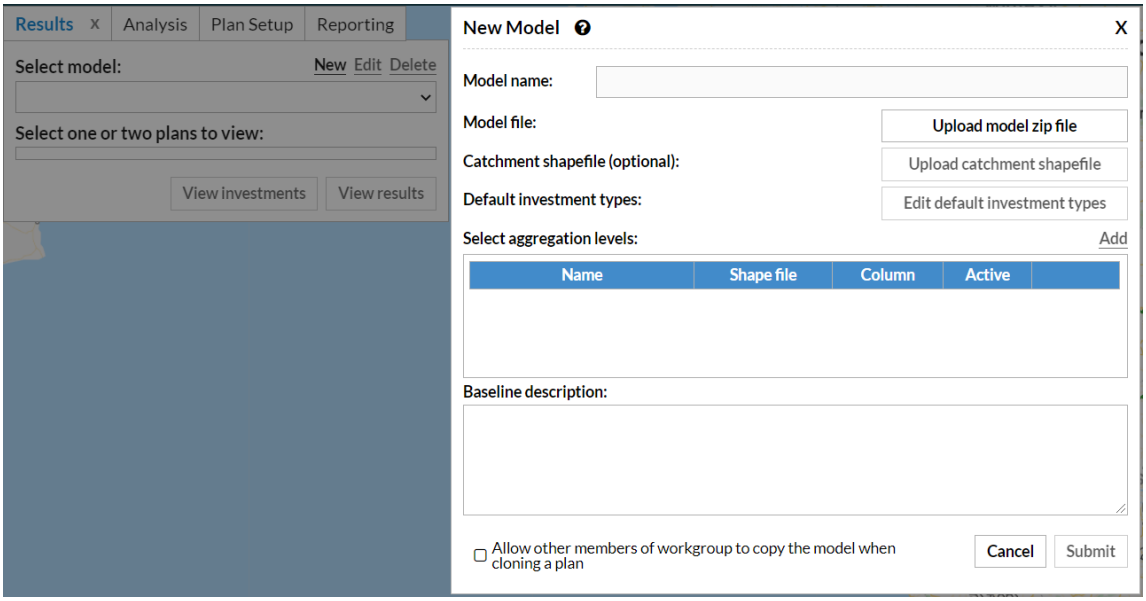
Upon entering the application, the user lands on the Results tab. This is because it is envisioned the journey begins by observing the scenarios which have been prepared based on stakeholder feedback. It continues by analyzing the different scenarios and comes full circle by allowing users to set up new plans if they require



The Model tab allows the user to add up a new model or update any pre-existing model in the previously defined workgroup.



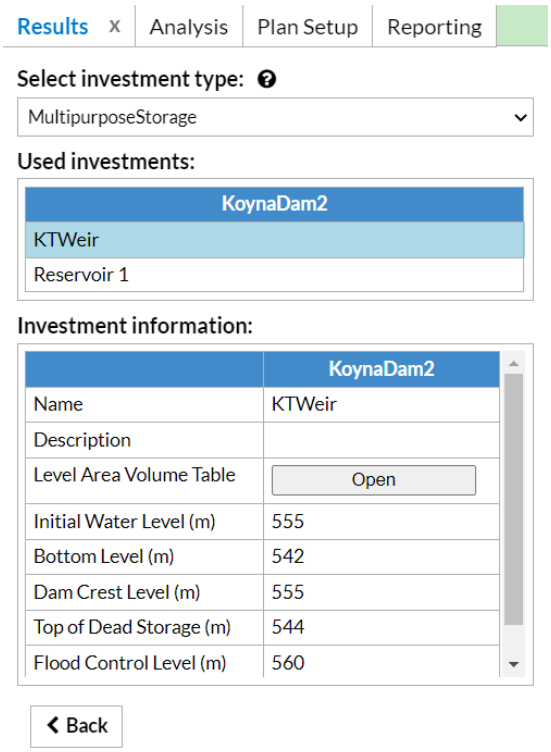
Clicking on the [Upload new model] button allows the user to add up a new model and its corresponding shapefiles. The user will select the model zip file from the system by clicking on “Upload Model zip file” button.



After user submit the model file along with optional shapefile added, using the **[Submit]** button provided, the user is direct over the **Results** tab where the user has option to view the investment associated with the model or can also view the results of the model.

The Results tab allows the user to first select the required model that it had under the **Select Model:** dropdown menu. And corresponding to the selected model, the plan or the scenario associated with the model is listed under the **Select one or two scenarios to view:** dropdown menu. The user has the option to select any of the plan or more and can compare the result of the corresponding plan with each other or with the Baseline.

After selecting any of the plan the user can click on the **[View investment]** to view the investment details associated with the plan. Clicking the buttons allows the user to enter the investment panel of the module.



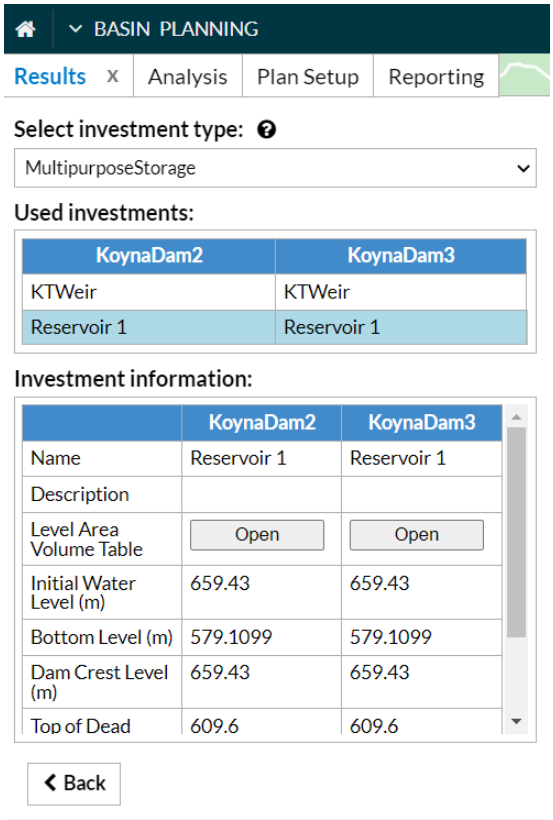
Under the **Select investment type** dropdown menu the user can select any of the following investment types as required with the project:

- **WaterSupply** represents potable water production schemes; the water demand is calculated by specifying the population and consumption per capita.
- **Irrigation** represents agricultural irrigation schemes; a water demand for the crop must be specified.
- **EnvironmentalFlow** can be used to represent water demand needed for the environment, should you have environmental flow calculations for your catchment your catchment you insert this type of investment in your plan and set the water demand to match the result from your analysis.

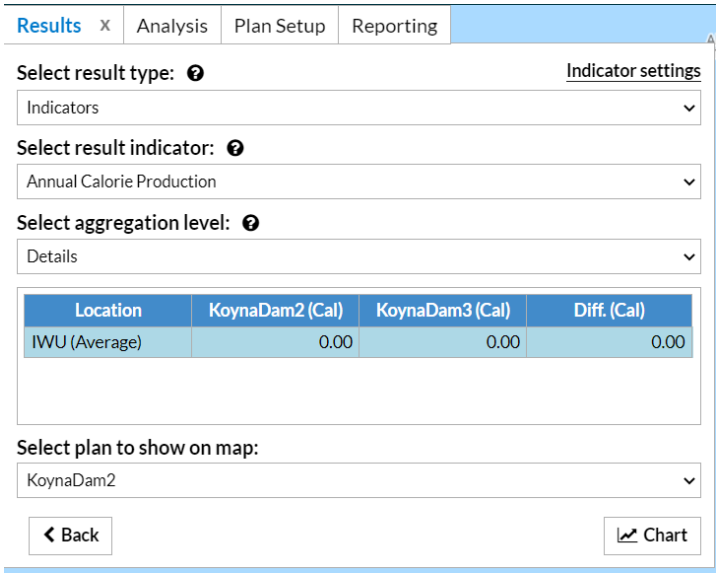
- **Other** type of water demand, represents water demand that does not fall within any of the categories above (for e.g. industrial, livestock, etc.)
- **HydropowerDam** represents hydropower plants located at a dam; it requires an installed capacity and the power demand and it will return energy produced.
- **HydropowerRiver** represents run-of-river hydropower schemes; this type of investment requires water demand and it will return water supplied.
- **MultipurposeStorage** is the investment type that can be used to represent reservoirs and storage (lakes, etc.) within your catchment.

After selection of the required investment type the module allows the user to view the associated used investment under the **Used investments:** dropdown menu. The parameters associated with the selected investment used is stated under the **Investment information panel.**

If the user has selected two or more plans, then the module gives the ability to the user to compare the investment information for those selected plan as shown:

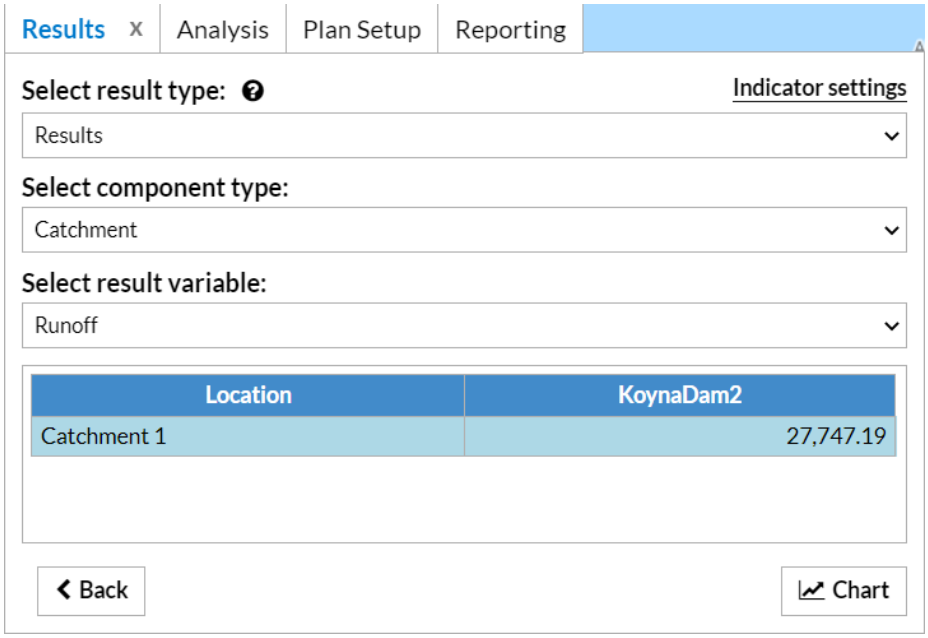


Similarly, clicking on the **[Results]** button, the user enters the Results panel of the module.

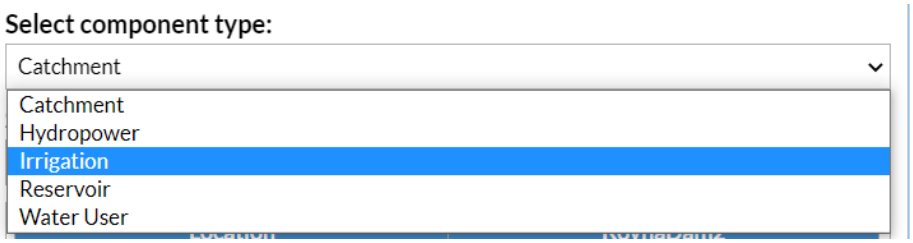


The user can view the results of the selected scenario using the **Results** tab. Viewing of results can happen in three ways: on the Results tab table, via the "Chart" button, or on the map. There are different indicators available in the application, the user chooses to present the indicators by deciding on indicator settings. These settings control what is presented on the table, map and charts. The user will select the scenario and then click on "View Results" button

The user has the option to view the result or selected indicator. Under the **Select result type** dropdown menu, the user can either select the indicator or the result. If the user chooses the **Results** option then the panel is updated to show the associated results component as shown below

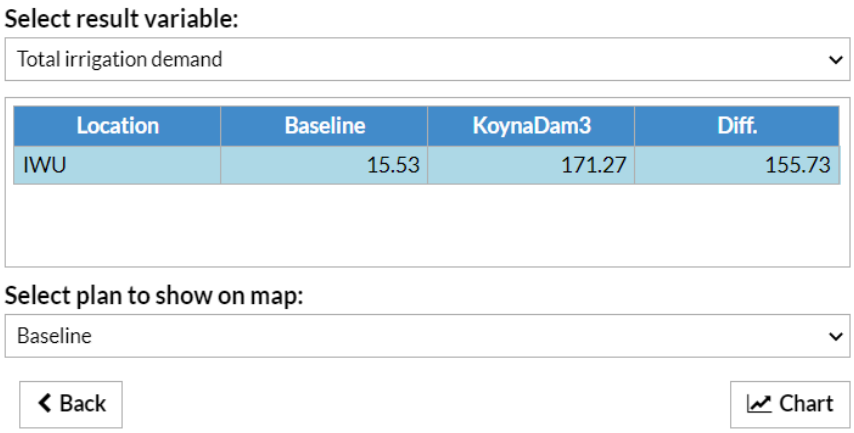


Under the **Select component type:** dropdown menu the user has option to select any of the result component related to the project such as catchment, hydropower, irrigation etc.

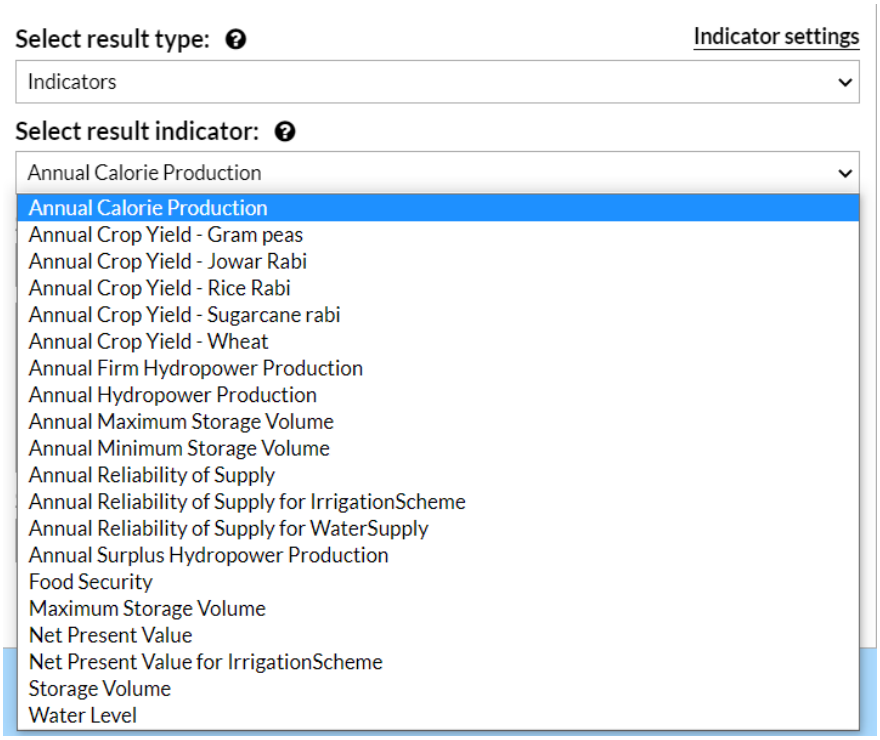


After selecting a particular component, using the **Select result variable** dropdown menu, the user can choose the result variable linked to that component such as Runoff, Generated power, Total irrigation demand etc. and can see the results in the result in the result window.

If the user has selected any two scenarios, then the comparison of the results can also be seen. Clicking on the **Chart** button, it can also view the graphical variation of the results. The **Select plan to show on map** dropdown allows user to represent the plan on the map view.



Similarly, if the user select the **Indicators** in the result type dropdown, then a set of indicators associated with the project are listed in the **Select result indicator** dropdown as shown:



Some of the indicators are explained as:

Annual energy production produced by hydropower schemes (GWh); this is directly dependent on the water level at the dam where the turbines are located.

Hydroelectric power produced is calculated from the following formula:

$$P = \Delta h(Q) \times Q \times \varepsilon(\Delta h) \times g \times \rho_{water}$$

Where P is the power generated, Δh is the effective head (difference) [L], Q is the discharge/release through turbine(s) [L3/T], ε is the machine (power) efficiency [-], g is the gravitational constant [L/T2] and ρwater is the density of water [M/L3].

The effective head difference is obtained by:

$$\Delta h(Q) = h_{reservoir} - h_{tailwater}(Q) - h_{conveyance}(Q)$$

Annual reliability of supply either as the magnitude of the supply given a certain demand (m3/s), or as a fraction of demand supplied at a chosen level of probability of exceedance (%).

Groundwater sustainability index as a comparison of the total groundwater recharge of the basin to the total abstraction from groundwater on an annual basis (%). The following equation is used:

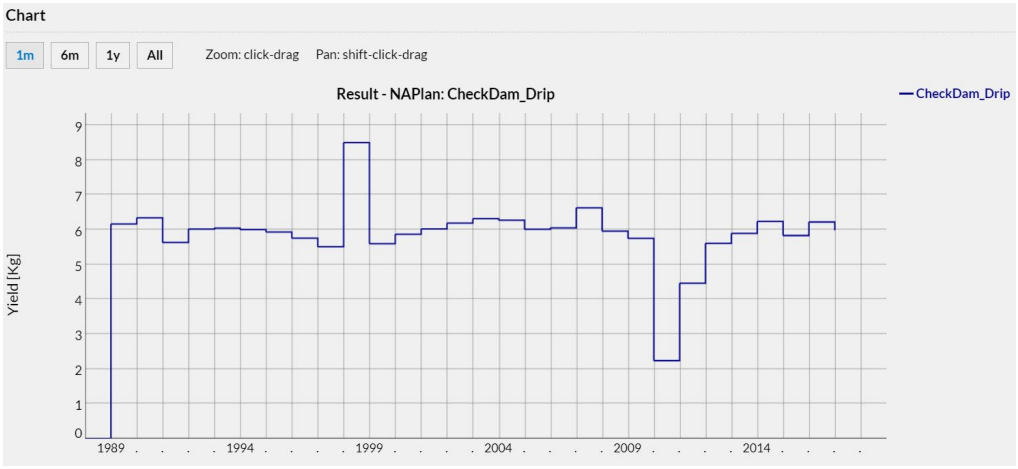
Annual GW Sustainability (%) = 100 x (1 – (Abstractions / Recharge))

Net Present Value is a measurement of profit calculated by subtracting the present value of costs (including initial cost) from the present values of benefits over a period (user specified currency).

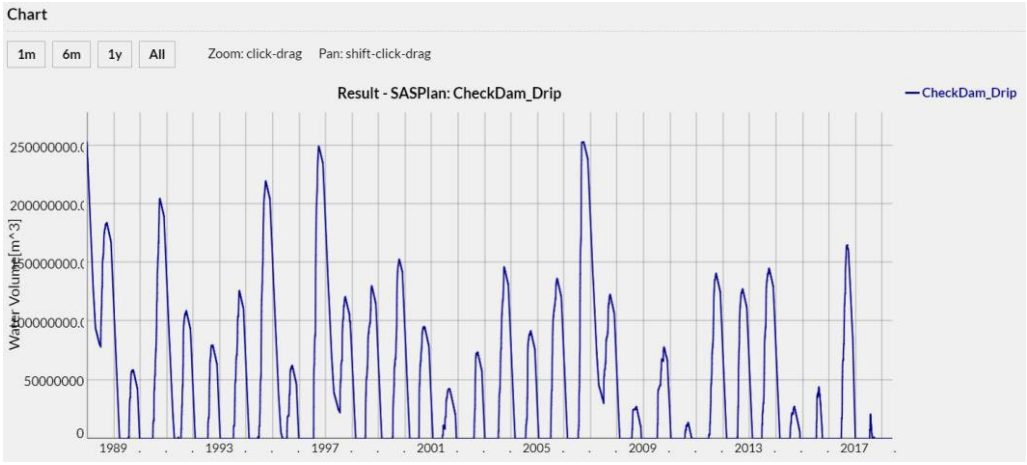
Reservoir status is an indicator providing water level, reservoir downstream release and storage over time (m, m3/s and m3 respectively).

There are different level of aggregation available for each indicator which a user can select it from the **Select aggregation level**: dropdown. By default, these are:

Summary level: this level of aggregation represents the whole focus area



Details level: this level allows viewing results at water user level



3.2.1.2 Analysis

The user can evaluate different scenarios through a process based on Multi Criteria Analysis (MCA). Scenarios have been compared in the "Results" tab, by looking at the difference between two scenarios in the indicator results table, at different levels of aggregation. To evaluate multiple plans according to concerns/priorities of different stakeholders in the basin, an analysis such as MCA can be used. In this analysis, stakeholders define strategies reflecting those concerns/priorities, and scenarios performance against those strategies is calculated in a score matrix.

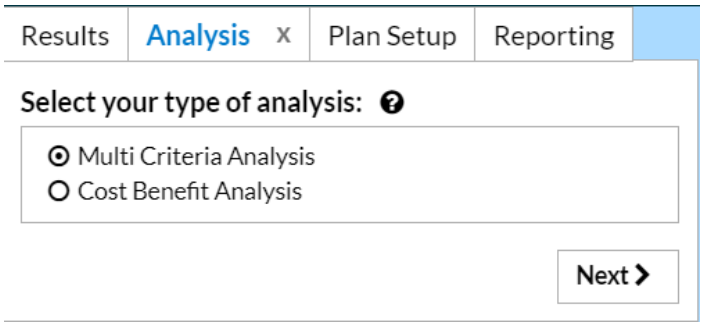
Indicator results are grouped according to the type of indicator and the results are scaled across plans. The output from the scaling is afterwards combined with the strategy weights, which in turned are summed up to produce the final score, per scenario and per strategy. Different sets of weights will reflect different priorities and therefore evaluate water users differently.

The purpose of the Analysis Manager is to create and compare Multi-Criteria Analyses (MCA) and Cost-Benefit Analyses (CBA). The analyses are presented as preconfigured spreadsheets that offer all required

functionality and logic. The Analysis Manager is designed as an explorer, in which analyses are organized in folders (groups) in an intuitively and convenient way that you design.

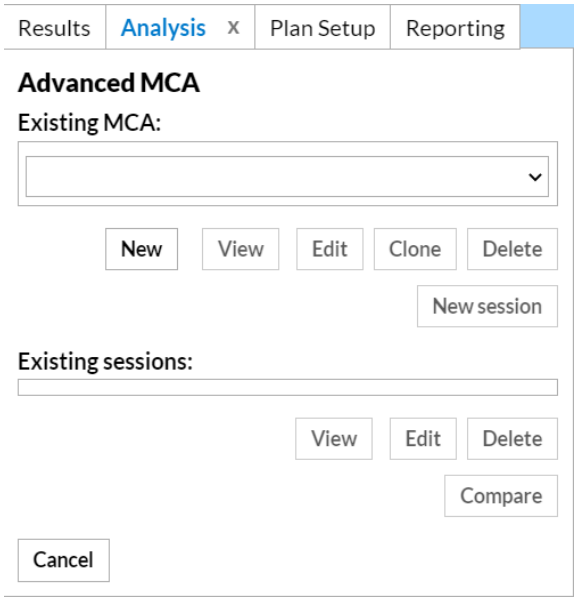
The Analysis Manager consist of Setups (basic configuration of MCAs and CBAs), Sessions (stakeholder feedback), and Comparisons (comparison of stakeholder feedback).

The different plans can be evaluated by comparing key Indicator results, as well as by running a simple Multi-Criteria Analysis (MCA) and comparing the MCA results. The MCA score matrix needs to include concerns / priorities of different stakeholders in the basin. When user will click on “Analysis” tab, the window will be opened as shown in the Figure:



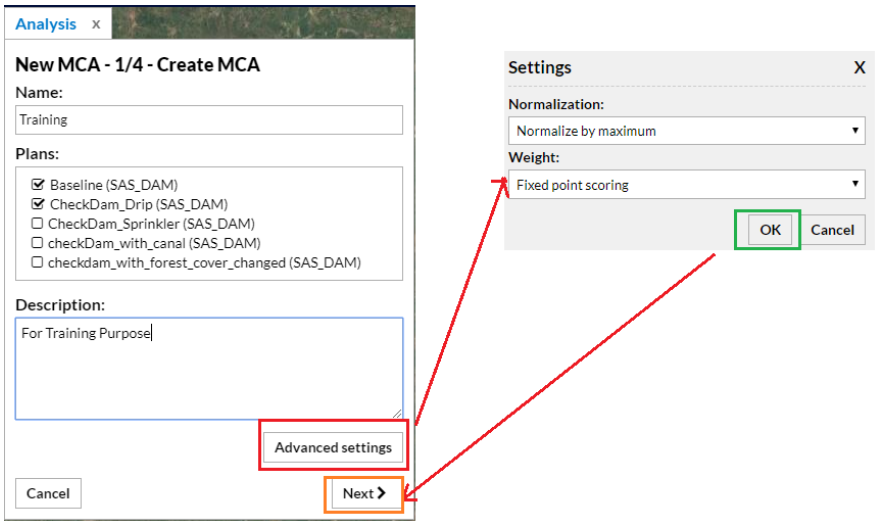
3.2.1.1.1 Multi Criteria Analysis (MCA)

MCA provides a mechanism to an end-user (often called stakeholder) to compare, via performance criteria, two or more simulations and to define, via the definition of criteria weights, his/her own preferred solution(s).
When user will select “Multi Criteria Analysis”, a button will be displayed. He will click that “Next” button and a popup modal will be opened.
If there are existing MCA in the system, it will be shown in the dropdown. To add new MCS, user will click on “New” button as shown in the figure:



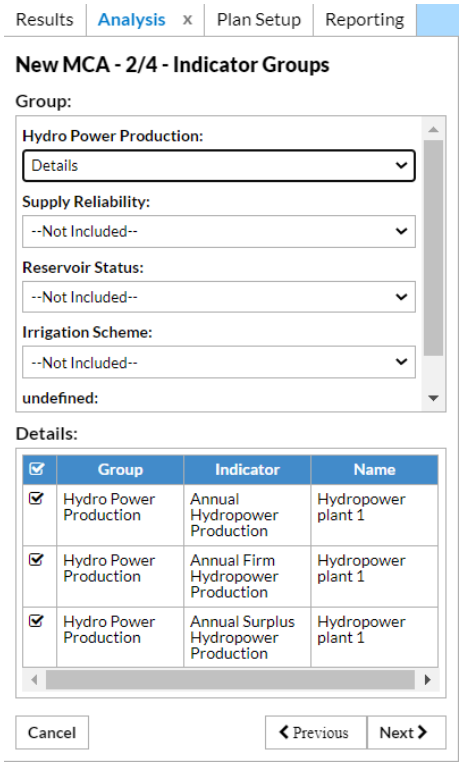
User will enter the details like Name and Description and select the plans for which he/she wants to do multi-criteria analysis. User can also change the advanced settings

for that MCA, click “Ok” and then click “Next” for further processing as shown in below figure:



In next step, user will select the “indicator groups “for that MCA and click “Next”. If user wants to go back to previous step, he will click “Previous” button.

The required groups are added and details or summary for that group can be viewed for that group.



After clicking next the user can see the Indicator and Advance Indicators as shown below:

New MCA - 3/4 - Indicators

Indicators | Normalized Indicators

Group	Indicator	Name	KoynaDam2 (KoynaDam)	Baseline (KoynaDam)
Hydro Power Production	Annual Hydropower Production	Hydropower plant 1	0.00	132.22
Hydro Power Production	Annual Firm Hydropower Production	Hydropower plant 1	0.00	12.44
Hydro Power Production	Annual Surplus Hydropower Production	Hydropower plant 1	0.00	119.78
Reservoir Status	Water Level	Reservoir 1	656.35	653.09
Reservoir Status	Water Level	KTWeir	546.97	553.86
Reservoir Status	Storage Volume	Reservoir 1	2,649,682,255.00	2,361,225,186.00
Reservoir Status	Storage Volume	KTWeir	2,203,668.87	5,255,594.16
Reservoir Status	Annual Maximum Storage Volume	Reservoir 1	2,980,088,917.00	2,963,679,687.00
Reservoir Status	Maximum Storage Volume	Reservoir 1	2,980,089,600.00	2,980,089,600.00
Reservoir Status	Annual Minimum Storage Volume	Reservoir 1	2,141,696,981.00	1,480,545,223.00

Show value | Cancel | Previous | Next

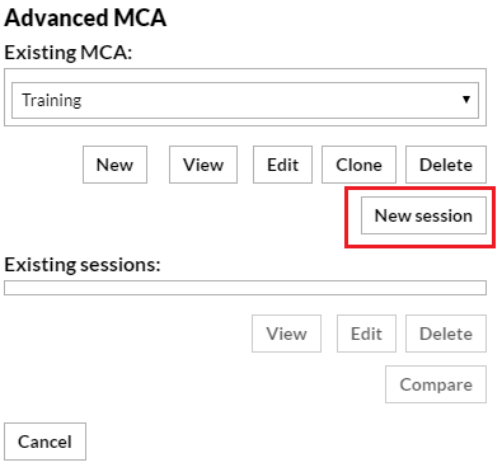
In the last step, user will check the pre-analysis. User can also de-select the indicators if user wants to. He also de-select the scenario. And click “Finish”.

New MCA - 4/4 - Pre-analysis

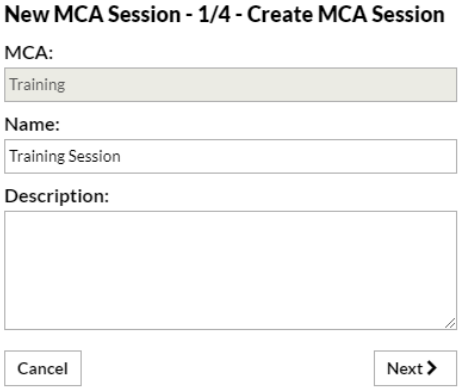
	Indicator	KoynaDam2 (KoynaDam)	Baseline (KoynaDam)
☑	Hydro Power Production / Annual Hydropower Production / Hydropower plant 1	2	1
☑	Hydro Power Production / Annual Firm Hydropower Production / Hydropower plant 1	2	1
☑	Hydro Power Production / Annual Surplus Hydropower Production / Hydropower plant 1	2	1
☑	Reservoir Status / Water Level / Reservoir 1	1	2
☑	Reservoir Status / Water Level / KTWeir	2	1
☑	Reservoir Status / Storage Volume / Reservoir 1	1	2
☑	Reservoir Status / Storage Volume / KTWeir	2	1

Cancel | Previous | Finish

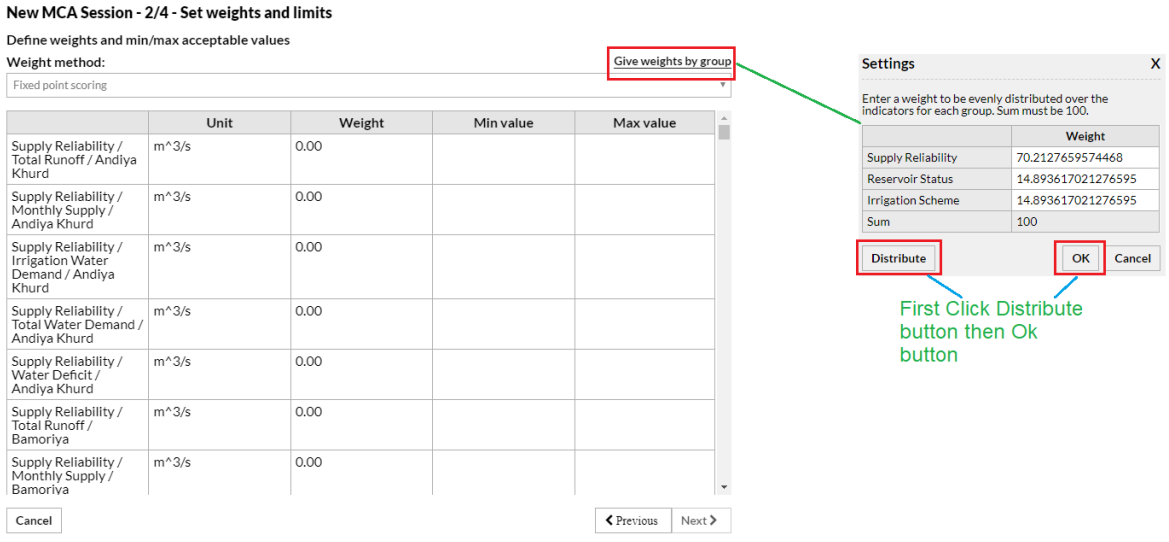
After click on Finish. The New MCA will be created and shown in the dropdown. User can view that MCA. He can also edit, clone and delete that MCA. User can also create new session by clicking on “New Session” button.



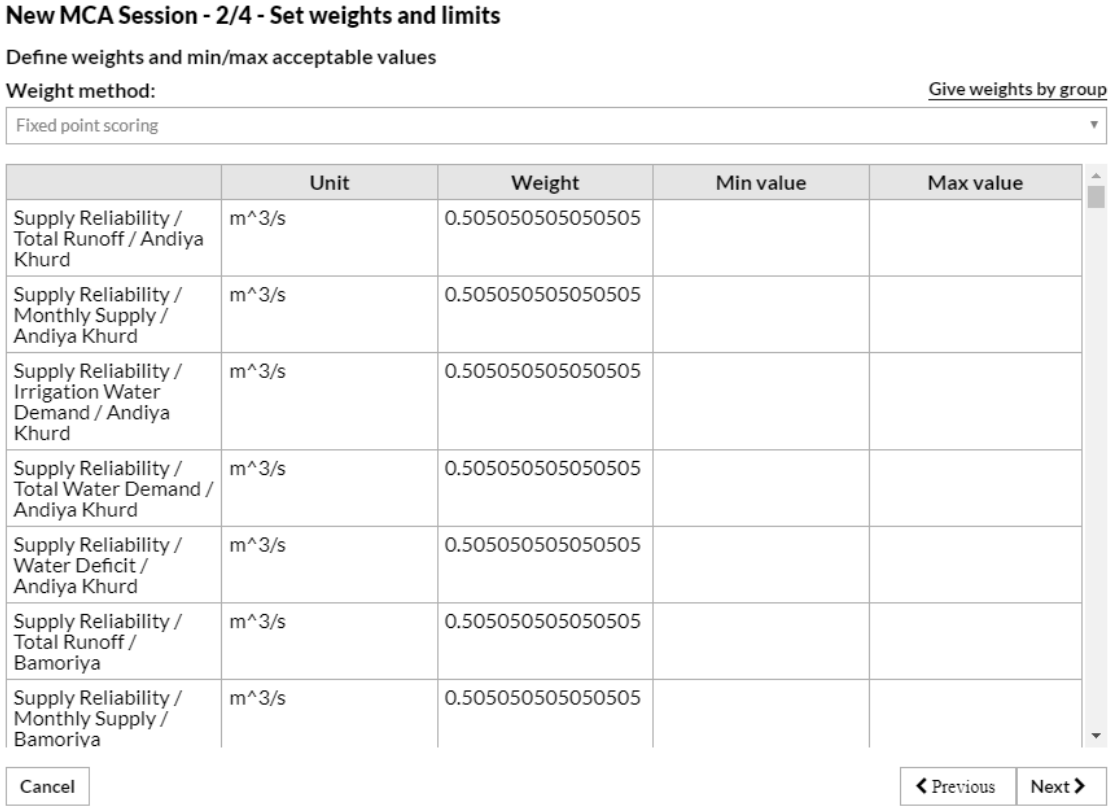
When user will click on “New Session”. A modal will be opened for Create MCA session. The user will enter the details for the session. And click “Next”



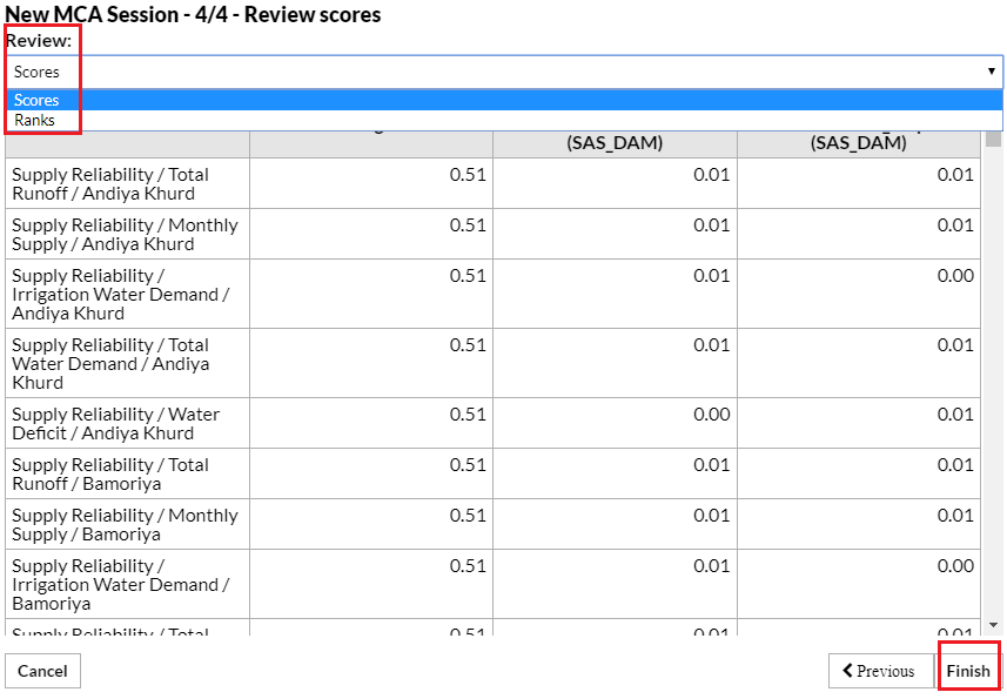
Now user will enter the weight settings by clicking on “Give weights by group”. He will give the weights to the indicators. The sum of indicators must be 100. After entering weights, user will click “Distribute” and then “OK” button will be active. And click “OK



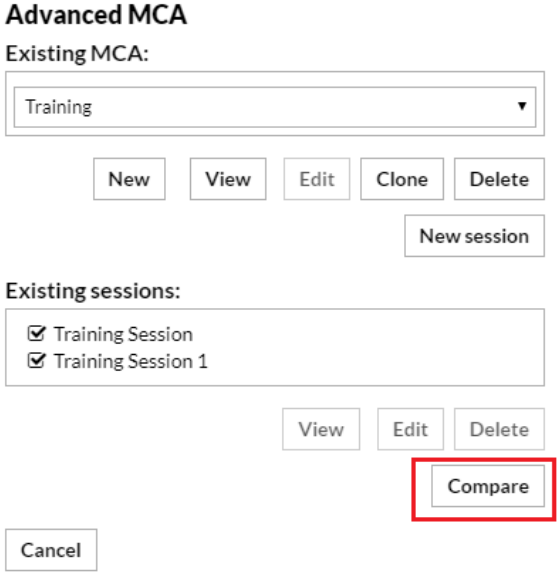
After clicking “OK” the weights are distributed according to their value in the indicators as shown in Figure 33 Create MCA Session - Set Weights and Limits – 2 and click “Next”. User can also give Min and Max value for that indicator.



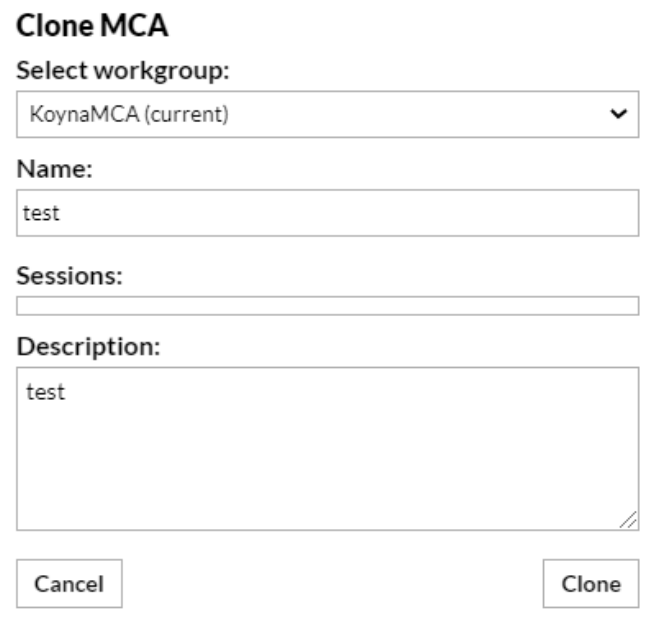
After this, user can review the criteria and Normalized Criteria values for the indicators of their scenarios. And click **Next.** The user can review the scores and ranks and click “Finish”. The New Session will be completed.



The created New MCA Session will be updated in “Existing Sessions”. User can also view, edit and delete the session. If there are multiple sessions, user can also compare two or more sessions. User will select the sessions, which he wants to compare and click “Compare”.



The user after creating a MCA or for an existing MCA can use the **Clone** command to duplicate or clone the selected MCA by just clicking on the clone button.
Clicking the button will take the user to a clone panel as shown below

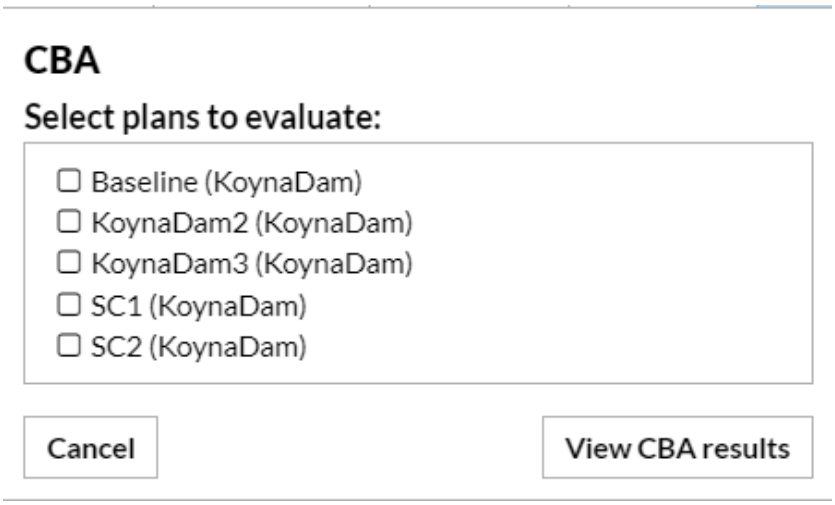


After selecting the workgroup in which a user wants to clone, the user needs to specify the **Name** and the **Description** for the cloned MCA. The command will execute after clicking on the **Clone** button.

3.2.1.1.2 *Cost Benefit Analysis (CBA)*

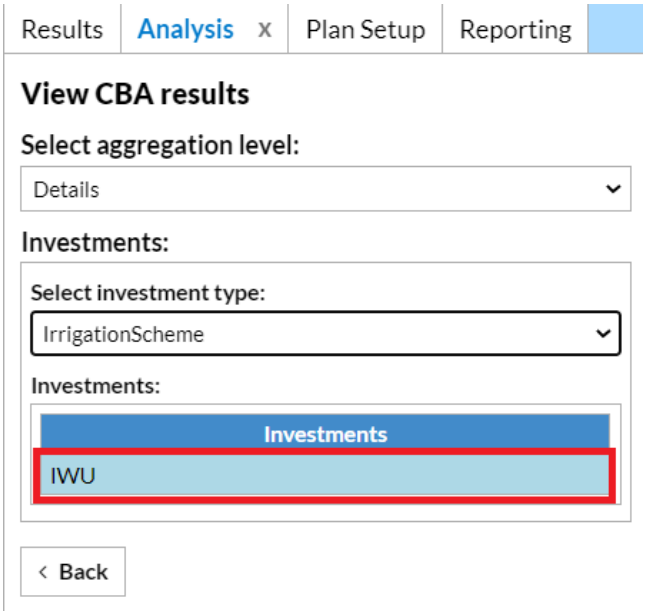
A CBA allows for the analysis of the financial viability of a single project (scenario). It also helps in to visualize and compare the Cost Benefit Analysis results from the plans in the workgroup.

After selecting the **Cost Benefit Analysis** radio button and clicking **Next**, the user enters the CBA panel of the module.

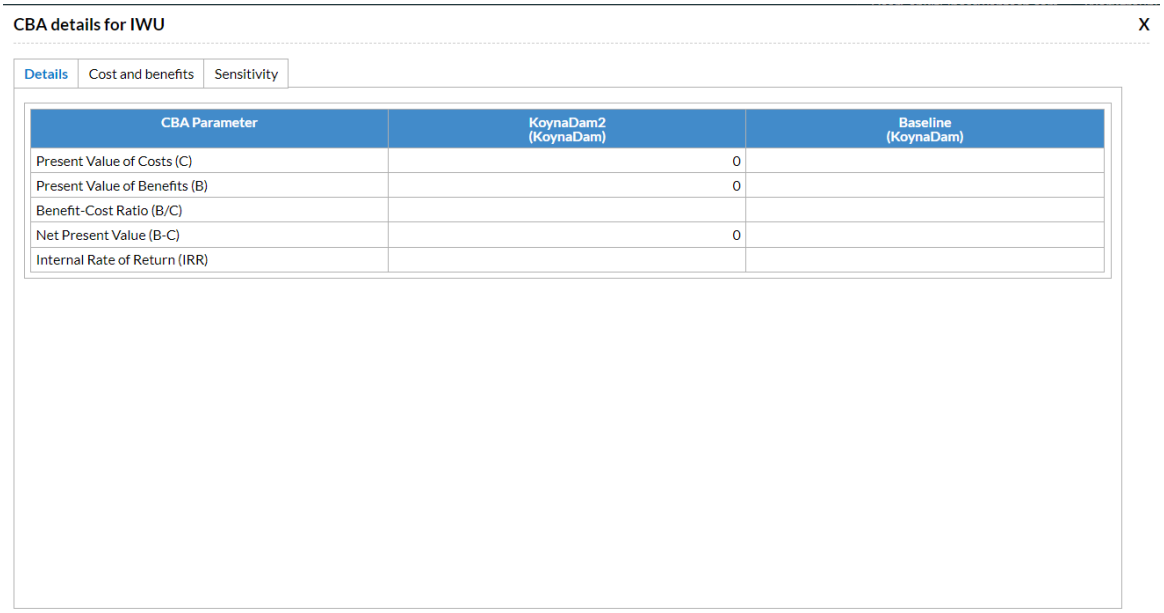


After selecting a plan to evaluate, or if the user require to compare the results of CBA for two or more plan, can select multiple plans and clicking on the **View CBA results** button will take user to the result window of the panel.

Under the result window the user will first select the aggregation level (Detail or Summary) and then will select the **Investment** defined for that plan.

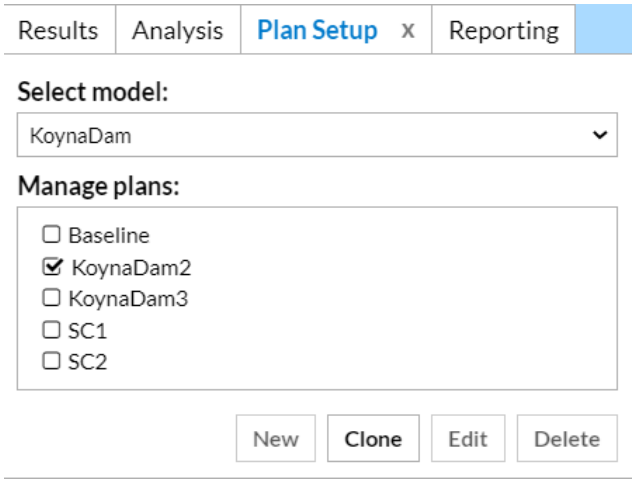


To view the **CBA** results for the selected investment type the, the investment is selected and a window will pop up defining the results as shown below:



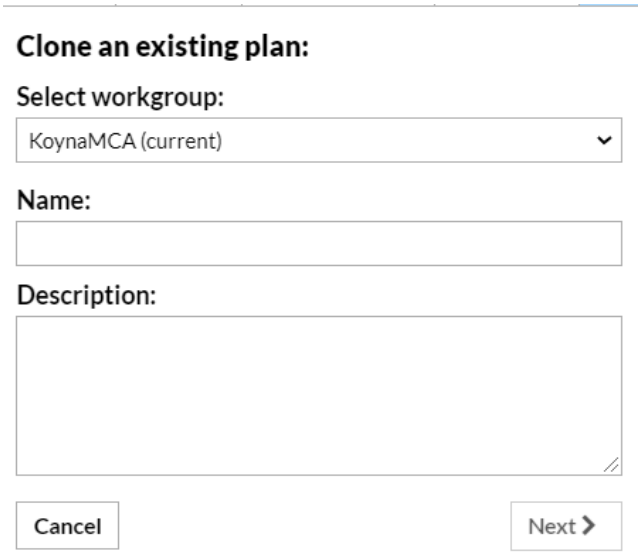
3.2.1.3 Plan Setup

When user will click on "Plan Setup", the user will create a scenario of their own. The user will add, edit and clone scenario. He can edit the scenarios except the baseline. The user can clone all the scenarios.

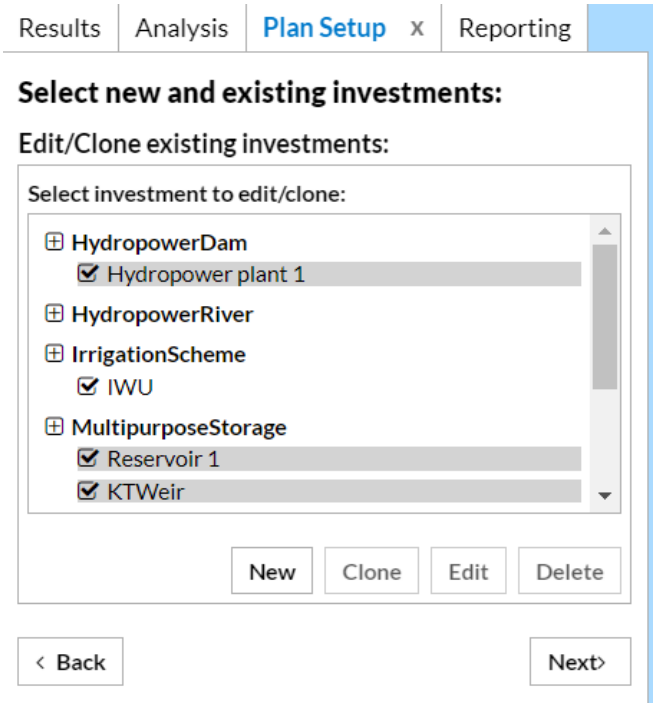


The process of cloning a scenario comprises of following steps:

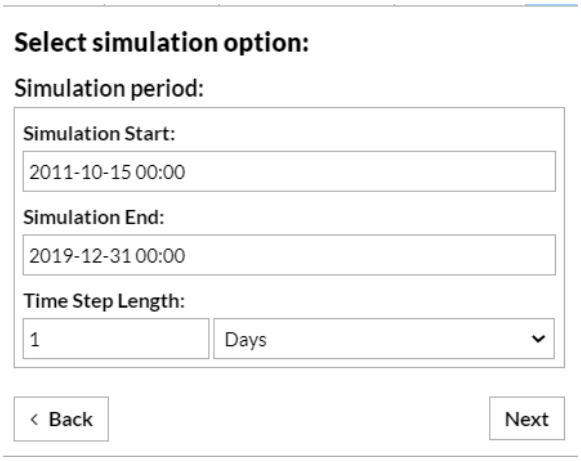
1. After selecting the scenario to be clone, the user needs to click on the **Clone** button.
2. The user needs to specify the workgroup in which the cloned scenario is to be specified, and also user need to specify the Name and description for the scenario after which the **Next** button will get enabled.



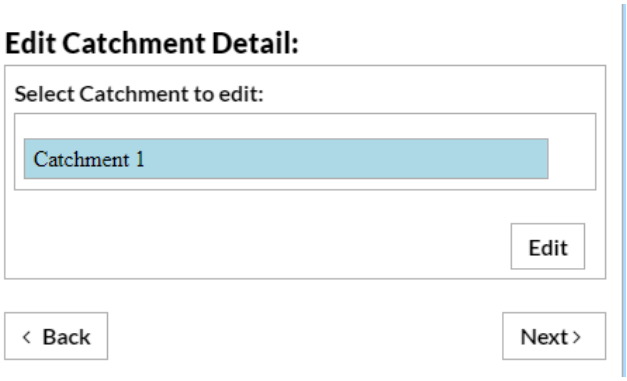
3. In the next step the user needs to specify the investment that the user needs to clone in the scenario.



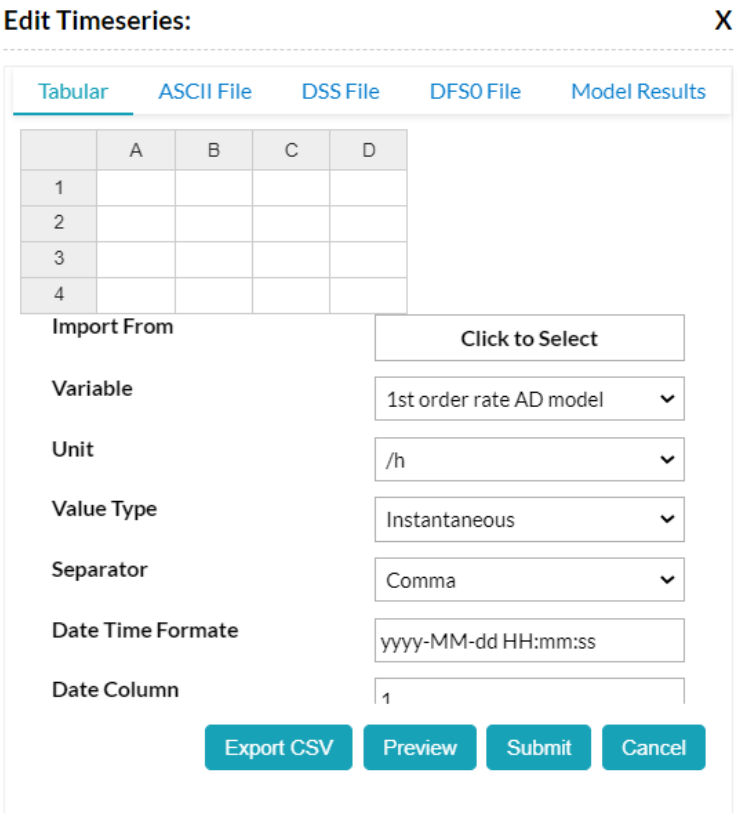
4. After defining the investment the user needs to specify the simulation run period under the **Select simulation option** panel



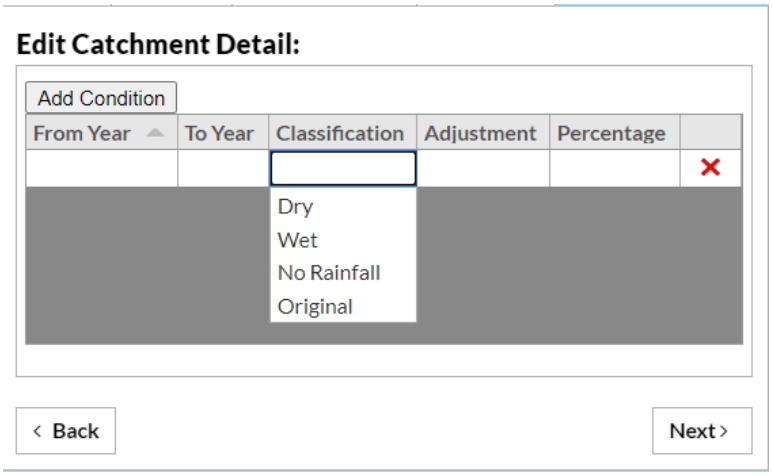
5. Next step involves the user to select the catchment linked to the plan and also edit the catchment details using the edit button.



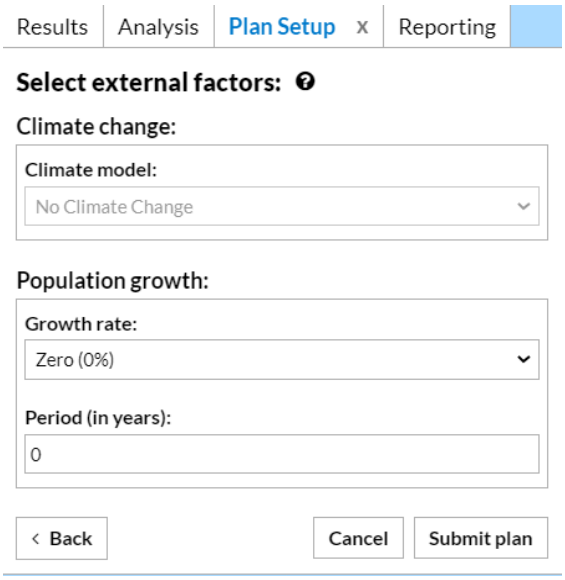
Clicking on the **Edit** button opens up the **Edit Timeseries** dialog box as shown below:



6. Next step involves to define or add the condition for the catchment such as dry, wet, etc. and so as the Adjustment as shown below:



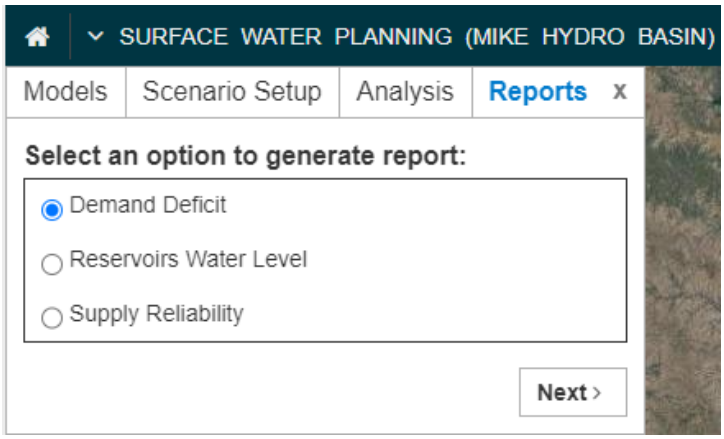
7. The final step is to specify any other external factor such as climate change factor or population growth



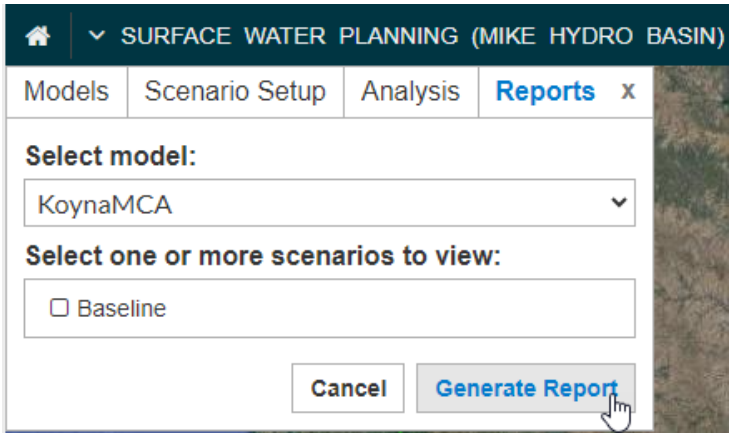
The user needs to click on the **Submit plan** button for the final submission and the cloning of the scenario is completed.

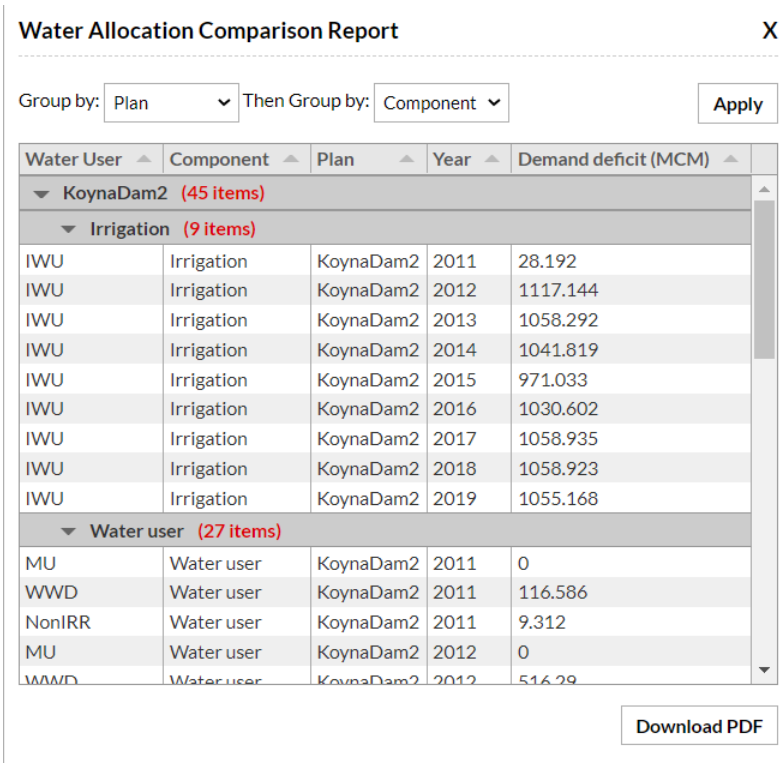
3.2.1.4 Reports

Under the Reports panel, the user has option to view the results for the selected plan. The results include Demand Deficit, Reservoir Water Level and Supply Reliability.

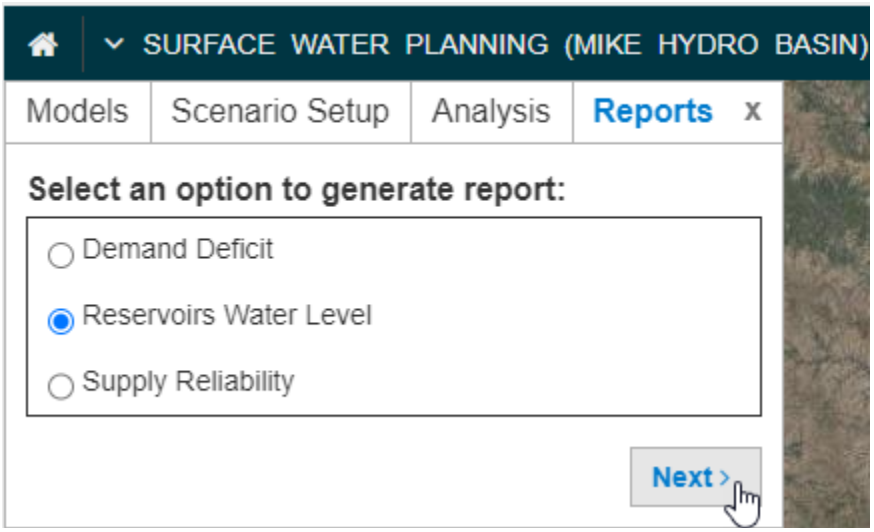


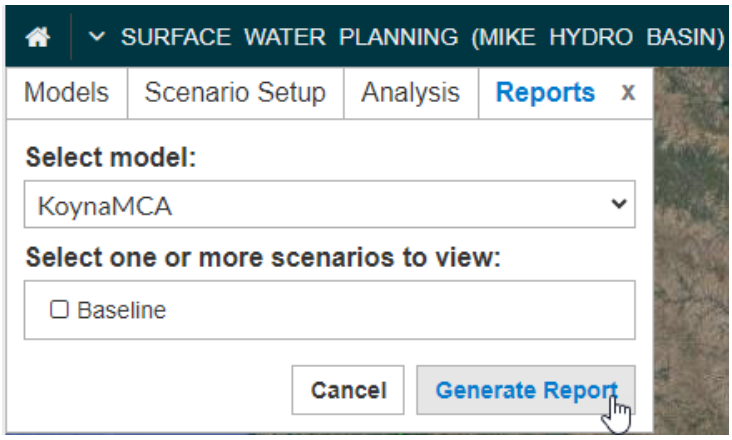
Selecting the **Demand Deficit** option and clicking on the **[Next]** button will allow the user to select the model and scenario for which they want to generated the report, as shown below.





Similarly, selecting the **Reservoir Water Level** option and clicking on the **[Next]** button will allow the user to select the model and scenario for which they want to generated the report, as shown below.





Reservoir Water Level Report X

Water Level as on Date: 15-Oct

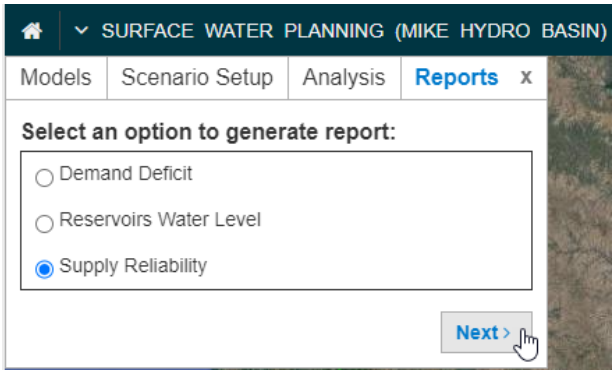
Group by: Reservoir Then Group by: Plan Apply

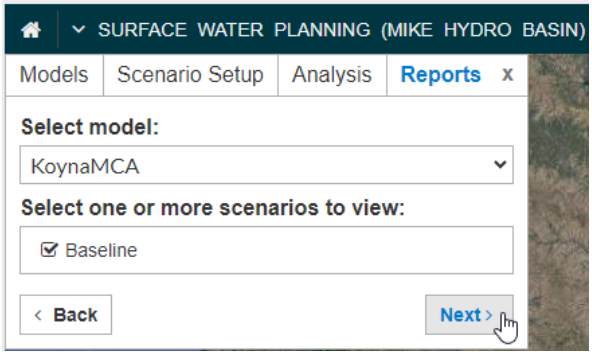
Reservoir	Plan	Year	Water Level	Flood Control Level	Diff
Reservoir 1 (9 items)					
KoynaDam2 (9 items)					
Reservoir 1	KoynaDam2	2011	659.43	659.43	0
Reservoir 1	KoynaDam2	2012	659.396	659.43	0.034
Reservoir 1	KoynaDam2	2013	659.32	659.43	0.11
Reservoir 1	KoynaDam2	2014	658.245	659.43	1.185
Reservoir 1	KoynaDam2	2015	659.21	659.43	0.22
Reservoir 1	KoynaDam2	2016	659.386	659.43	0.044
Reservoir 1	KoynaDam2	2017	659.319	659.43	0.111
Reservoir 1	KoynaDam2	2018	659.287	659.43	0.143
Reservoir 1	KoynaDam2	2019	659.43	659.43	0
KTWeir (9 items)					
KoynaDam2 (9 items)					
KTWeir	KoynaDam2	2011	555	560	5
KTWeir	KoynaDam2	2012	546.827	560	13.173
KTWeir	KoynaDam2	2013	552.636	560	7.364

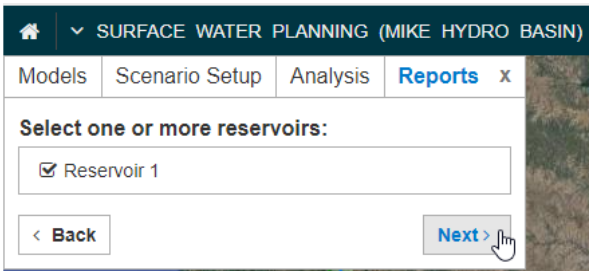
Download PDF

The user has the option to download the PDF for the generated report by clicking the **Download PDF** button.

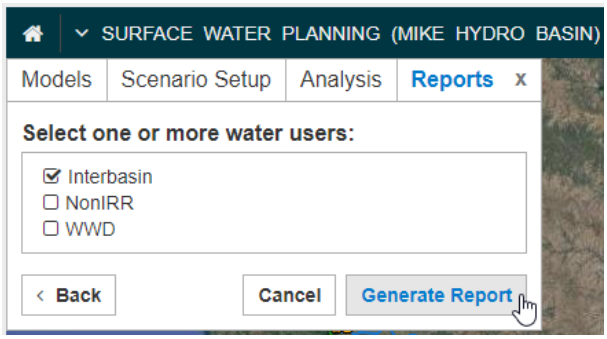
Clicking on the **Supply Reliability** button and clicking on the **[Next]** button will allow the user to select the scenario and reservoir for which they want to generate the report as shown.

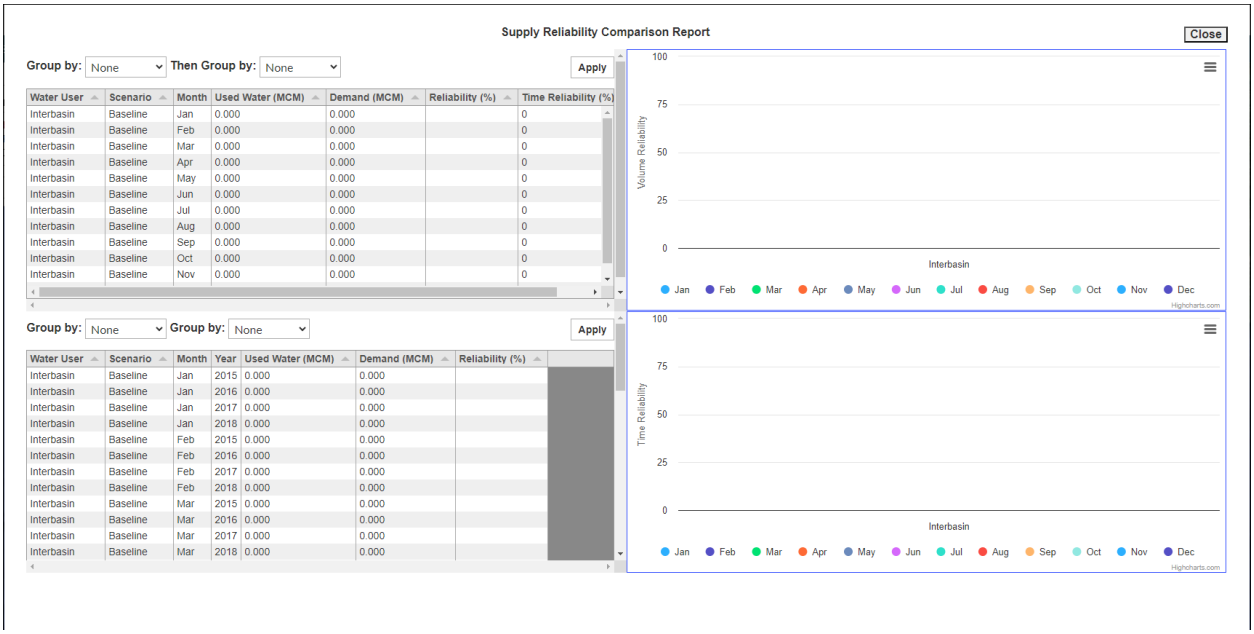






After that the user can select the water user and clicking on the **Generate Report** button will generate the Supply Reliability Comparison Report, as shown below.

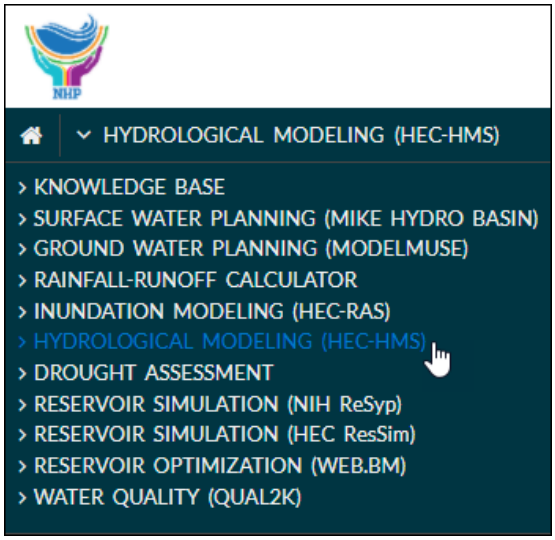



Supply Reliability Comparison Report
Close
Group by: None
Then Group by: None
Apply
Water User | Scenario | Month | Used Water (MCM) | Demand (MCM) | Reliability (%) | Time Reliability (%)
Interbasin | Baseline | Jan | 0.000 | 0.000 | | 0
Interbasin | Baseline | Feb | 0.000 | 0.000 | | 0
Interbasin | Baseline | Mar | 0.000 | 0.000 | | 0
Interbasin | Baseline | Apr | 0.000 | 0.000 | | 0
Interbasin | Baseline | May | 0.000 | 0.000 | | 0
Interbasin | Baseline | Jun | 0.000 | 0.000 | | 0
Interbasin | Baseline | Jul | 0.000 | 0.000 | | 0
Interbasin | Baseline | Aug | 0.000 | 0.000 | | 0
Interbasin | Baseline | Sep | 0.000 | 0.000 | | 0
Interbasin | Baseline | Oct | 0.000 | 0.000 | | 0
Interbasin | Baseline | Nov | 0.000 | 0.000 | | 0
Volume Reliability
100
75
50
25
0
Interbasin
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Highcharts.com
Group by: None
Group by: None
Apply
Water User | Scenario | Month | Year | Used Water (MCM) | Demand (MCM) | Reliability (%)
Interbasin | Baseline | Jan | 2015 | 0.000 | 0.000
Interbasin | Baseline | Jan | 2016 | 0.000 | 0.000
Interbasin | Baseline | Jan | 2017 | 0.000 | 0.000
Interbasin | Baseline | Jan | 2018 | 0.000 | 0.000
Interbasin | Baseline | Feb | 2015 | 0.000 | 0.000
Interbasin | Baseline | Feb | 2016 | 0.000 | 0.000
Interbasin | Baseline | Feb | 2017 | 0.000 | 0.000
Interbasin | Baseline | Feb | 2018 | 0.000 | 0.000
Interbasin | Baseline | Mar | 2015 | 0.000 | 0.000
Interbasin | Baseline | Mar | 2016 | 0.000 | 0.000
Interbasin | Baseline | Mar | 2017 | 0.000 | 0.000
Interbasin | Baseline | Mar | 2018 | 0.000 | 0.000
Time Reliability
100
75
50
25
0
Interbasin
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Highcharts.com

3.3 Hydrological Modeling (HEC-HMS)

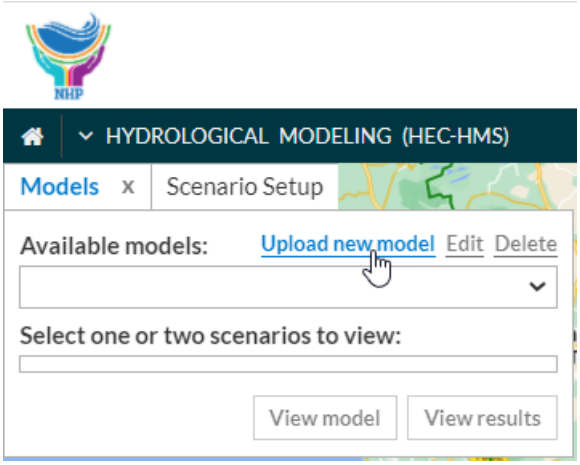
3.3.1 Uploading a Model

After selecting the workgroup created from the **Workgroup** dropdown menu to work on, the user needs to select the **Hydrological Modelling (HEC-HMS)** module from the module dropdown provided on the window as shown.

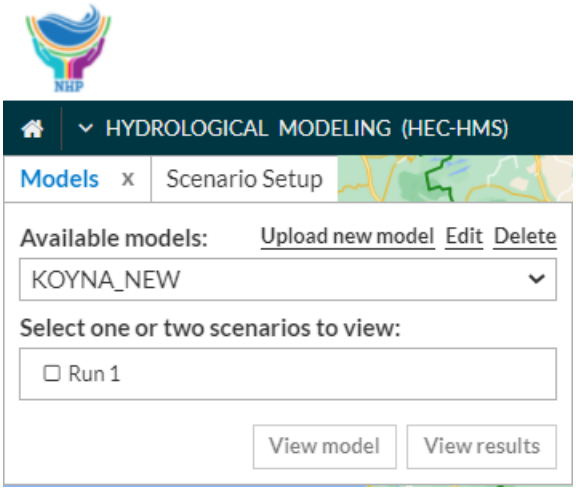


Clicking on the HYDROLOGICAL MODELING (HEC-HMS) module, the user will enter the module interface directly. Here the user can upload a new .zip model file. The steps to add a model are as follows:

Step 1: Clicking on the **[Upload new model]** button provided, will allow the user to upload a HEC-HMS model in a .zip format.

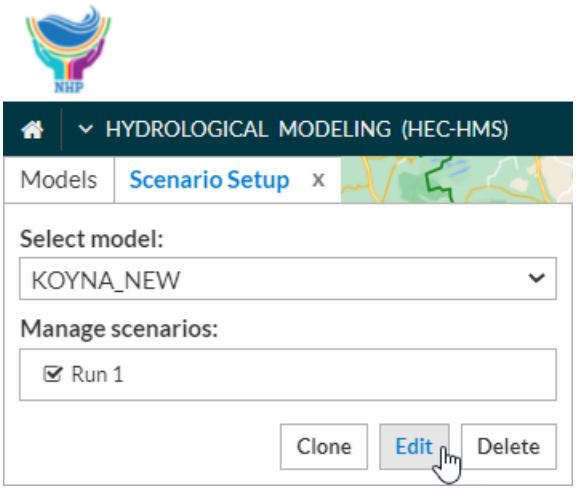


Step 4: After uploading a model it appears on the module interface as shown below.

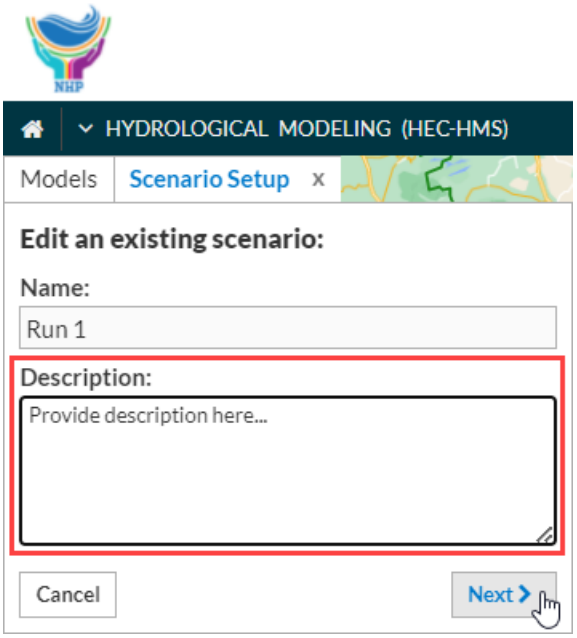


3.3.2 Scenario Setup

After uploading the HMS model, the user can setup the scenario as per their requirements. The scenario setup option allows the user to clone the scenario or to edit the parameters associated with the model.

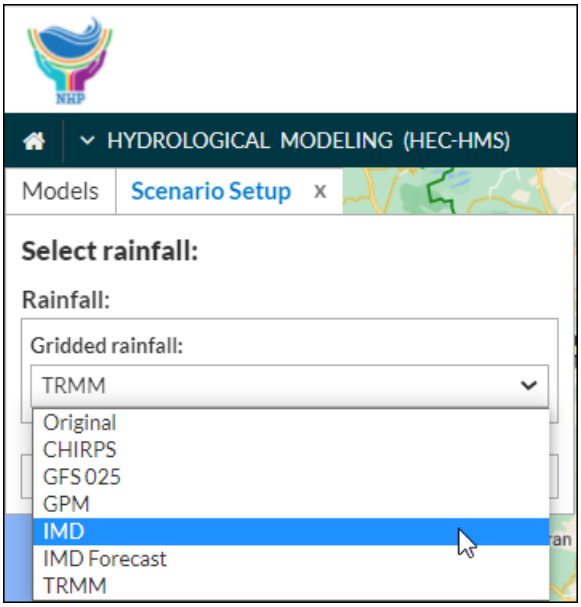


After selecting the scenario, clicking on the **[Edit]** button provided will allow the user to setup an existing scenario as per their requirement. The module allow the user to edit or write the description for that scenario.



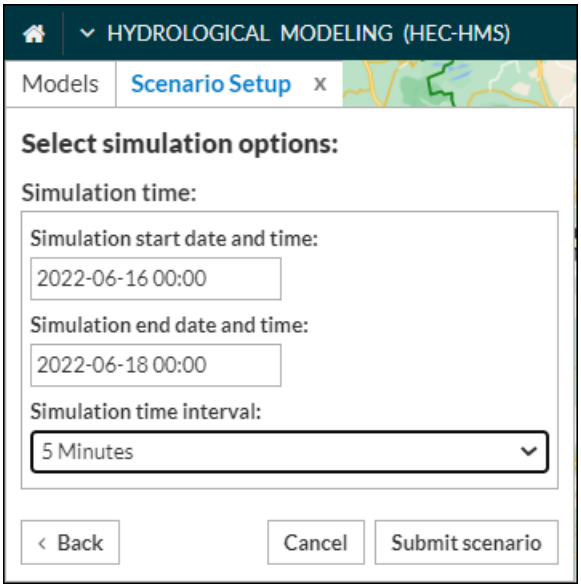
Clicking on the **[Next]** button, the user can edit or define the rainfall for their model. HEC-HMS model uses the gridded data available from different sources for computation. The DSS-PM itself consist a collection of rainfall data which can be viewed in detail at the Knowledge Base section of the module.

The Select Rainfall panel will allow the user to choose any one of the available gridded rainfall as shown.



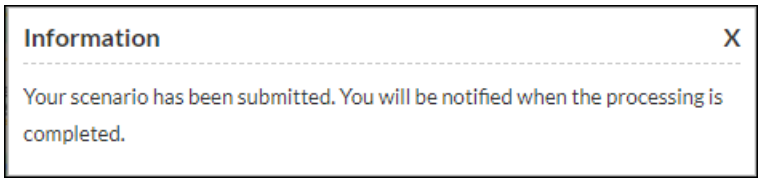
If the user desire to run a scenario using a real time data, then they can select either the **GFS 025** or the **IMD Forecast** rainfall. Also if the user wants to run a forecast analysis, they can opt for the **GFS 025** rainfall.

After selecting the desired gridded rainfall, clicking on the **[Next]** button will allow the user to select the simulation time window for which the user want to run the analysis.



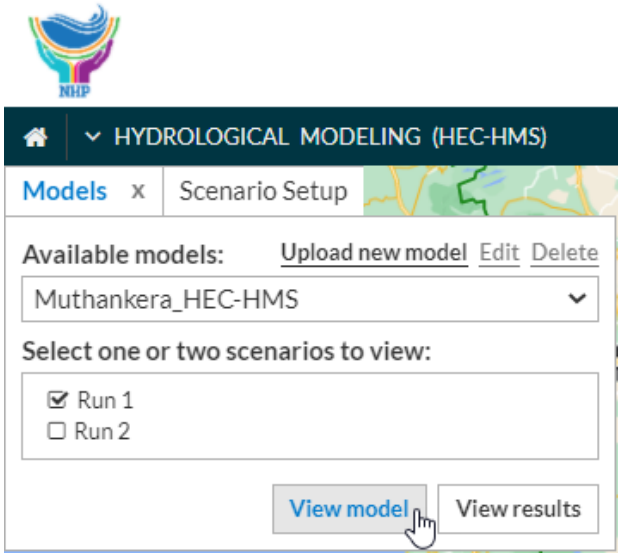
The user will define the simulation start and end date and time entries and will then select the time interval for which the run is to be executed.

After defining all the required parameters for a model, the user can click on the **[Submit Scenario]** button to final submit the scenario. Clicking on the button an informational message box will pop up showing the successful submission of the scenario.

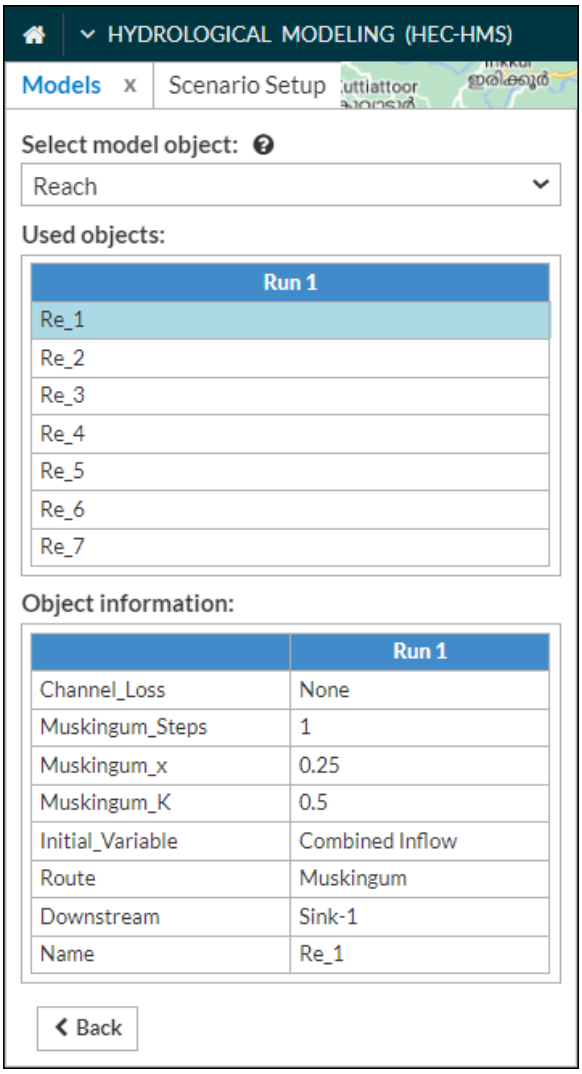


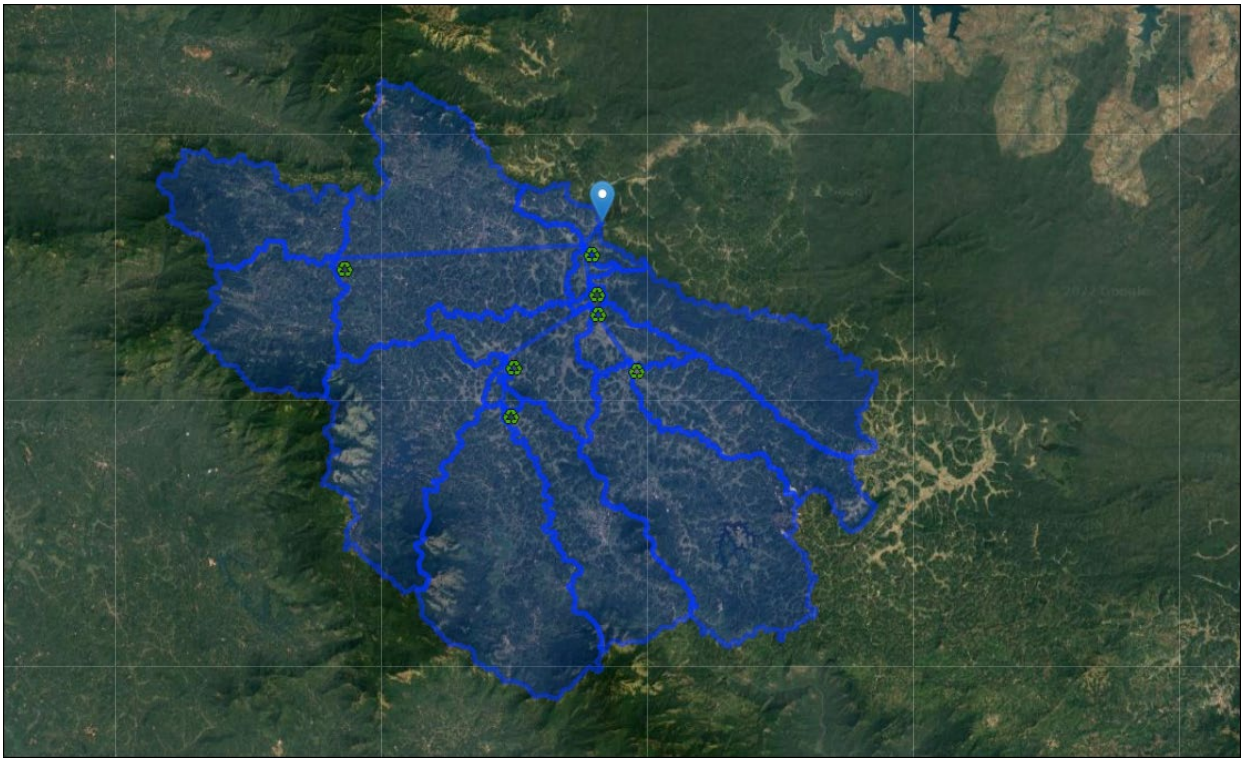
3.3.3 View Model

After uploading the model, the user can select any of the available scenarios and clicking on the **[View model]** will display the associated parameters and HMS elements to the model as shown.



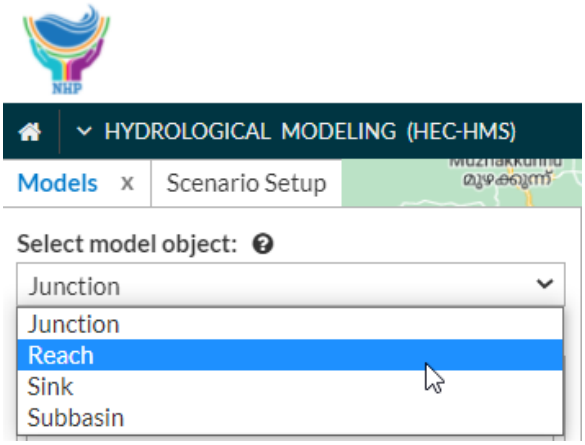
The data of the model will be visible on the panel as well as on the Map View in the shapefile format.



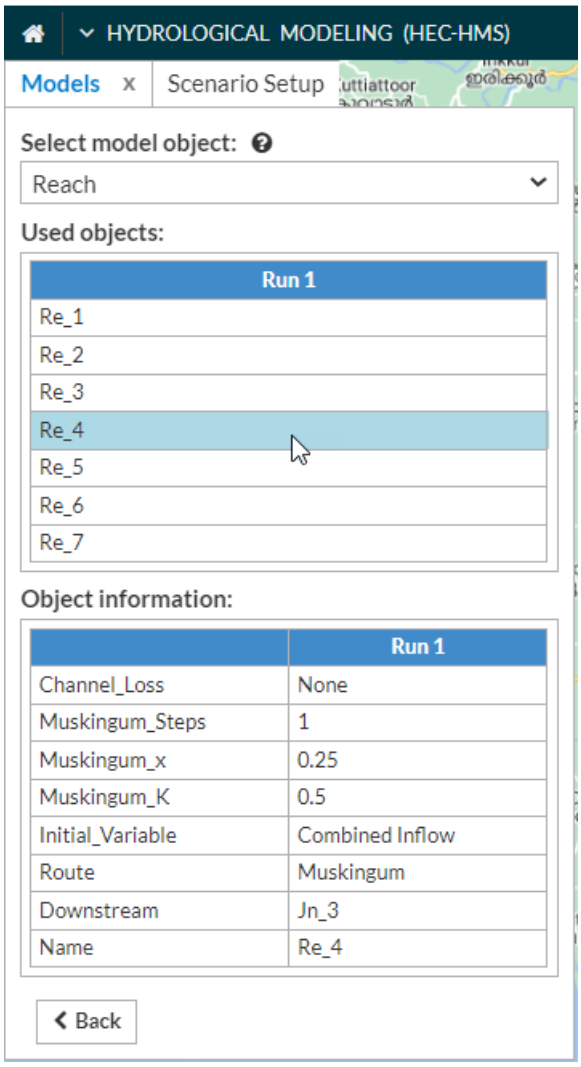


From the data panel, the user can view the different elements associated to their model.

The ***Select model object:*** dropdown will allow the user to select the desired element types available in their model such as Junctions, Reach, and Subbasins etc.

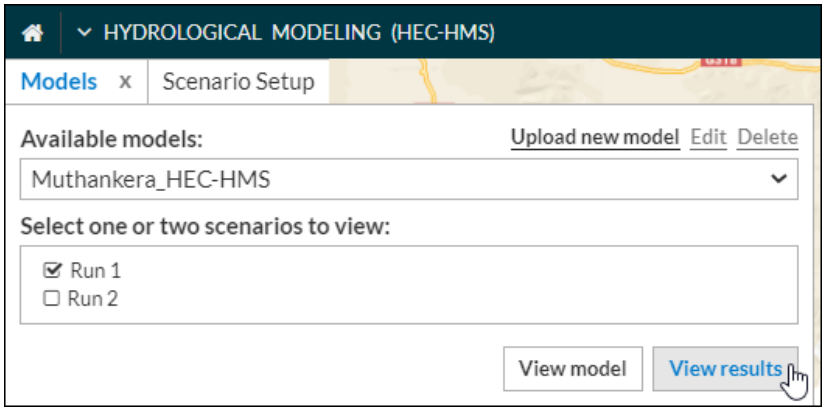


After selecting the element the user can select the different elements under the ***Used objects:*** panel and can view the data associated with the elements in the ***Object information:*** panel as shown below for a reach element (Re_4).

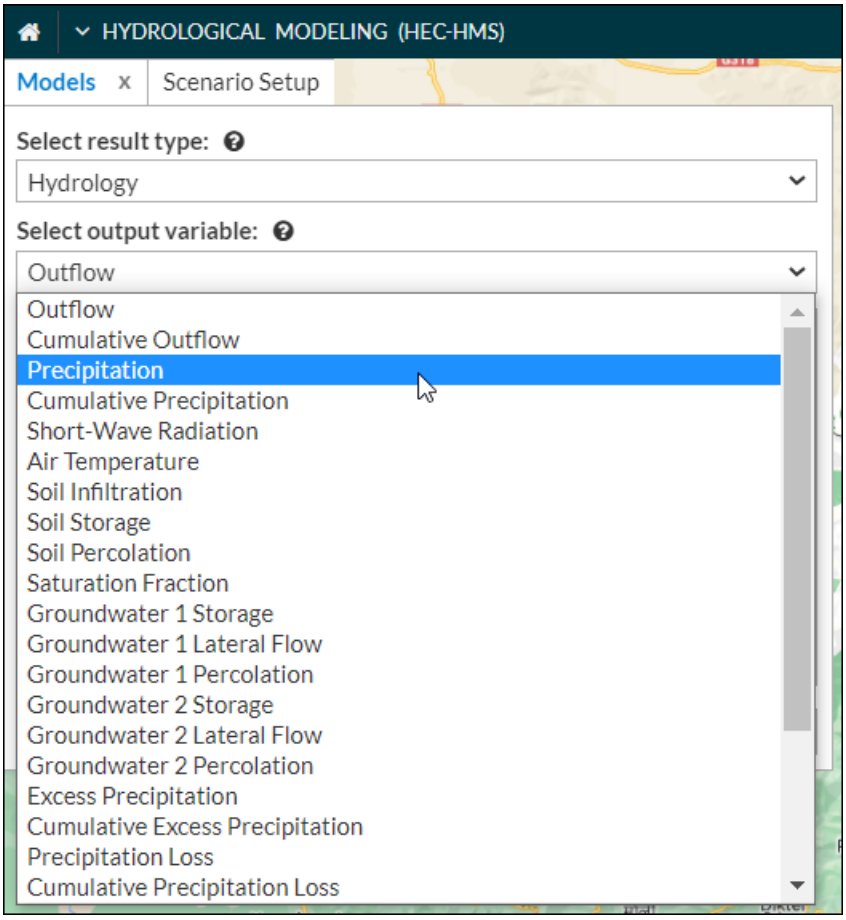


3.3.4 View Results

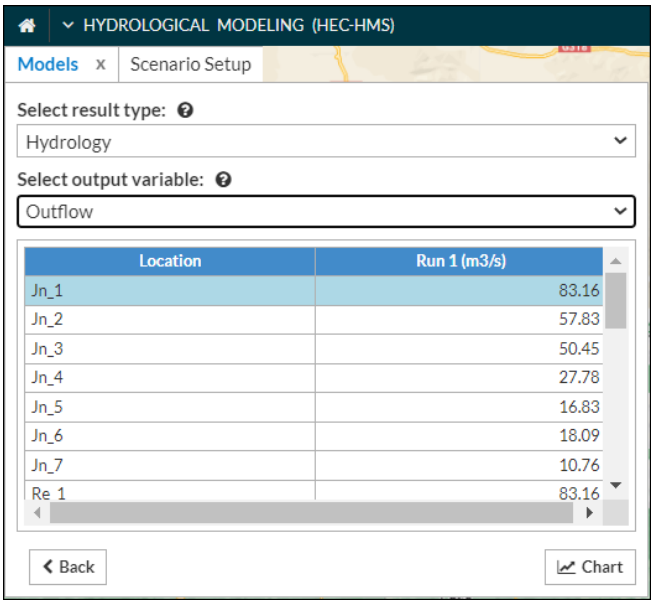
The user can view the result for their model using the **[View results]** button provided in the graphical or tabular format as required.



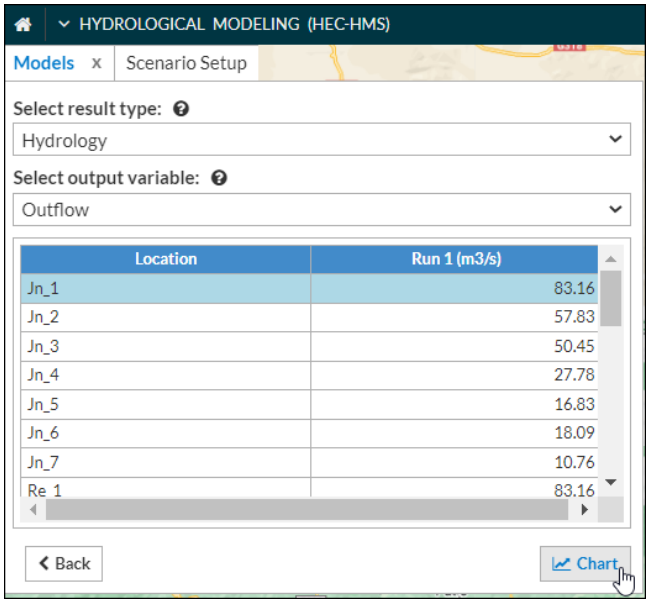
The ***Select output variable:*** dropdown will allow the user to select one of the many variables for the model such as Outflow, Cumulative Outflow, Precipitation, etc.



After selecting the required format the user can view the result in tabular format under the panel for all the elements available in the model as shown.



The user can view the graphical representation of the result by simply clicking on the **[Chart]** button provided, which pop ups the chart window.


HYDROLOGICAL MODELING (HEC-HMS)
Models
Scenario Setup
Select result type:
Hydrology
Select output variable:
Outflow
Location
Run 1 (m3/s)
Jn_1 83.16
Jn_2 57.83
Jn_3 50.45
Jn_4 27.78
Jn_5 16.83
Jn_6 18.09
Jn_7 10.76
Re_1 83.16
Back
Chart

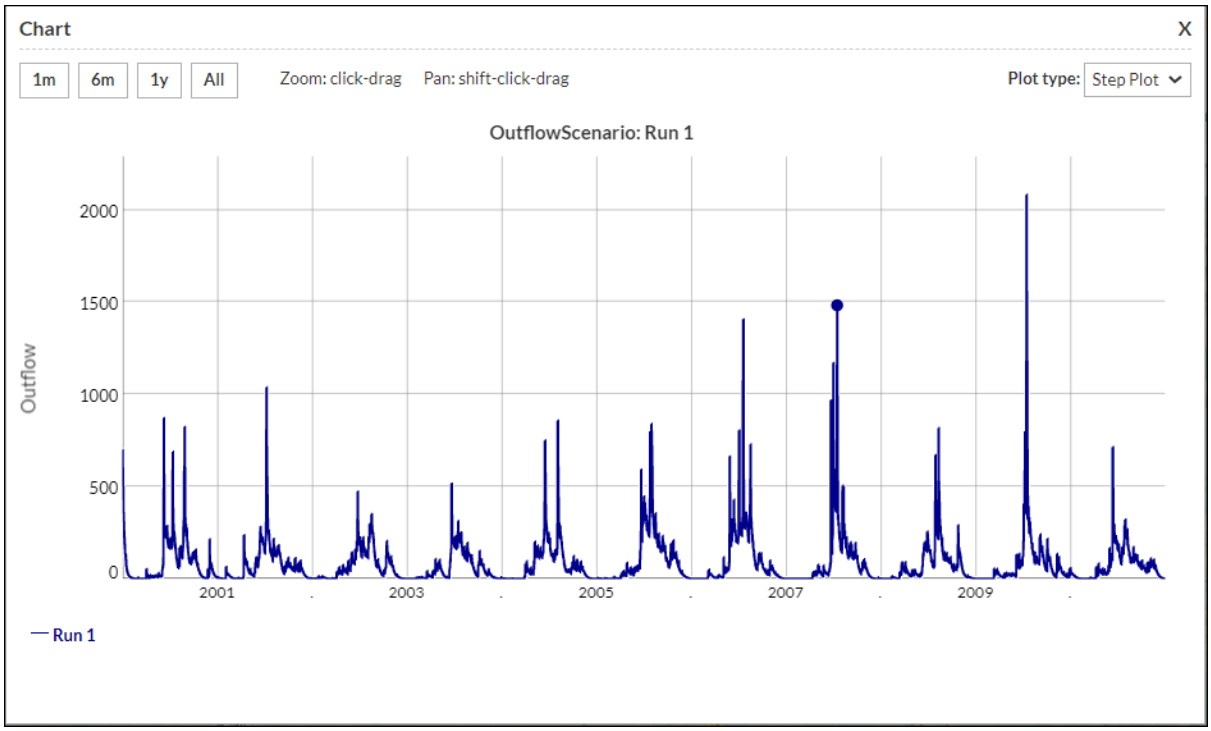
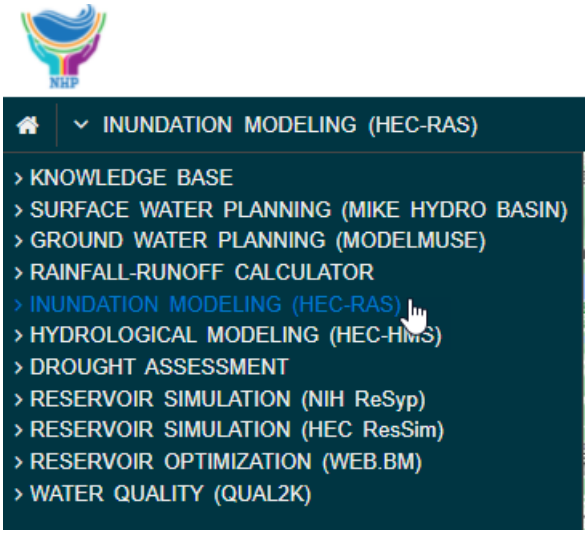


Chart
X
1m
6m
1y
All
Zoom: click-drag
Pan: shift-click-drag
Plot type:
Step Plot
OutflowScenario: Run 1
Outflow
2000
1500
1000
500
0
2001
2003
2005
2007
2009
Run 1

3.4 Inundation Modeling (HEC-RAS)

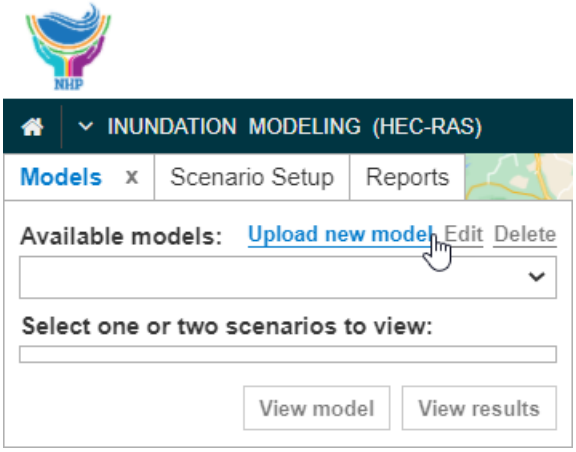
3.4.1 Uploading a Model

After selecting the workgroup created from the **Workgroup** dropdown menu to work on, the user needs to select the **Inundation Modeling (HEC-RAS)** module from the module dropdown provided on the window as shown.

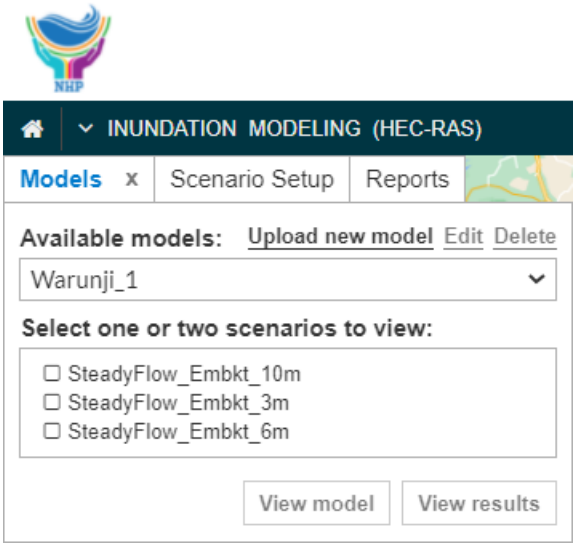


Clicking on the INUNDATION MODELING (HEC-RAS) module, the user will enter the module interface directly. Here the user can upload a new .zip model file. The steps to add a model are as follows:

Step 1: Clicking on the **[Upload new model]** button provided, will allow the user to upload a HEC-RAS model in a .zip format.

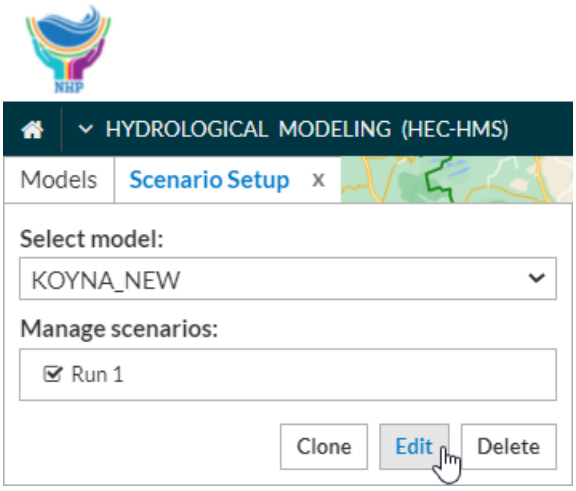


Step 4: After uploading a model it appears on the module interface as shown below.

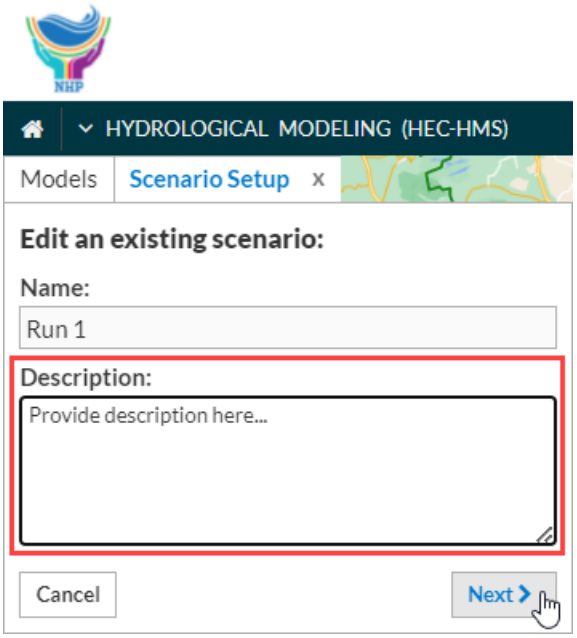


3.4.2 Scenario Setup

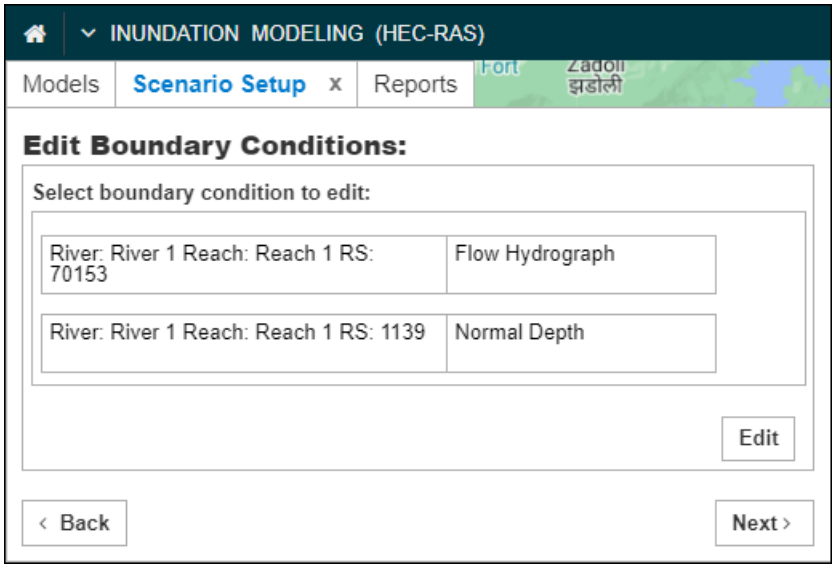
After uploading the HMS model, the user can setup the scenario as per their requirements. The scenario setup option allows the user to clone the scenario or to edit the parameters associated with the model.



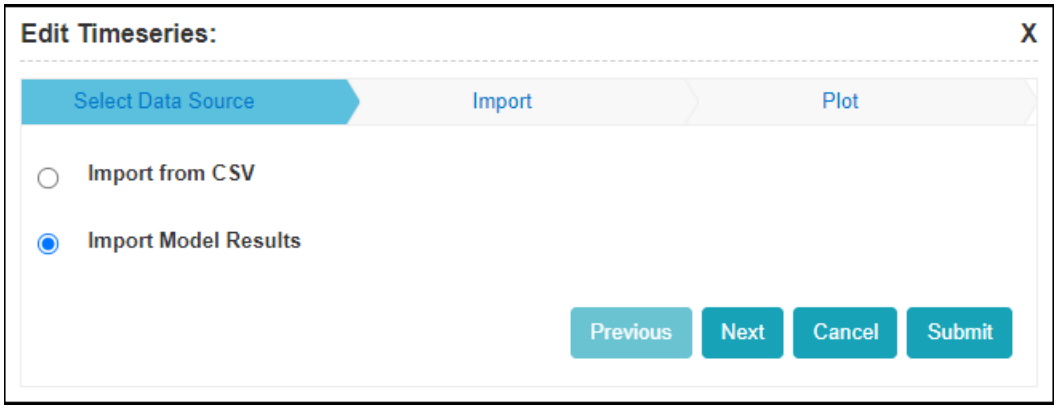
After selecting the scenario, clicking on the **[Edit]** button provided will allow the user to setup an existing scenario as per their requirement. The module allow the user to edit or write the description for that scenario.



Clicking on the **[Next]** button, the user can edit or define the boundary condition associated with their RAS model.

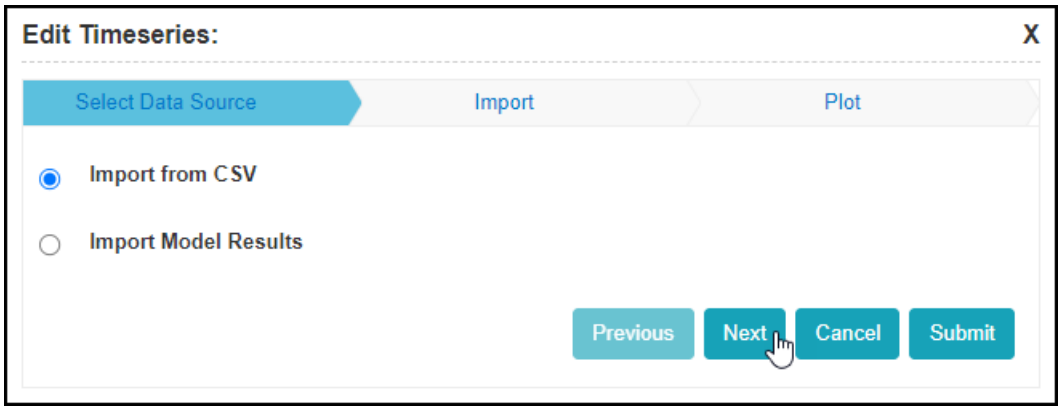


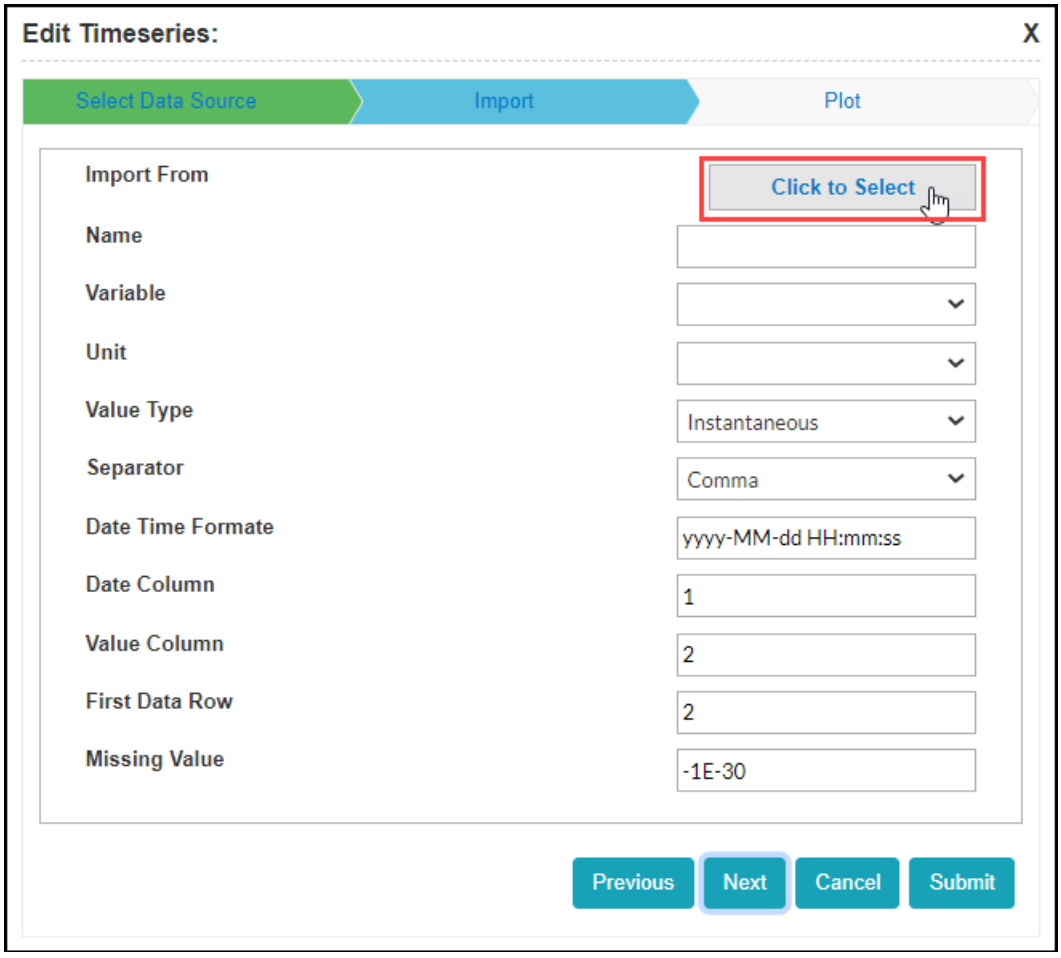
The user can select any of the boundary condition and then click on the **[Edit]** button to edit the data. For example, if the user wants to edit the Flow Hydrograph boundary condition, clicking on the edit button will open up the **Edit Timeseries:** dialog box and user can perform their changes.



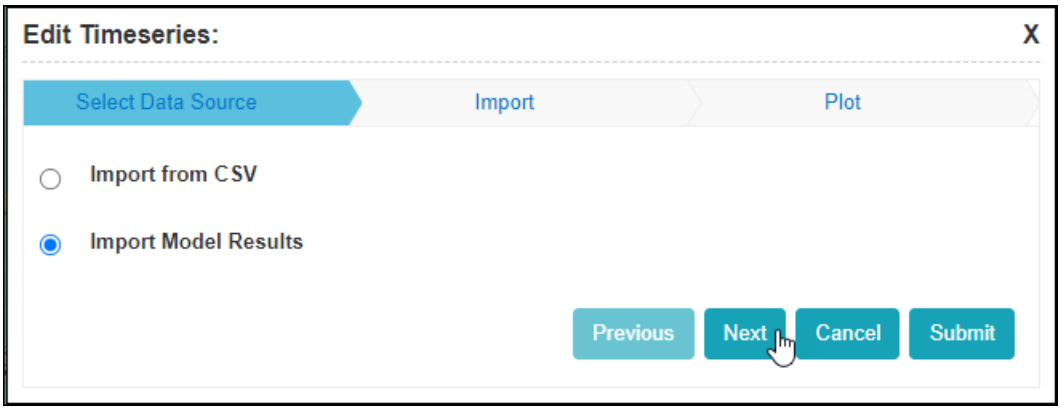
Here the user is allowed to edit the time series using following two options

a. **Import from CSV** radio button, where they can import a .csv file containing the time series and specify necessary details as shown

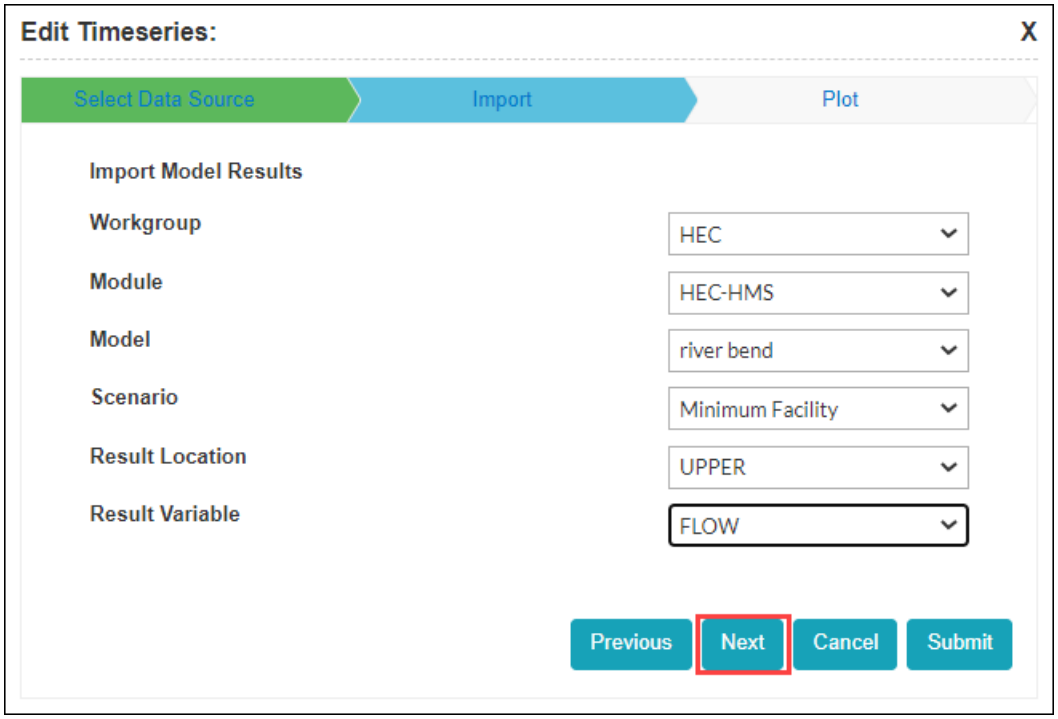




b. Or they can select the **Import Model Result** radio button which allow the user to use the flow hydrograph obtained using the **Hydrological Modeling (HEC-HMS)** module.

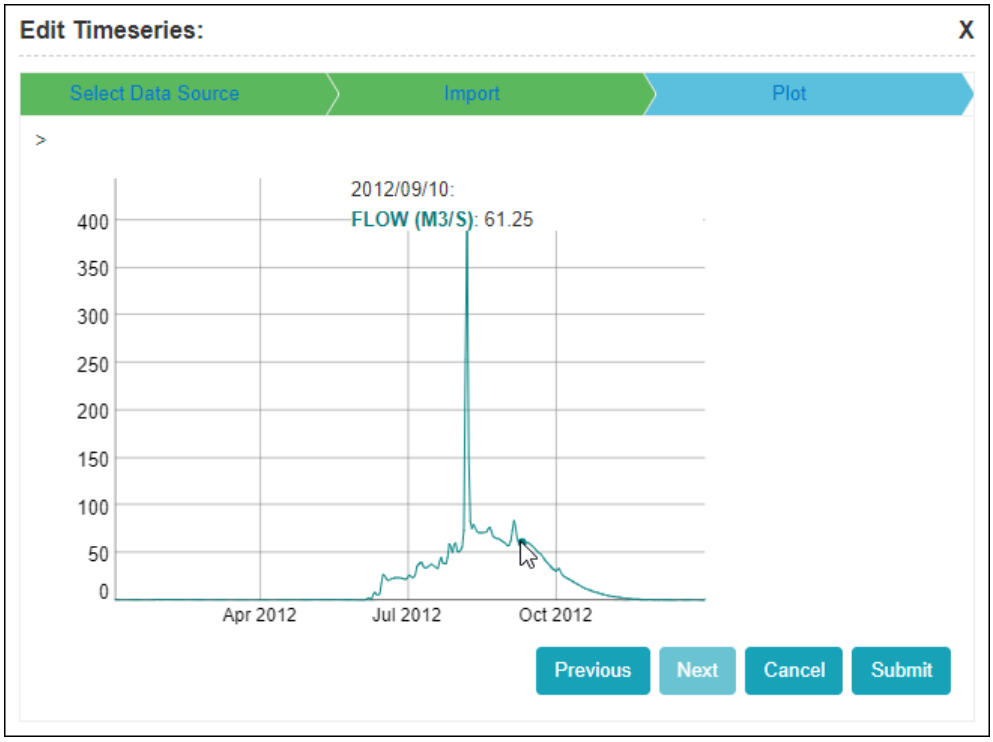


Selecting the Import Model Results radio button and clicking on next will allow the user to define necessary details of the module and the scenario from which the flow hydrograph data is to be obtained as shown.



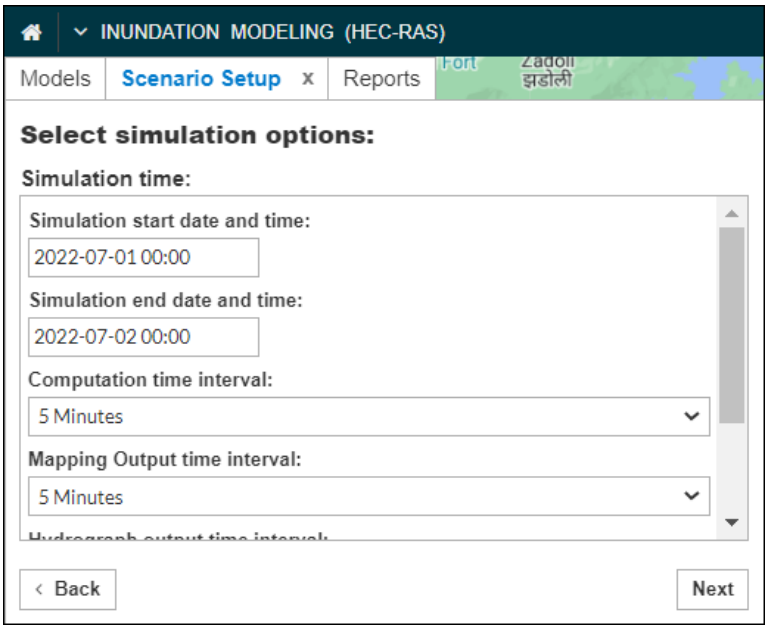
Here, the user first need to define the workgroup under which their project lies. Next from the **Module** dropdown, they can select their module. After this the user can select the Scenario, location and the variable form which the time series data will be obtained.

After defining all the parameters, the user can view the resulting plot of the time series to be used as the boundary condition by clicking on **[Next]** button as shown below.



Clicking on the **[Submit]** button will select the desired time series as the boundary condition.

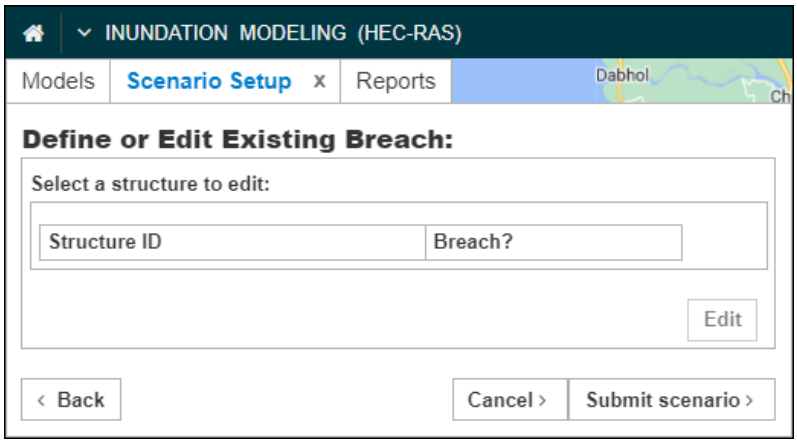
After defining the boundary condition for the model, clicking on the **[Next]** button will allow the user to select the simulation time window for which the user want to run the analysis.



Here the user will require to specify the following parameters

- Simulation start date and time
- Simulation end date and time
- Computational time interval
- Mapping Output time interval
- Hydrograph output time interval
- Detailed output time interval

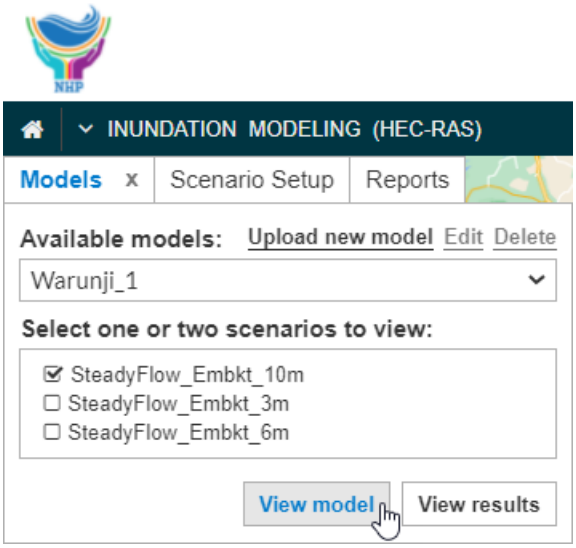
After defined all the above parameters, if the user has defined in their mode, they would be required to specify the data for the Breach structure.



After defining all the required parameters for a model, the user can click on the **[Submit Scenario]** button to final submit the scenario. Clicking on the button an informational message box will pop up showing the successful submission of the scenario.

3.4.3 View Model – Inundation Modeling (HEC-RAS)

After uploading the model, the user can select any of the available scenarios and clicking on the **[View model]** will display the associated parameters and RAS elements to the model as shown.

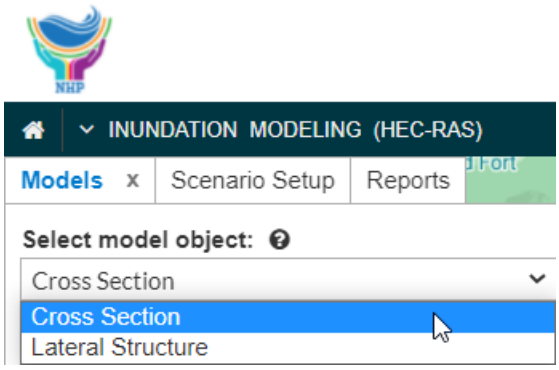


The data of the model will be visible on the panel as well as on the Map View.

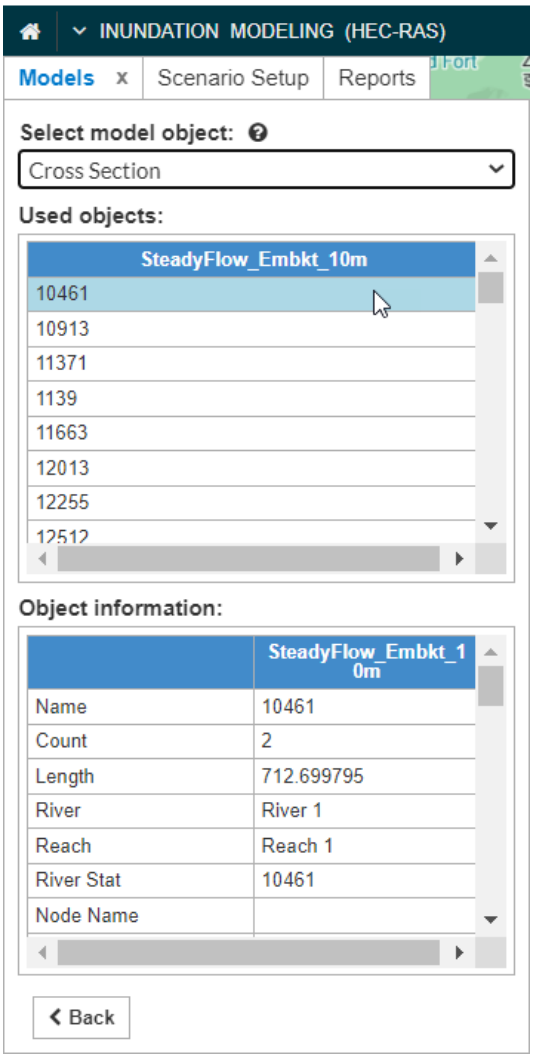
Another model showing a storage area can be seen as shown below.

From the data panel, the user can view the different elements associated to their model.

The ***Select model object:*** dropdown will allow the user to select the desired element types available in their model such as Cross Sections, Lateral Structures or any other RAS elements.

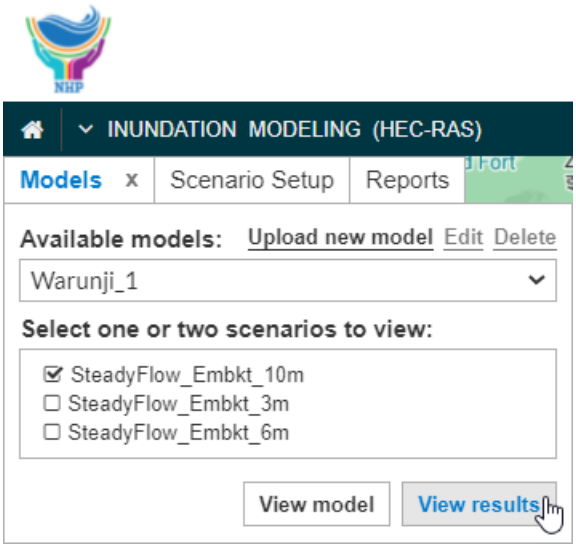


After selecting the element the user can select the different elements under the ***Used objects:*** panel and can view the data associated with the elements in the ***Object information:*** panel as shown below for a cross section element (10461).

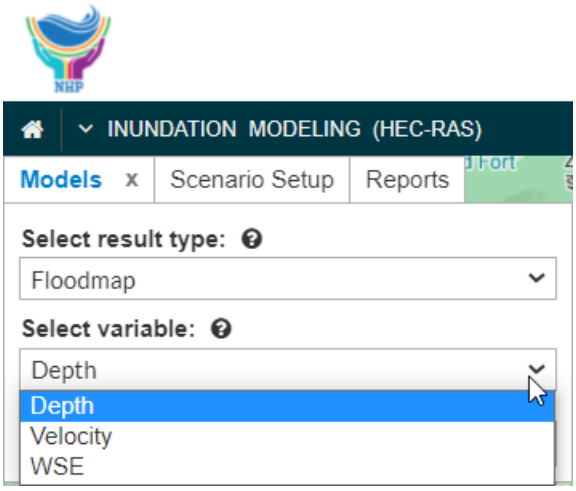

INUNDATION MODELING (HEC-RAS)
Models
Scenario Setup
Reports
Select model object:
Cross Section
Used objects:
SteadyFlow_Embkt_10m
10461
10913
11371
1139
11663
12013
12255
12512
Object information:
SteadyFlow_Embkt_10m
Name
10461
Count
2
Length
712.699795
River
River 1
Reach
Reach 1
River Stat
10461
Node Name
Back

3.4.4 View Results

The user can view the result for their model using the **[View results]** button provided in the graphical or tabular format as required.



The ***Select output variable:*** dropdown will allow the user to select one of the many variables for the model such as Depth, Velocity, WSE, etc.

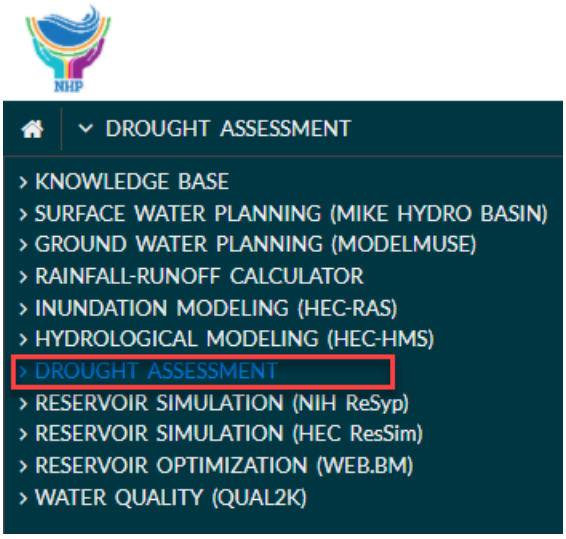


After selecting the required format the user can view the resulting floodmap on the Map View of the module by clicking on the **[View]** button.

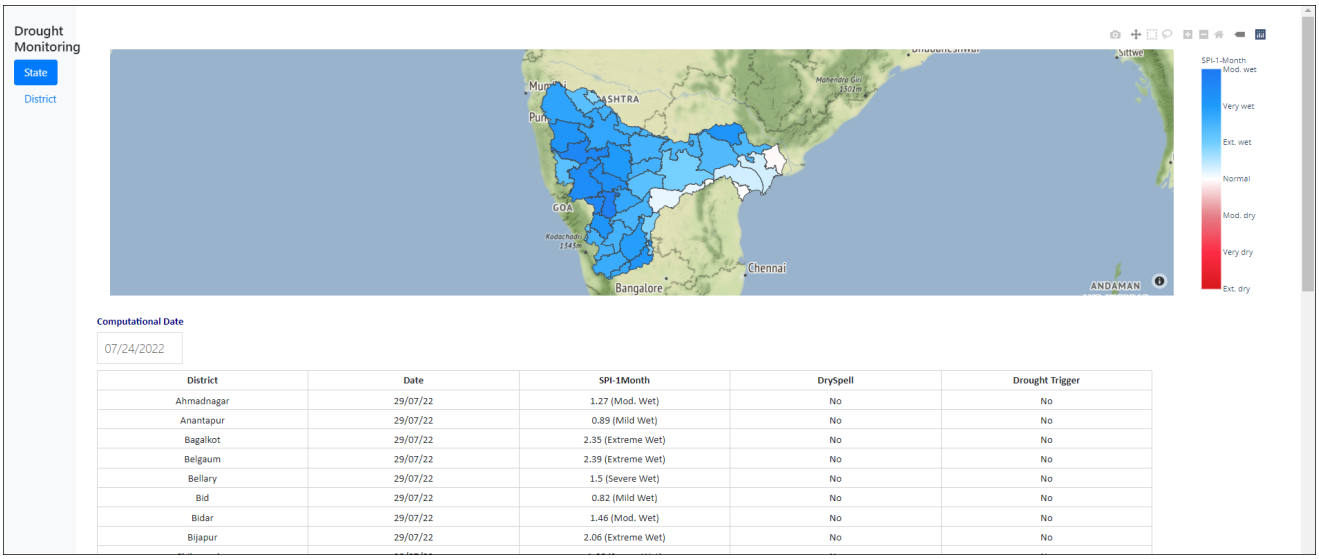

Floodmap (Dep
0
8.33
16.67
25
33.33
41.67
50
Opacity %
100

3.5 Drought Assessment

After selecting the workgroup, the user can select the **Drought Assessment** module from the module dropdown provided on the window as shown.



Clicking on the Drought Assessment option, the user will enter the module interface directly as shown.

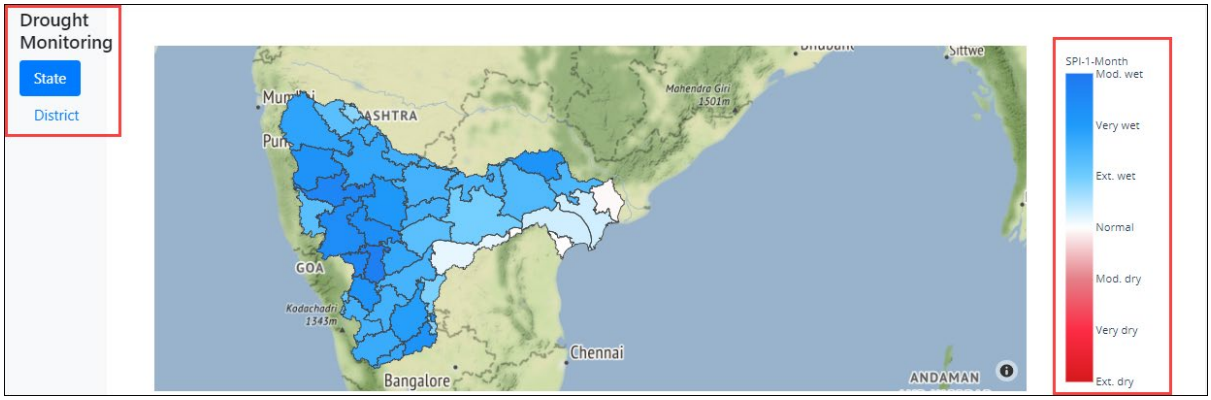


District	Date	SPI-1Month	DrySpell	Drought Trigger
Ahmadnagar	29/07/22	1.27 (Mod. Wet)	No	No
Anantapur	29/07/22	0.89 (Mild Wet)	No	No
Bagalkot	29/07/22	2.35 (Extreme Wet)	No	No
Belgaum	29/07/22	2.39 (Extreme Wet)	No	No
Bellary	29/07/22	1.5 (Severe Wet)	No	No
Bid	29/07/22	0.82 (Mild Wet)	No	No
Bidar	29/07/22	1.46 (Mod. Wet)	No	No
Bijapur	29/07/22	2.06 (Extreme Wet)	No	No

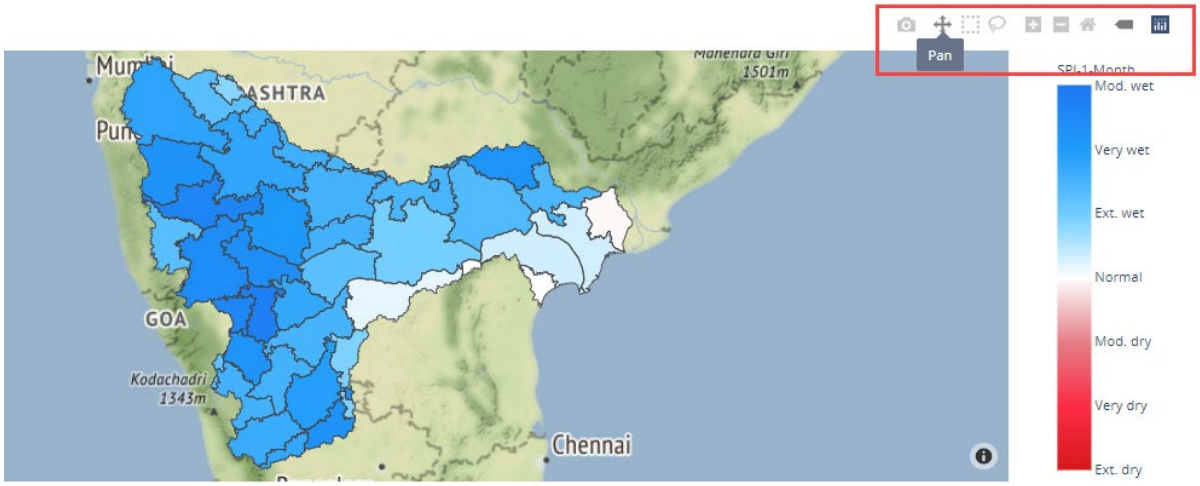
The module interface consists of different sections which allow the user to study the effect of drought.

The Map View of the module display the drought condition of the basin in a raster format. The legends associated for the raster, indicating the SPI index over the area can be viewed on the right side of the map view, as shown.

In addition, using the **Drought Monitoring** section, the user can select the desired state or the district for which they require to assess the data.



Hovering over the map view allow the user to the access to the map toolbar placed at the upper right corner.



The map toolbar consist of different tools such as,

- Download plot as a png
- Pan
- Box Select
- Lasso Select
- Zoom in
- Zoom out
- Reset view

The user have the option to select a date under the **Computational Date** section, if they require to view the historical data. Just below the Map View, the user will get the tabular data for the drought assessment for different districts.

Computational Date

07/24/2022

District	Date	SPI-1Month	DrySpell	Drought Trigger
Ahmadnagar	29/07/22	1.27 (Mod. Wet)	No	No
Anantapur	29/07/22	0.89 (Mild Wet)	No	No
Bagalkot	29/07/22	2.35 (Extreme Wet)	No	No
Belgaum	29/07/22	2.39 (Extreme Wet)	No	No
Bellary	29/07/22	1.5 (Severe Wet)	No	No
Bid	29/07/22	0.82 (Mild Wet)	No	No
Bidar	29/07/22	1.46 (Mod. Wet)	No	No
Bijapur	29/07/22	2.06 (Extreme Wet)	No	No
Chikmagalur	29/07/22	1.66 (Severe Wet)	No	No
Chitradurga	29/07/22	1.92 (Severe Wet)	No	No
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Raichur	29/07/22	1.25 (Mod. Wet)	No	No
Rangareddy	29/07/22	1.46 (Mod. Wet)	No	No
Ratnagiri	29/07/22	0.69 (Mild Wet)	No	No
Sangli	29/07/22	2.6 (Extreme Wet)	No	No
Satara	29/07/22	2.2 (Extreme Wet)	No	No
Shimoga	29/07/22	1.55 (Severe Wet)	No	No
Sindhudurg	29/07/22	0.42 (Mild Wet)	No	No
Solapur	29/07/22	1.78 (Severe Wet)	No	No
Tumkur	29/07/22	2.2 (Extreme Wet)	No	No
Udupi	29/07/22	0.96 (Mild Wet)	No	No
Uttara Kannada	29/07/22	1.16 (Mod. Wet)	No	No
Warangal	29/07/22	2.18 (Extreme Wet)	No	No
West Godavari	29/07/22	-0.05 (Mild Dry)	No	No
Yadgir	29/07/22	1.55 (Severe Wet)	No	No

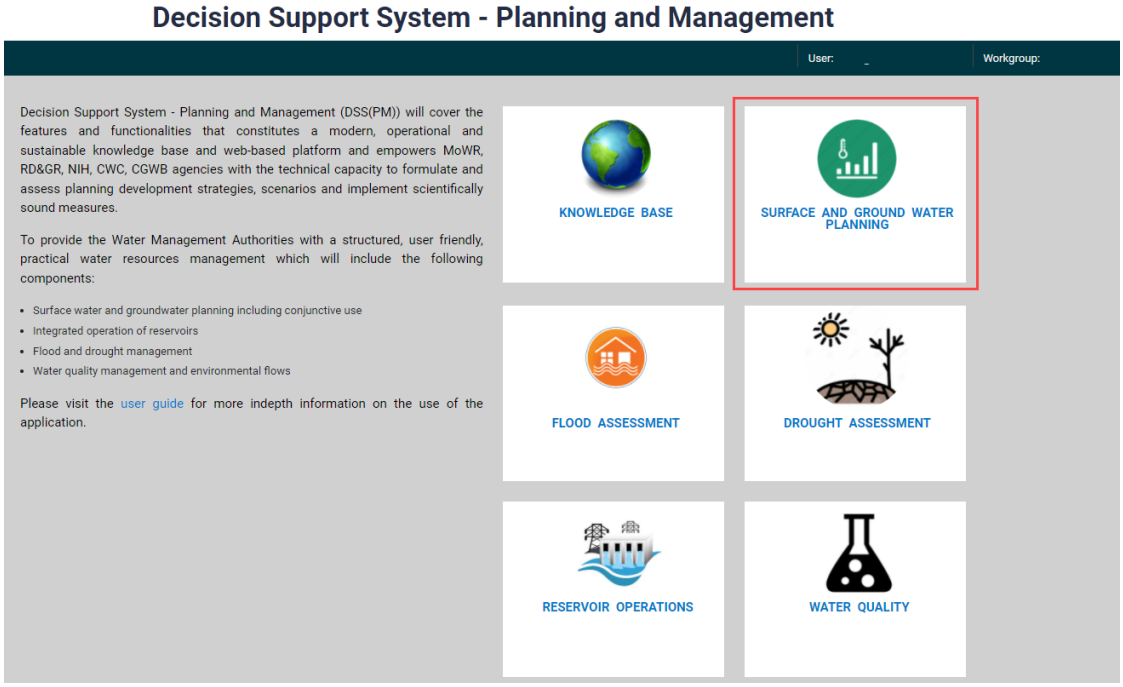
« ‹ 1 › »

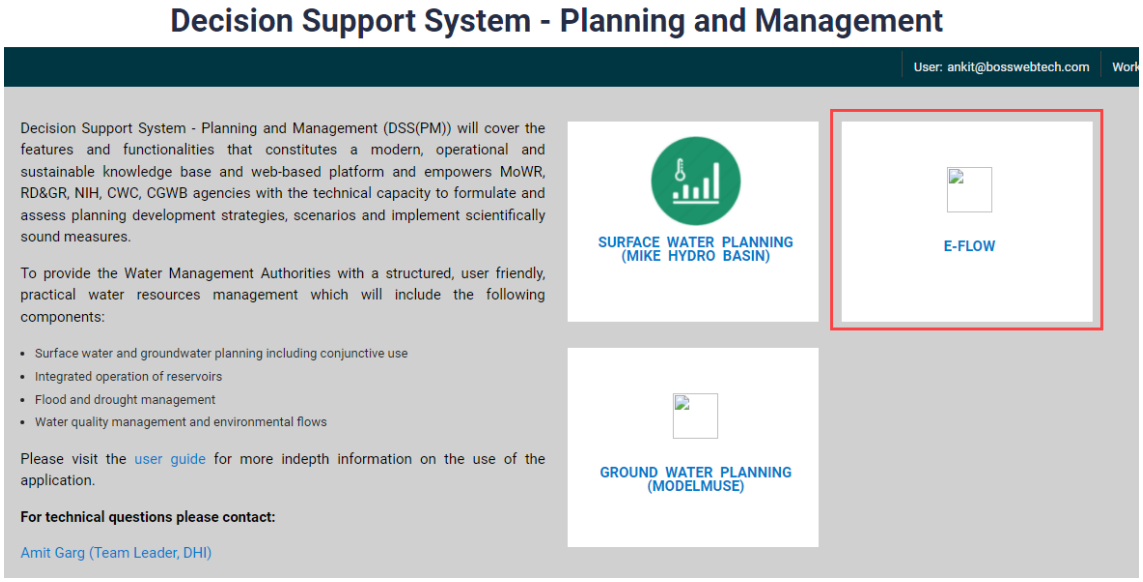
This data has been provided in a tabular manner with different columns such as,

- Date
- SPI Month: indicating the monthly average value of the SPI index.
- DrySpell:
- Drought Trigger

3.6 E-Flow

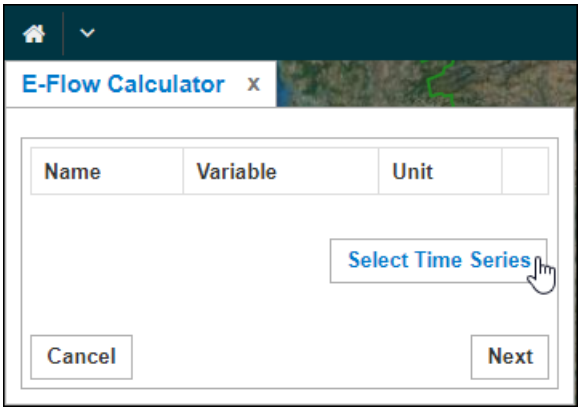
From the DSS-PM home page, the user will select the **SURFACE AND GROUND WATER PLANING** option and from there they have the option to select the **E-FLow** module option as shown below.



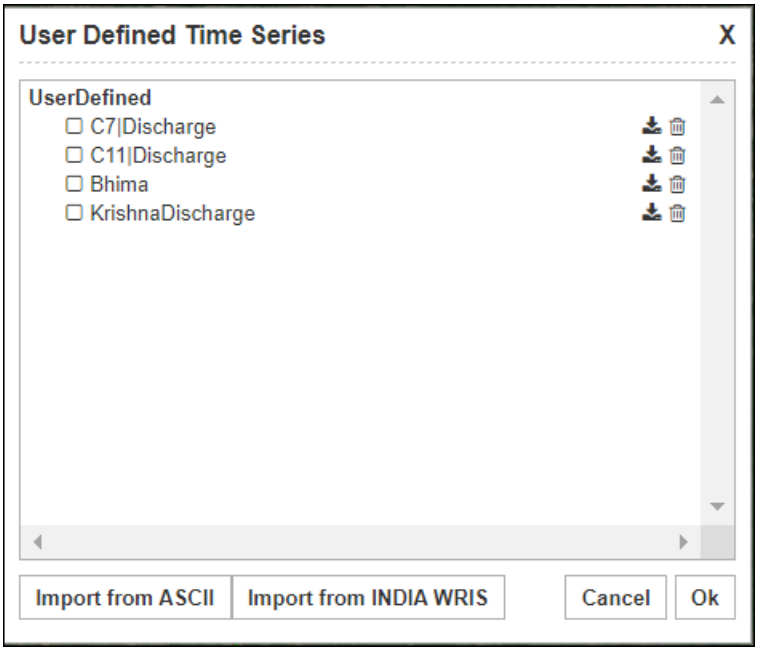


After entering the module, the user can click on the E-Flow Calculator button to open up the panel from where they can proceed to the calculator.

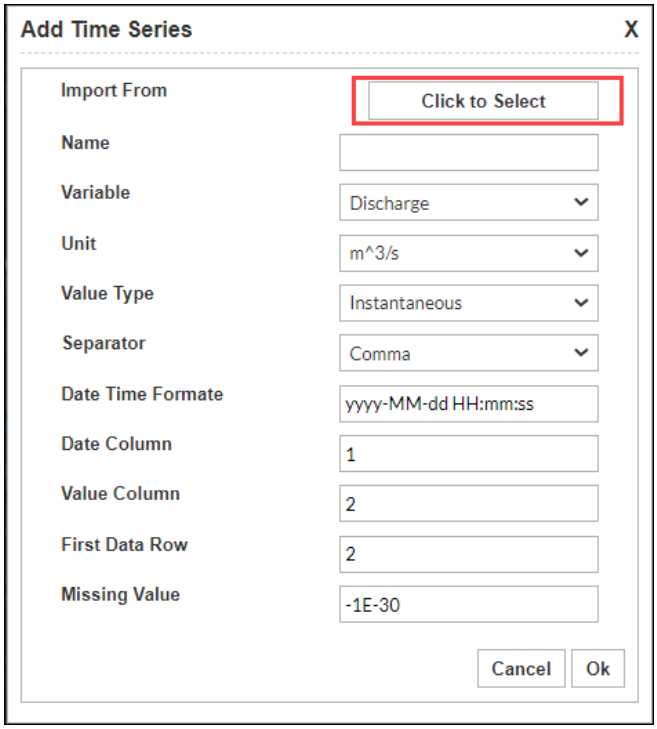
Clicking on the **Select Time Series** buttons allows the user to open up the User Define Time Series dialog box.



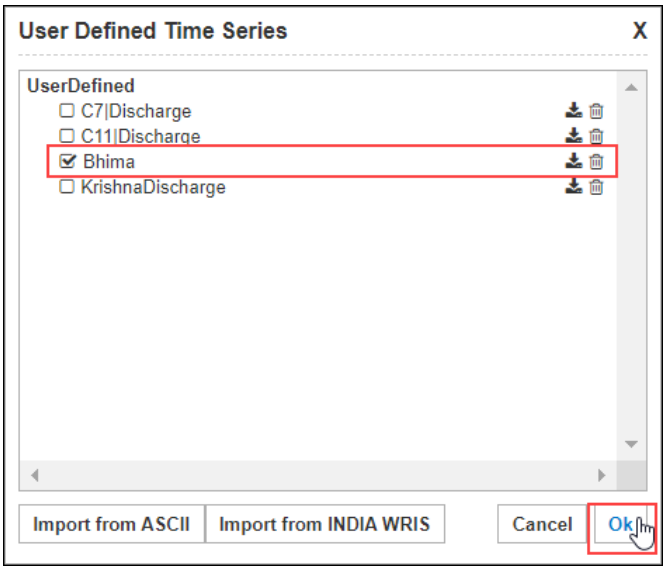
From the User Defined Time Series dialog box, the user can select the previously defined time series available under the UserDefined section, or can import an ASCII fie using the **Import from ASCII** button.



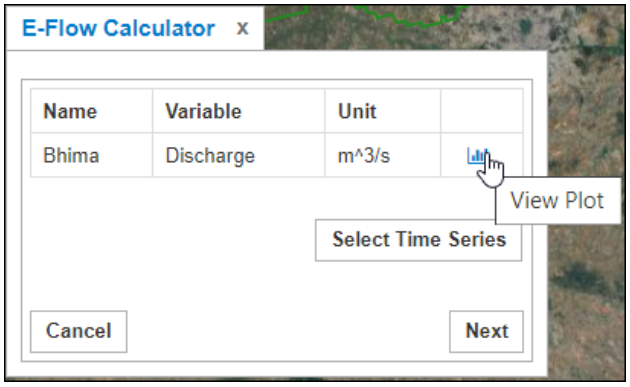
Clicking on the **Import from ASCII** opens up the Add Time Series dialog box, which allows the user to import the time series using the **Click to select** button and define other data associated with the time series such as variable, unit, value type etc.



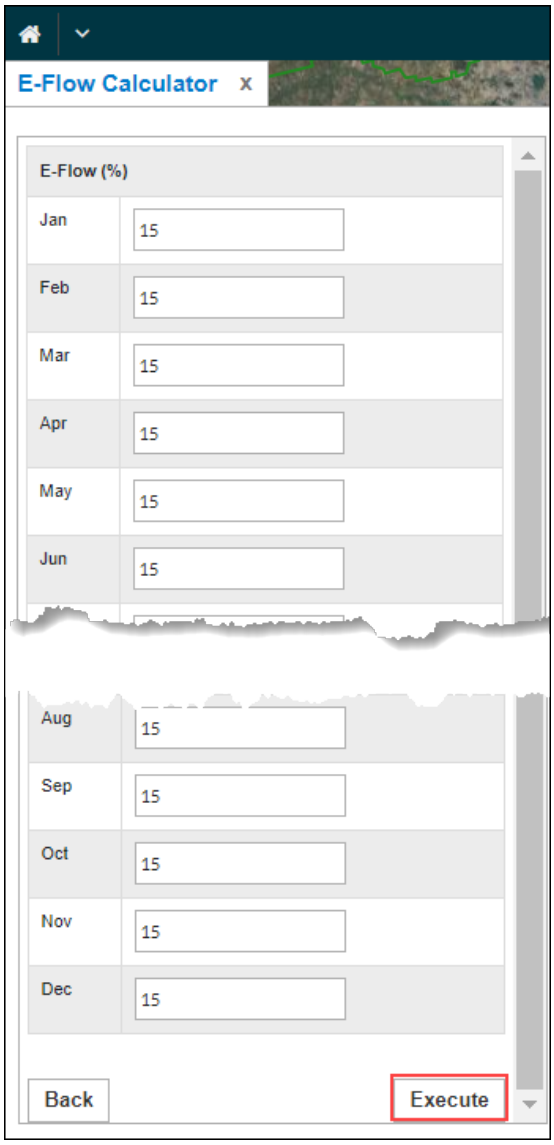
Either after selecting a predefined time series or importing one, clicking on **[OK]** button will add up the selected time series under the E-Flow Calculator panel.



After adding the time series to the panel, user can click on the **View Plot** button provided to view the graphical representation of the time series.

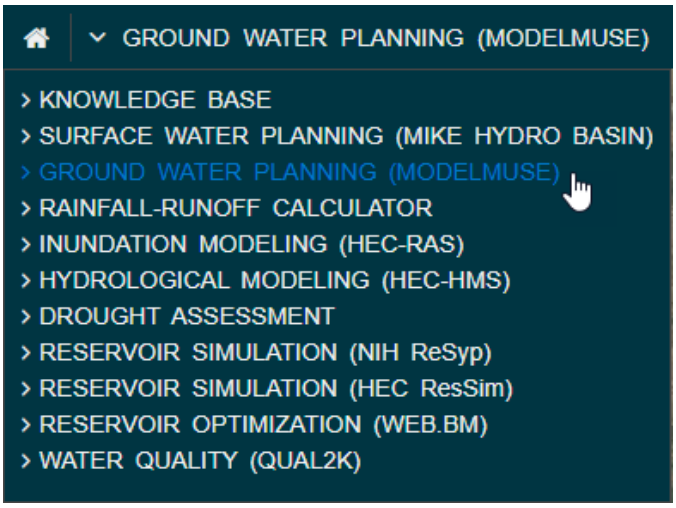


Clicking on the **[Next]** button, the user can specify the E Flow (%) value for different months throughout the year and click on the **[Execute]** button to execute the command.



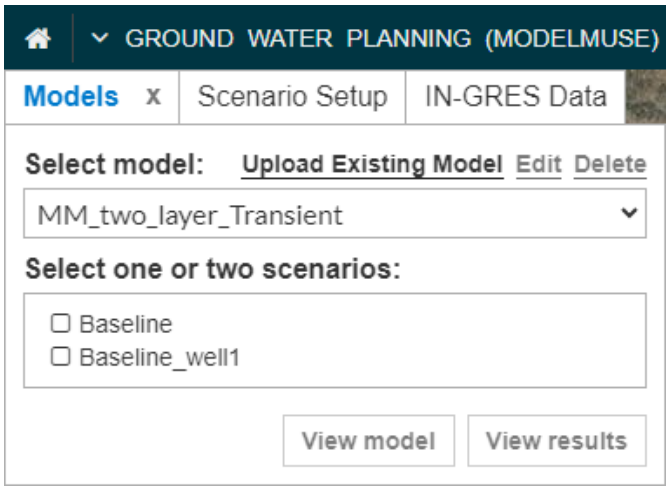
3.7 Ground Water Planning (MODELMUSE)

After selecting the workgroup from the **Workgroup** dropdown menu to work on, the user needs to select the **GROUND WATER PLANNING (MODELMUSE)** module from the module dropdown provided in the window as shown.

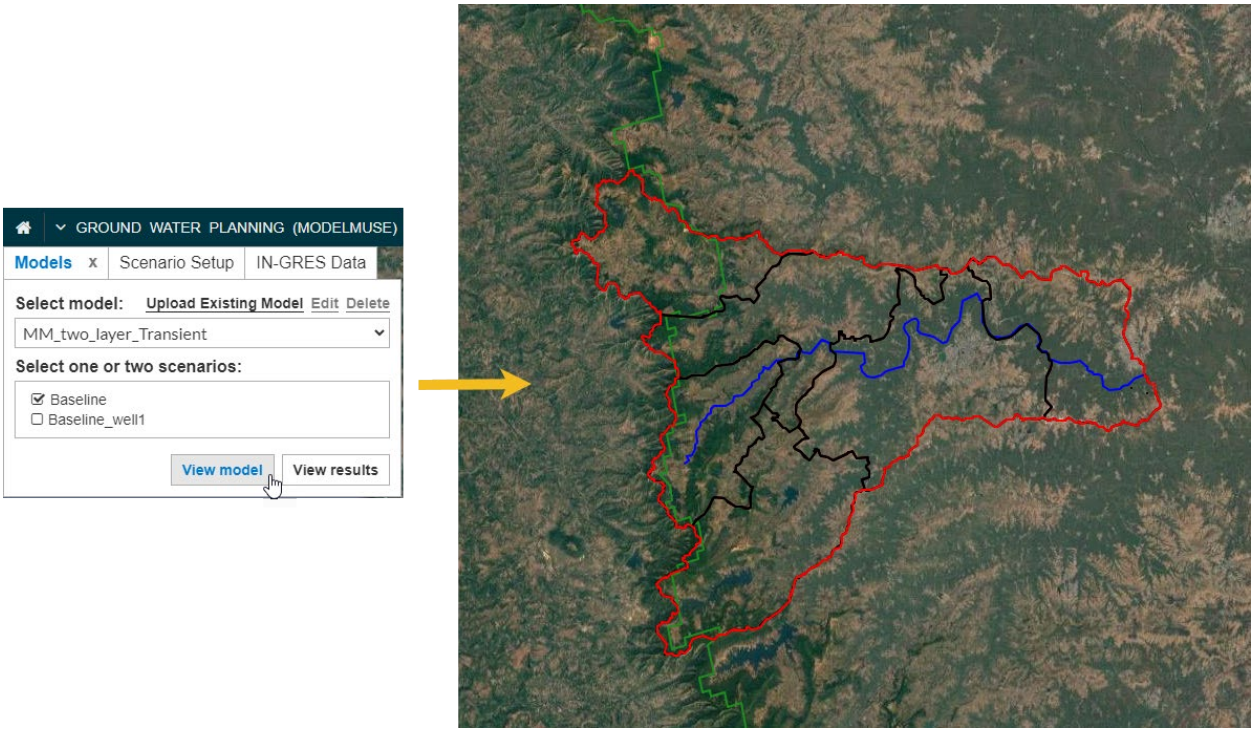


3.7.1 Models

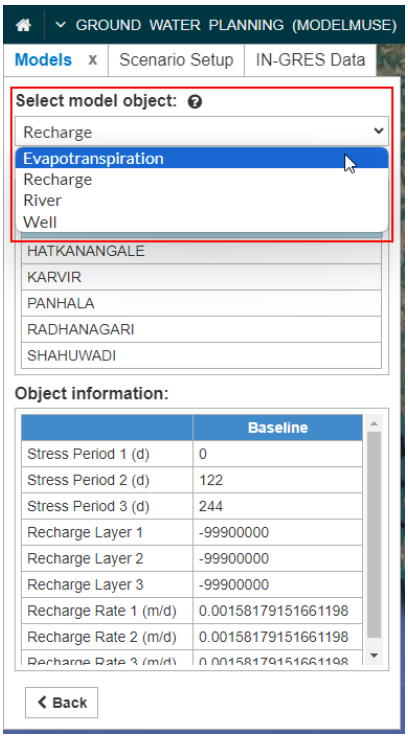
Clicking on the GOUND WATER PLANNING (MODULEMUSE) module, the user will enter the module interface directly, as shown below.



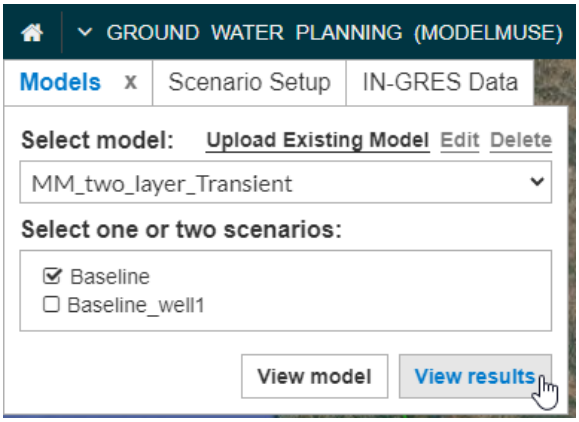
Here the user can upload a new .zip model file using the **Upload Existing Model** option provided. After adding the model, the user can view the model as well as the result by selecting the required scenario and clicking on the **[View model]** and **[View Results]** buttons, as shown below.

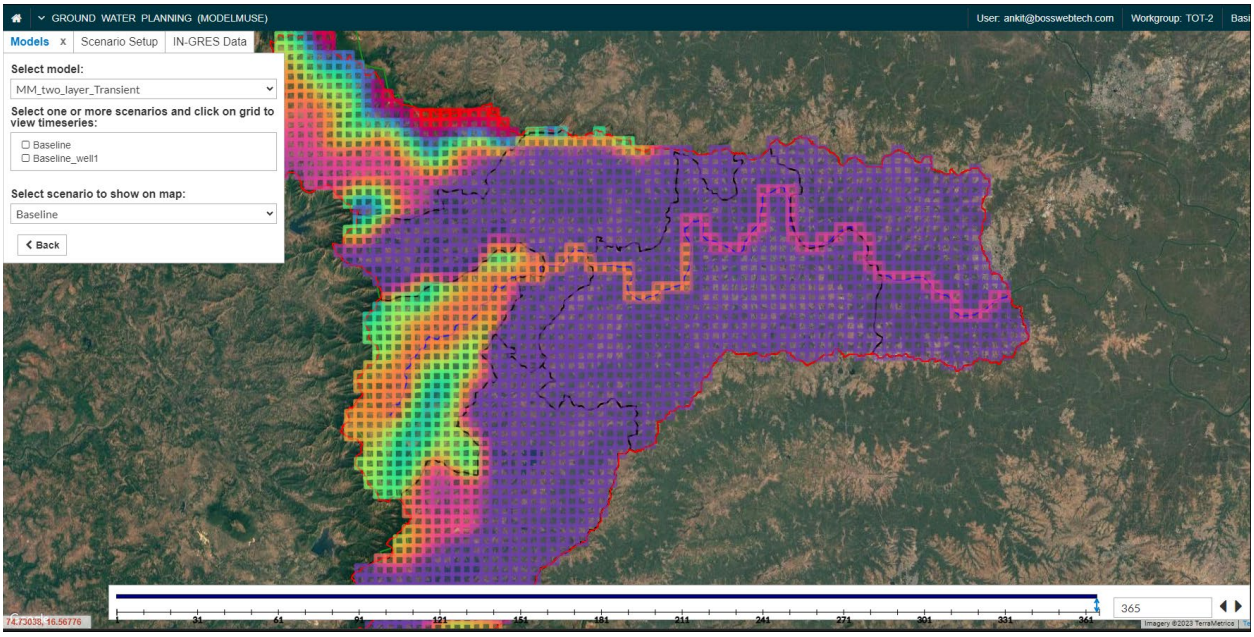


The user can view the information related to different model object, directly from the interface by selecting the model object as shown.

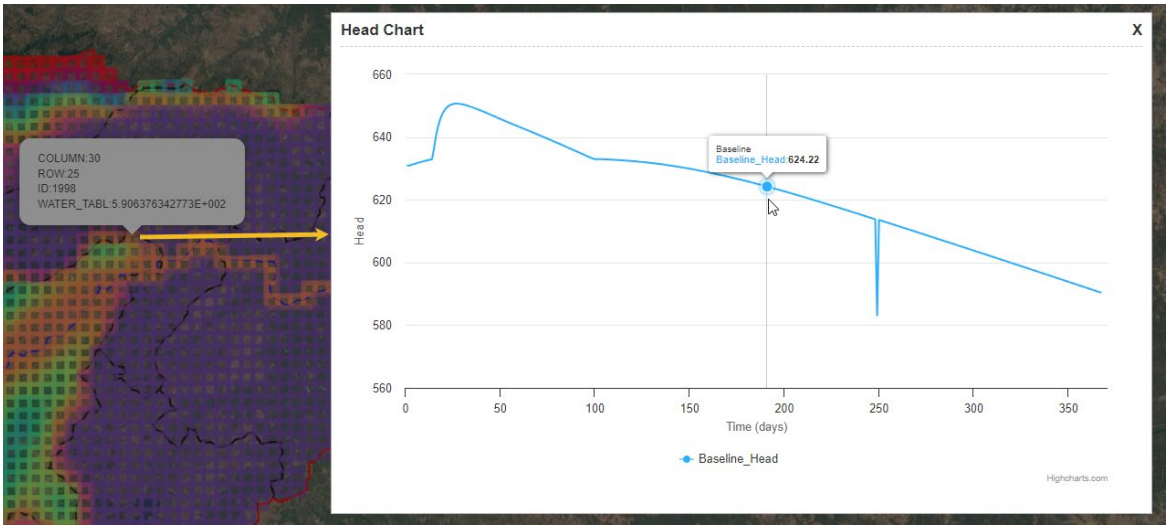


After selecting the desired scenario and clicking on the **[View Results]** tab, the module displays a grid over the map view of the depicting the model, as shown below.



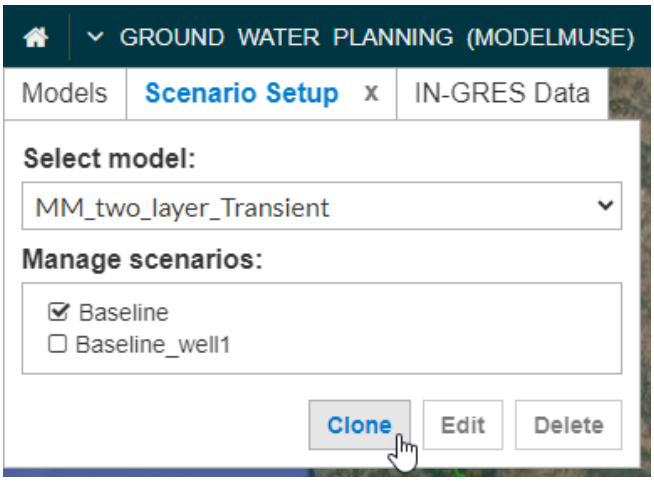


Selecting a scenario and clicking anywhere on the grid displays a time series result on the map view.

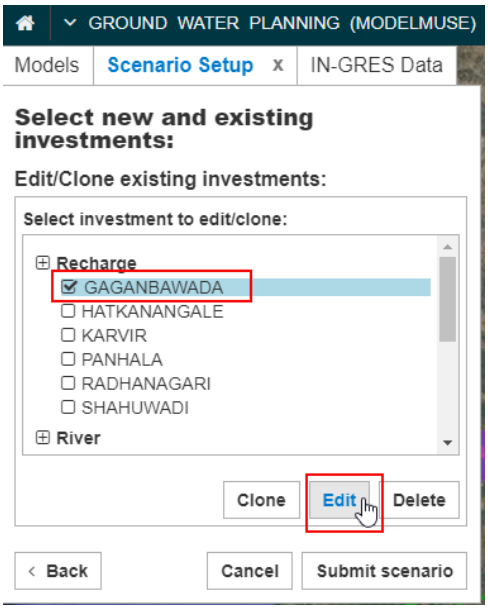


3.7.2 Scenario Setup

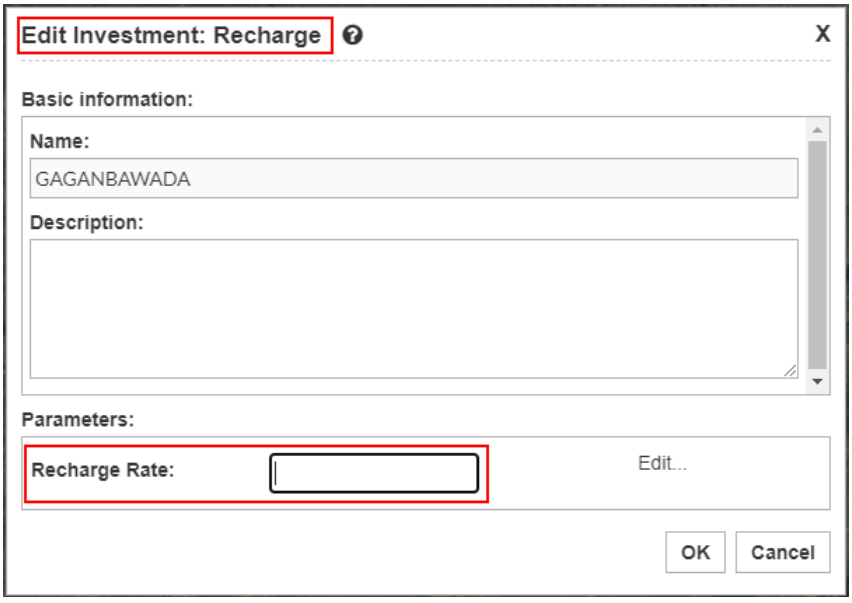
The **Scenario Setup** panel is identical to the Surface Water Planning (MIKE HYDRO BASIN) panel. The **Scenario Setup** allow the user to clone, edit or even delete the scenario form the uploaded model.



Clicking on the **[Clone]** button for any scenario, the **Select new and existing investment** section of the module allows the user to clone or edit the existing investment as shown.



Clicking on the **[Edit]** button will open up the **Edit Investment** dialog, where the user can edit the description or the parameters for their investment. For example, below image shows the **Edit Investment** dialog for the Recharge investment, where the user can specify/change the **Recharge Rate** parameter.



After defining the investment data, clicking on the **[Submit Scenario]** button will update the scenario in the model.

3.7.3. IN-GRES Data

The **GEOUND WATER PLANNING (MODELMUSE)** module also allows user to download or view the IN_GRES data by specifying the location.