

MIKE+
Guide to existing MIKE URBAN Users
Migration



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1 Introduction

MIKE+ is the new and future modelling platform for modelling all urban and river water systems.

It is introduced as a full featured urban modelling package for modelling Water Distribution, Collection System, Rivers and 2D Overland. MIKE+ is the successor of MIKE URBAN.

The MIKE 2025 Release includes MIKE+. However, MIKE URBAN 2020 update 1 is the last release of MIKE URBAN and it is required to be installed on the same PC as the MIKE+ 2025 version in order to import and migrate existing MIKE URBAN models.

The current document targets existing MIKE URBAN users with the aim of informing about the current contents and features of MIKE+ as well as outlining the main steps involved in migrating from MIKE URBAN to MIKE+.

2 Release and License Information

MIKE+ is our primary urban software product for sale with the MIKE+ Release 2019 and forward.

New purchases of MIKE+ ArcGIS product include licenses to access both MIKE+ and MIKE URBAN. MIKE+ and MIKE URBAN can coexist on the PC and run simultaneously.

MIKE+ comes in two versions:

- MIKE+
- MIKE+ ArcGIS

The difference between the two version is that MIKE+ ArcGIS includes a license for ArcGIS Pro, ArcGIS and one seat for ArcGIS Online as well as installation files for ArcGIS Pro.

In both MIKE+ and MIKE+ ArcGIS, there is an ArcGIS integration option by which export of data to ArcGIS Pro is possible. This integration requires a license for ArcGIS Pro.

Existing users of MIKE URBAN with a valid Service and Maintenance Agreement (SMA) have got access to MIKE+ ArcGIS version without additional fees.

2.1 Releases

The following list describes the main improvements added to the first versions of MIKE+ (initially named MIKE URBAN+). MIKE+ is now considered fully replacing MIKE URBAN with many advantages, and the content of the latest versions is not described here. Refer to release notes of the latest versions for specific information on their content.

- the first release in May 2019, MIKE URBAN+ 2019, includes support of water distribution and collection systems
- the second release in November 2019, MIKE URBAN+ 2020, includes:

- 2D Overland flood modelling
 - Culvert Structures
 - Sediment Transport
 - Import of existing MIKE URBAN Scenarios
 - Enhanced LTS functionality
 - Improved result presentation workflow
- the third release in June 2020, MIKE URBAN+ 2020 Update 1, includes:
 - Enhancements to 2D Overland flood modelling
 - New river hydraulics module and option to connect to collection system and
- the fourth release in November 2020, MIKE+ 2021, includes
 - Water Hammer
 - Support of SWMM5 hydraulics and hydrology
 - Cross section generation for river
 - Cross section viewing of 1D and 2D results
 - Non-Newtonian 2D flow
- the fifth release in May 2021, MIKE+ 2021 Update 1, includes
 - Support of water quality for SWMM5 projects
 - Pump emergency storage estimation for collection systems
 - Support of EPANET 2.2 engine for Water Distribution
- the sixth release in November 2021, MIKE+ 2022, includes
 - Coupling of SWMM5 with 2D Overland module
 - Export of map data and profile plots to CAD file
 - New tool to analyze results differences between collection systems simulations
 - All river structures supported
 - Automatic import of river models from MIKE HYDRO River or MIKE 11
 - Optimization module for pumps and valves scheduling for Water Distribution
- the tenth release in November 2023, MIKE+ 2024, includes
 - A full-featured river module replacing MIKE HYDRO River and MIKE 11
 - New functionalities to compute average demand, leakage, and demand patterns per zone, for Water Distribution models
 - A new tool to convert 2D flood results to polygon classes.

3 Getting Started with MIKE+

This chapter provides a quick introduction to MIKE+.

Example files for all model types are provided with the installation in both SI and US units.

In the following illustration of a Collection System model, Sirius is used as an example.

3.1 Open MIKE+ model and explore MIKE+ GUI

1. Start MIKE+

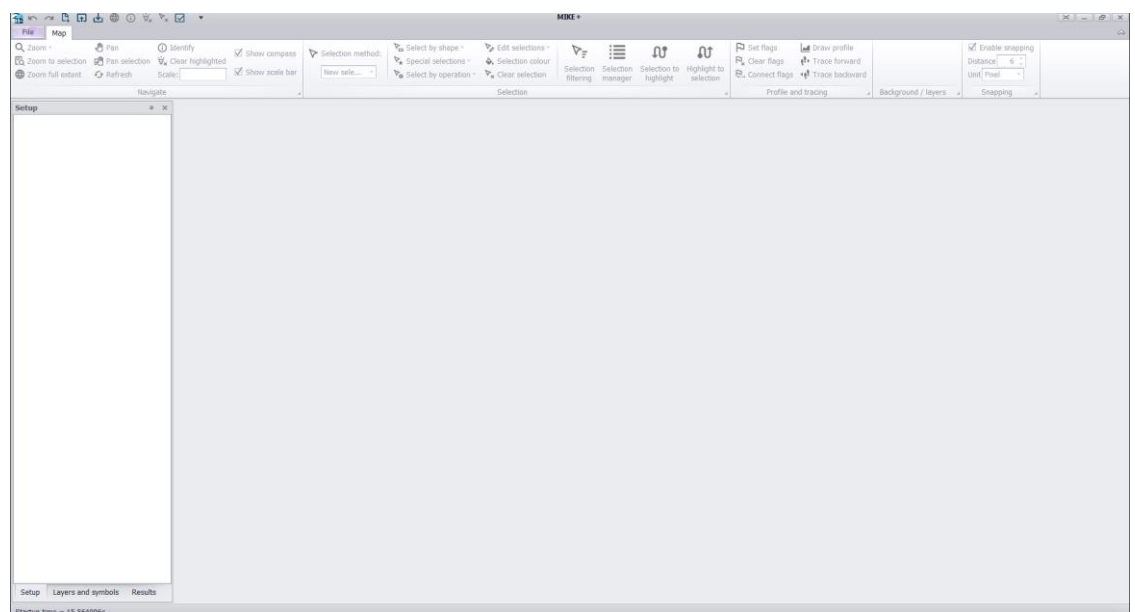


Figure 3.1 Start screen

2. Open the model Sirius.mupp

a. File/Open

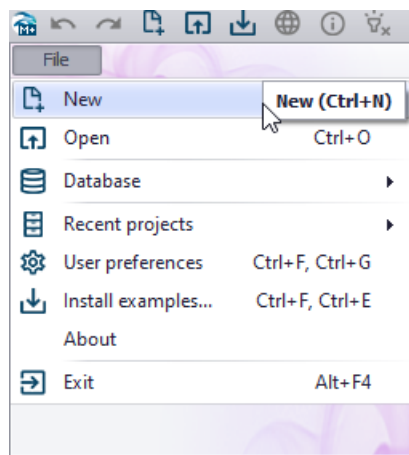


Figure 3.2 File | New

b. Browse to the MIKE+ project file Sirius.mupp and click “Open”

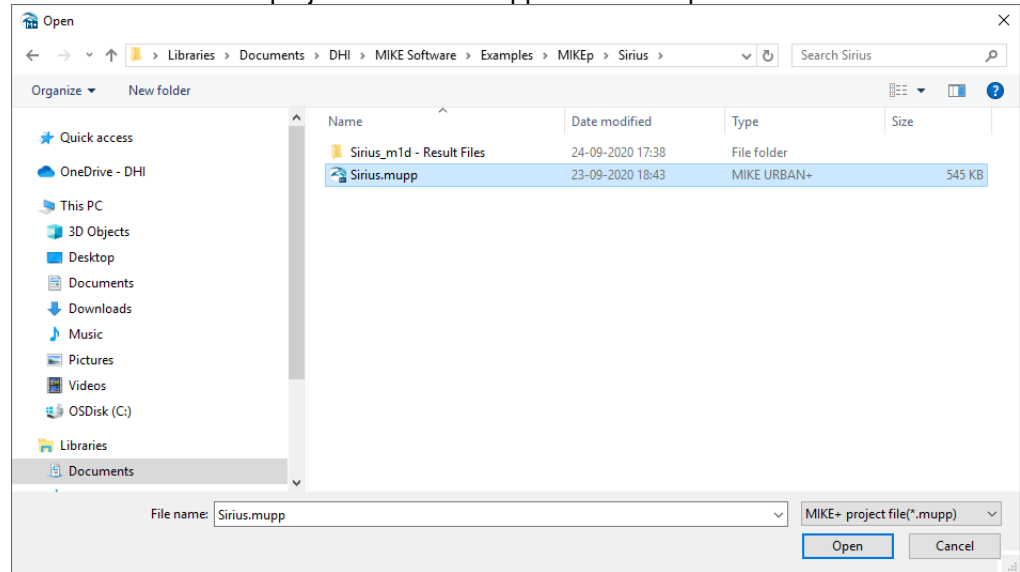


Figure 3.3 Browse for MIKE+ project file, *.mupp

c. Review the application window

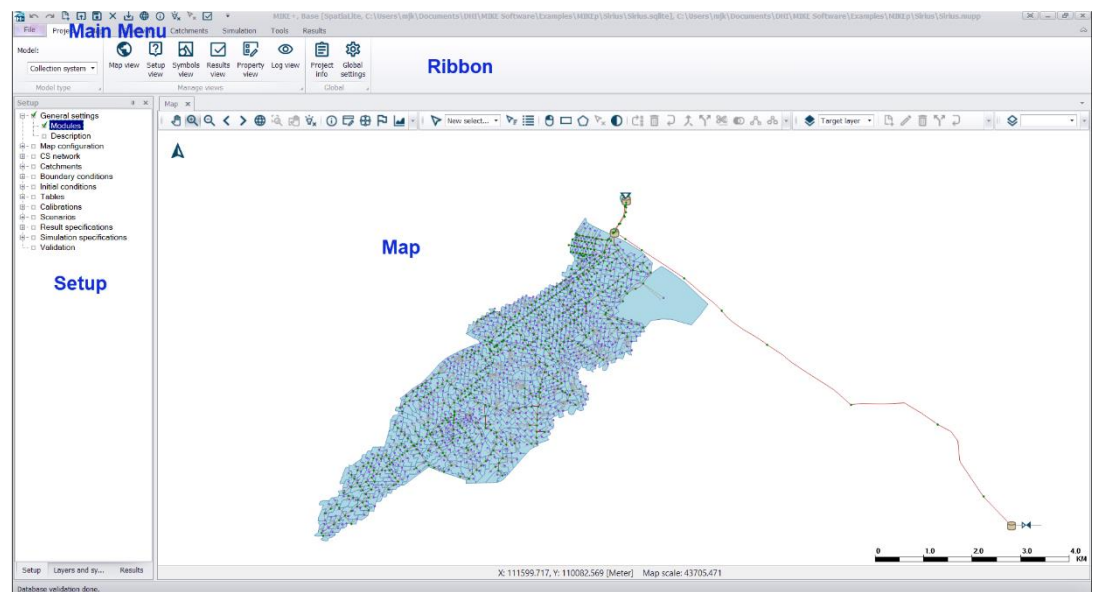


Figure 3.4 Overview application window

Map: map view of the model with default symbology

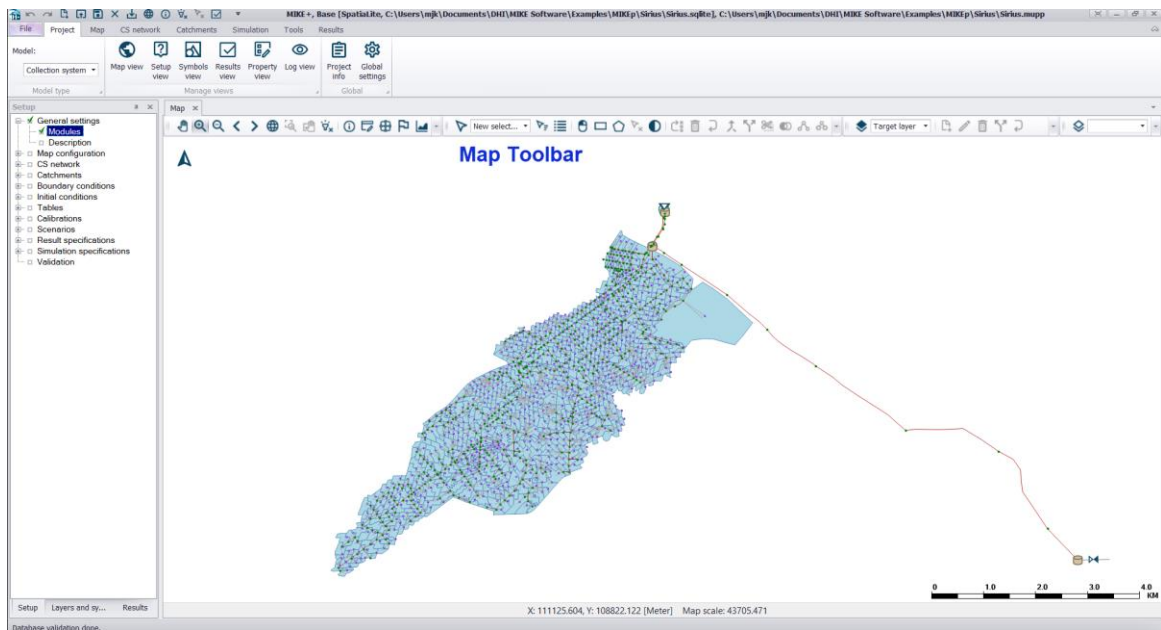


Figure 3.5 Map and toolbar window

The map is per default 'docked', but can be 'floated' (right 'click' + 'Float', or drag the tab).

The map is brought to the front by clicking on the 'Map' tab)

Setup: One of three 'Table of contents':

- **Setup:** Access to model setup editors
- **Layers and Symbols:** Configuring map symbols
- **Results:** Result presentation

Context-sensitive contents – only editors associated with currently active modules are shown (controlled by 'Model type' editor)

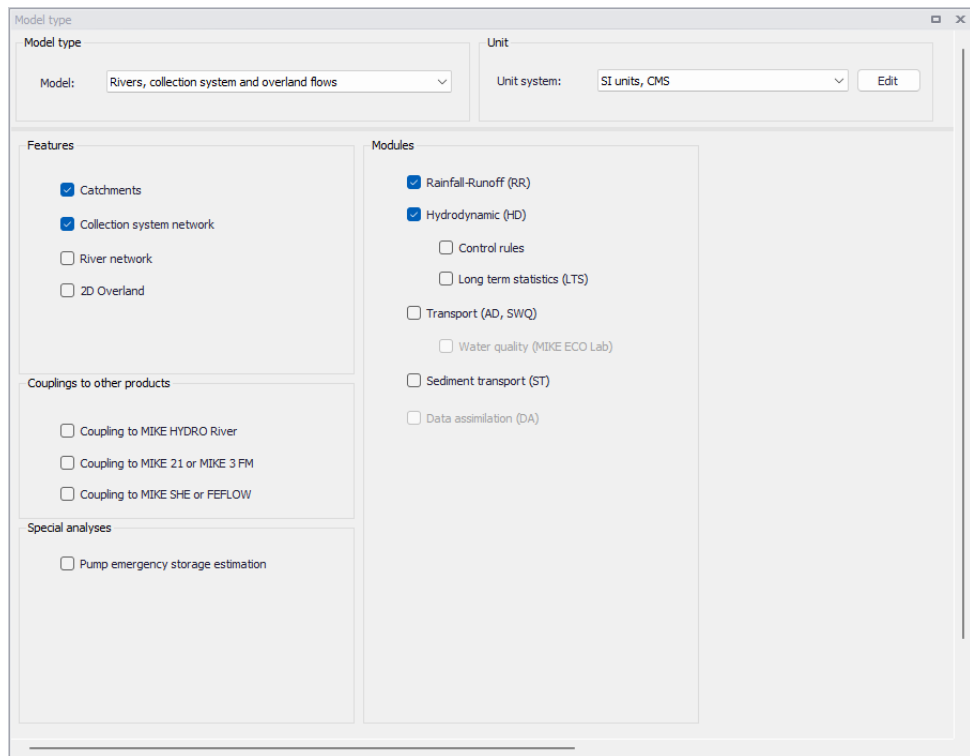


Figure 3.6 Modules selection

Logical workflow sequence, entries organised in modules and groups

Data validation:

Green: all OK

Red: Some data is incomplete or incorrect

3.2 Project Info: provides a general information on the project contents

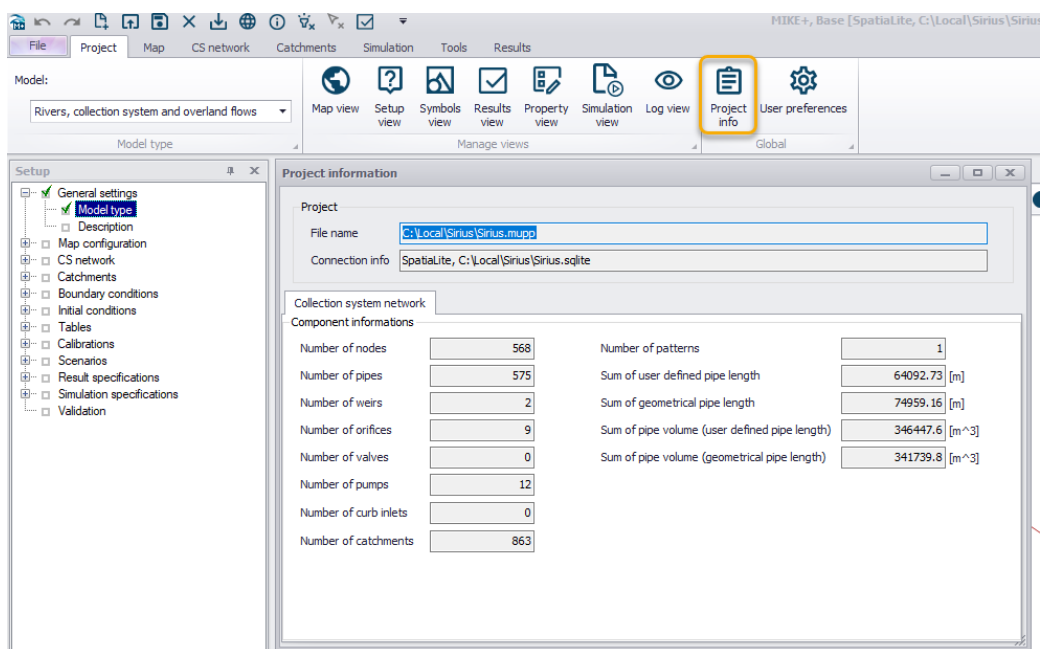


Figure 3.7 Project information

3.2.1 Opening editors

General features

A click on any group entry folds/unfolds a group.

A click on any low-level entry opens an editor and per default docks it as a tabbed document.

'Docked' editors are displayed one at a time. Any editor can be brought to the front by clicking on its tab.

When 'Floated', editors are displayed in a stack, with the active editor on top.

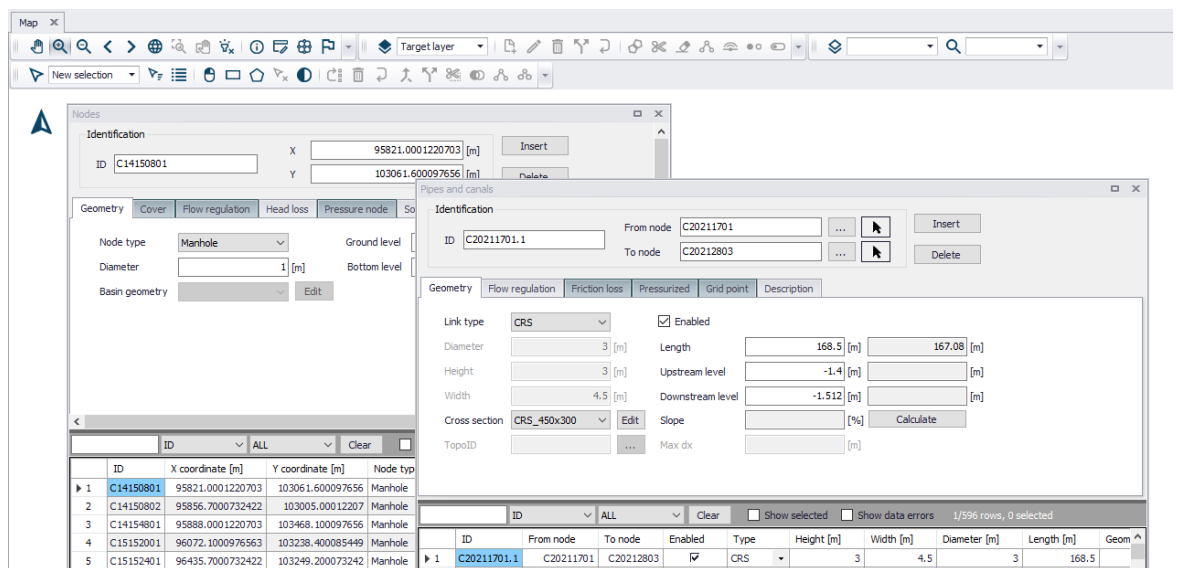


Figure 3.8 Dialogs floating

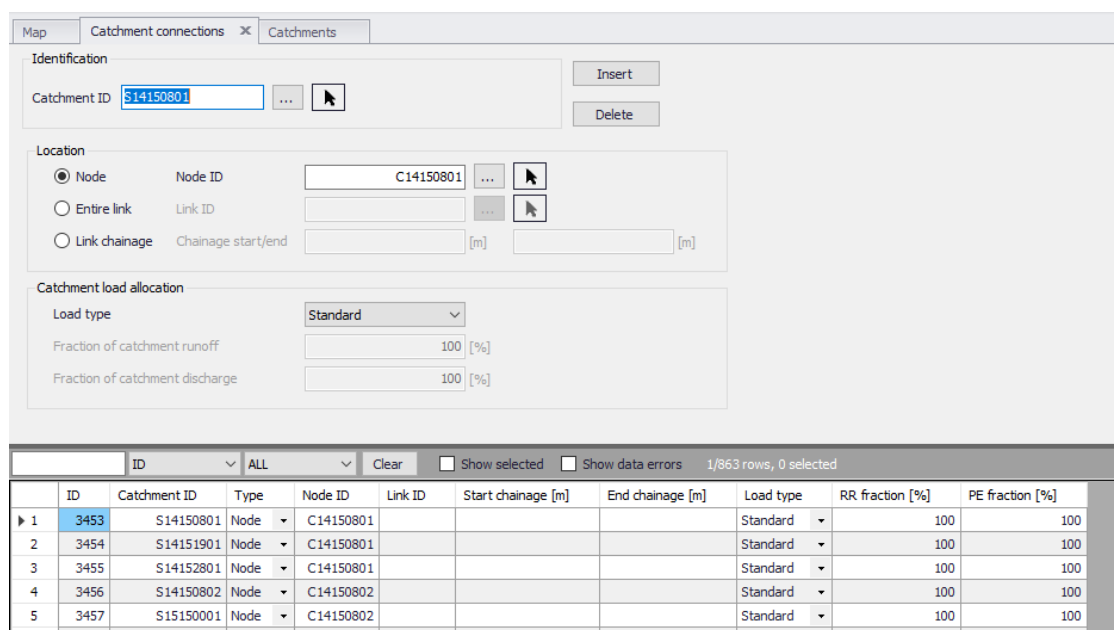


Figure 3.9 Dialogs docked

3.2.2 Editor Functionality

Error validation

Move the cursor above red marks with exclamation marks, to view the error description.

ID	X [m]	Y [m]	Node type	Diameter [m]	Ground level [m]	Bottom level [m]
1	C14150801	95821.0001220703	103061.600097656	Manhole	1	22.82
2	C14150802	95856.7000732422	103005.00012207	Manhole	1	28.02

Figure 3.10 On-the-fly data validation

Filtering

ID	Catchment ID	Type	Node ID	Link ID	Start chainage [m]	End chainage [m]	Load type	RR fraction [%]	PE fraction [%]
1	3453	S14150801	Node	C14150801			Standard	100	100
2	3454	S14151901	Node	C14150801			Standard	100	100
3	3455	S14152801	Node	C14150801			Standard	100	100
4	3456	S14150802	Node	C14150802			Standard	100	100
5	3457	S15150001	Node	C14150802			Standard	100	100
6	3458	S14154801	Node	C14154801			Standard	100	100
7	3459	S14152901	Node	C15152001			Standard	100	100

Figure 3.11 Catchment Connections

Other functions

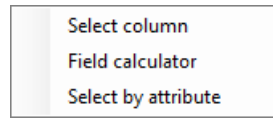


Figure 3.12 Grid functions (1)

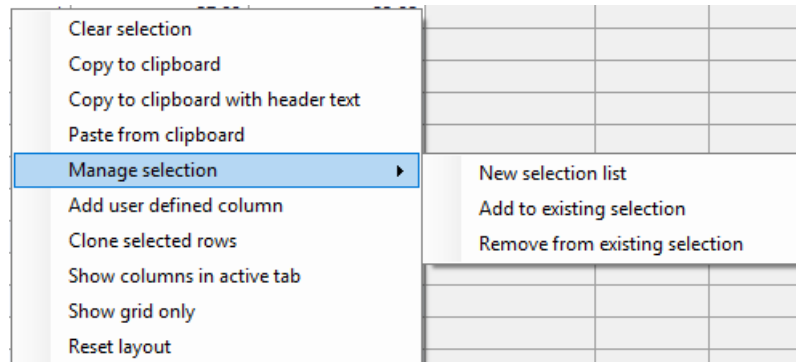


Figure 3.13 Grid functions (2)

3.3 Boundary conditions

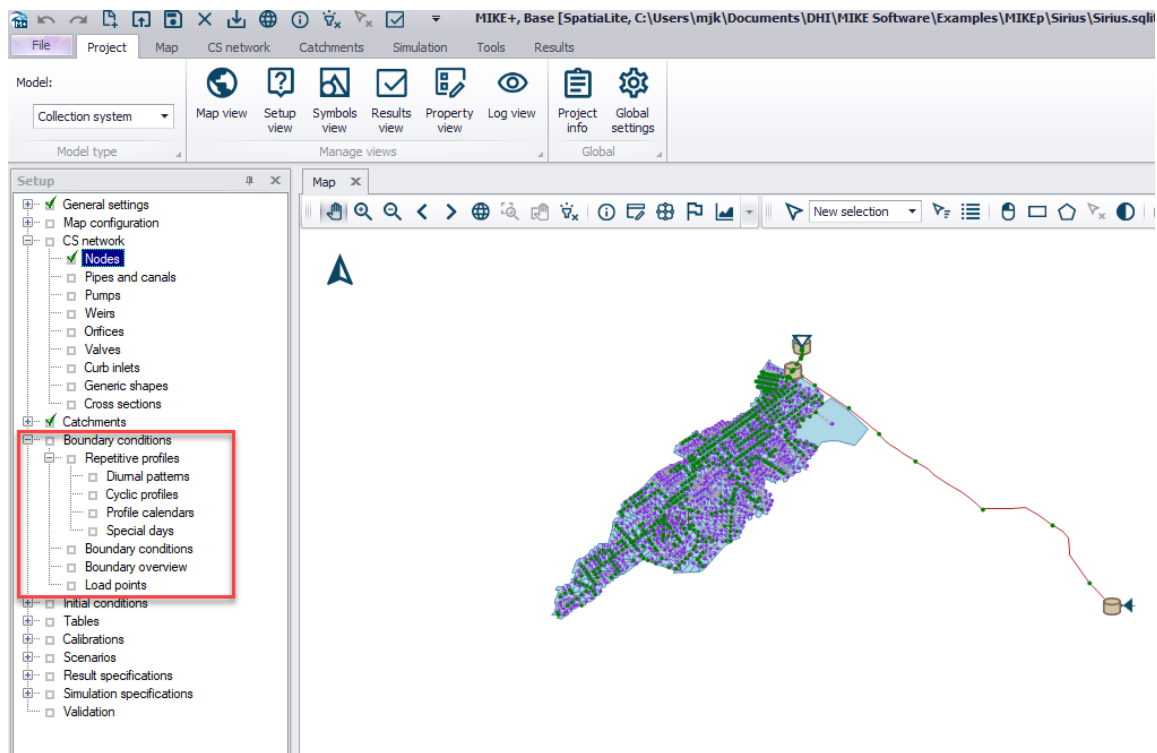


Figure 3.14 Boundary Conditions

3.3.1 Boundary Conditions Editor

'Identification' box

BC 'passport': Identifier (name), Type, Activity

Serves all types of BC.

Map Boundary conditions X

Identification

ID: SiriusRiver_Node_13 Type: Outlet water level

Apply Boundary Outlet Levels

Spatial extent Temporal variation Limited interval

All
 List
 Individual

Source type: Start chainage

Geo-coded
 Data source location X
 Grid distributed weights

Node_13
 1: Domestic WW

- Outlet water level
- Rainfall
- Air temperature
- Evapo-transpiration
- Catchment discharge
- Catchment discharge per area
- Catchment discharge per PE
- Load point discharge
- Load point discharge per unit
- Inflow to node
- Inflow to link
- Inflow from result file
- Outlet water level
- Exfiltration from node
- Exfiltration from link
- Stormwater loads(surface)
- Stormwater loads(RDII)
- Open inflow to river
- Source inflow to river
- River water level
- River Q/h relation
- Free river outflow
- Closed river boundary

Q/h relation Description

[m] Downstr. chainage [m]

ID ALL Clear Show selected Show data errors 1/7 rows, 0 selected

ID	Type	Group No	Apply Boundary	Load type	Connection type	List Name
1 SiriusRiver_Node_13	Outlet water level	Outlet Levels	<input checked="" type="checkbox"/>		Individual	

Figure 3.15 Boundary Conditions

‘Spatial extent’ tab

Linking of the actual BC with the model

- All – entire model
- List (selection): reference to a sub-set of model elements, defined in a ‘selection manager’ (in MU Classic: ‘*.mus’ file)
- Individual: reference to individual model element
- Geo-coded: applies for load points associated with individual model elements
- Data source location: applies for meteorological stations (e.g. rain gauges)
- Grid-distributed weights: applies for rainfall supplied as RADAR grid data

‘Temporal variation’ tab

ID	Boundary type	Group No	Apply Boundary	Load type	Connection type	List Name	Load category	X coordinate [m]	Y coordinate [m]	Catchment ID	Node ID	Link ID
1	SinusRiver_Node_13 Outlet water level	Outlet Levels	<input checked="" type="checkbox"/>		Individual		1: Domestic WW				Node_13	
2	SinusRiver_Node_14 Outlet water level	Outlet Levels	<input checked="" type="checkbox"/>		Individual		1: Domestic WW				Node_14	
3	SinusRiver_Node_15 Outlet water level	Outlet Levels	<input checked="" type="checkbox"/>		Individual		1: Domestic WW				Node_15	
4	SinusRiver_Node_16 Outlet water level	Outlet Levels	<input checked="" type="checkbox"/>		Individual		1: Domestic WW				Node_16	
5	Wastewater Load point discharge	Network Loads	<input checked="" type="checkbox"/>	DWF	Geo-coded		1: Domestic WW					
6	Rainfall_1_year Rainfall	Catchment Loads	<input checked="" type="checkbox"/>		All		1: Domestic WW					
7	Runoff_input Inflow from result file	Network Loads	<input type="checkbox"/>		All							

Figure 3.16 Temporal Variations

Provides information about quantities and temporal variation

- Constant
- Cyclic
- Time series

‘Limited interval’ tab

Per default, a BC applies during entire simulation period. Activating ‘Limited interval’ restricts the BCs activity for the specified time interval only

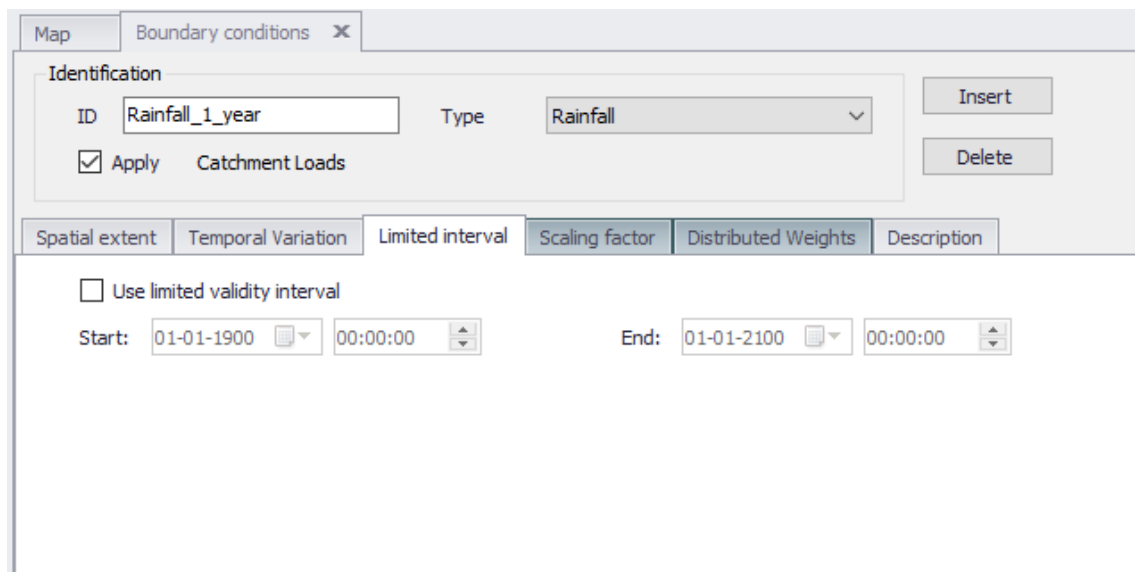


Figure 3.17 Limited interval

'Scaling factor' tab

'Scaling factor' other than '1' scales the specified BC quantity up or down.

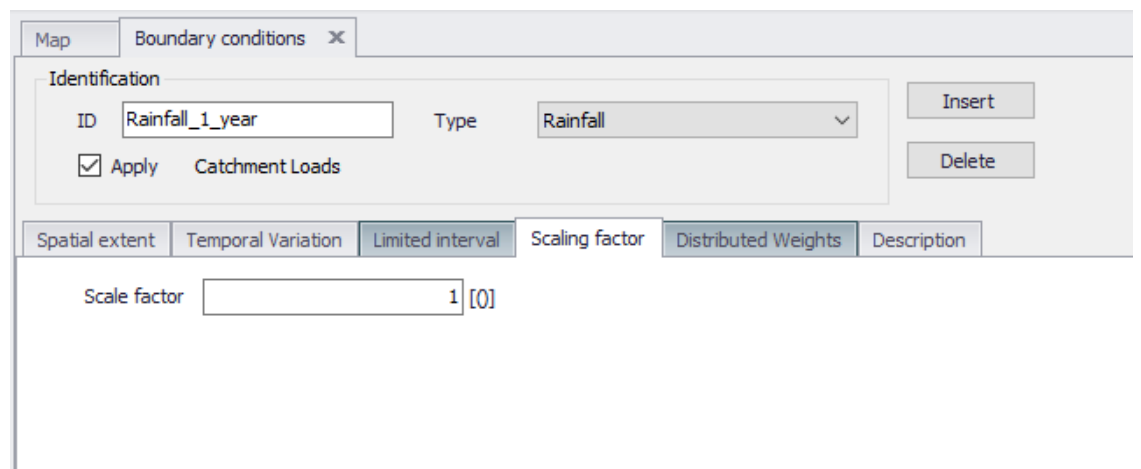


Figure 3.18 Scaling factor

'Distributed weights' tab

Contains user-specified or automatically computed 'weighting factors', i.e. contributions of RADAR grid cells to each catchment in the model. Note that the sum of weights for each catchment must be one. Data validation automatically controls that the data are correct.

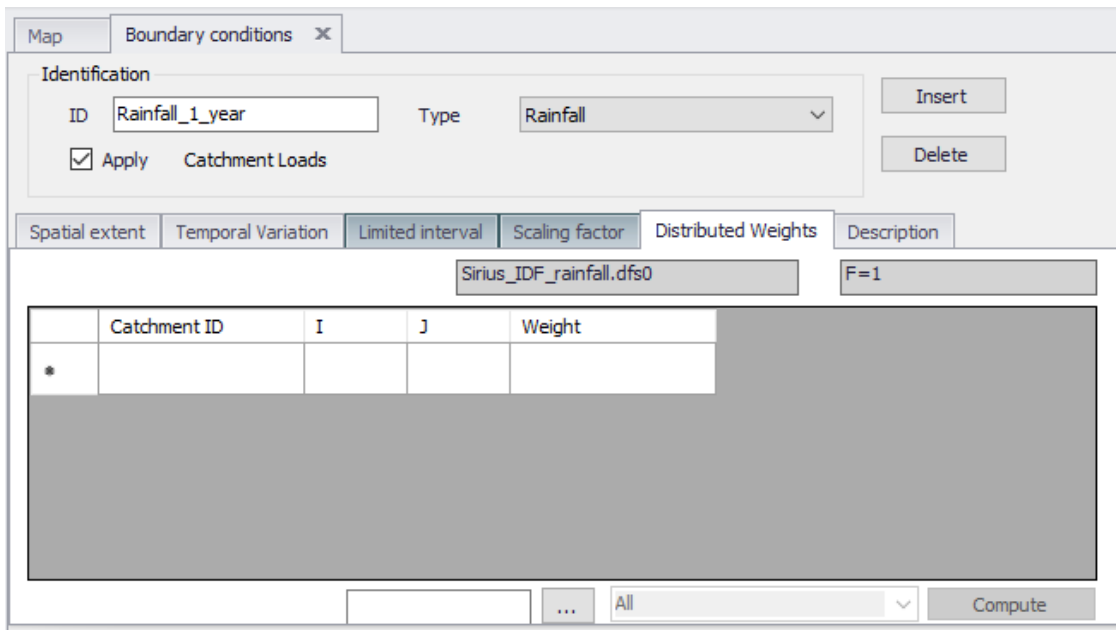


Figure 3.19 Distributed Weights

'Description' tab

Contains user-specified description of the actual BC. Good as a reminder!

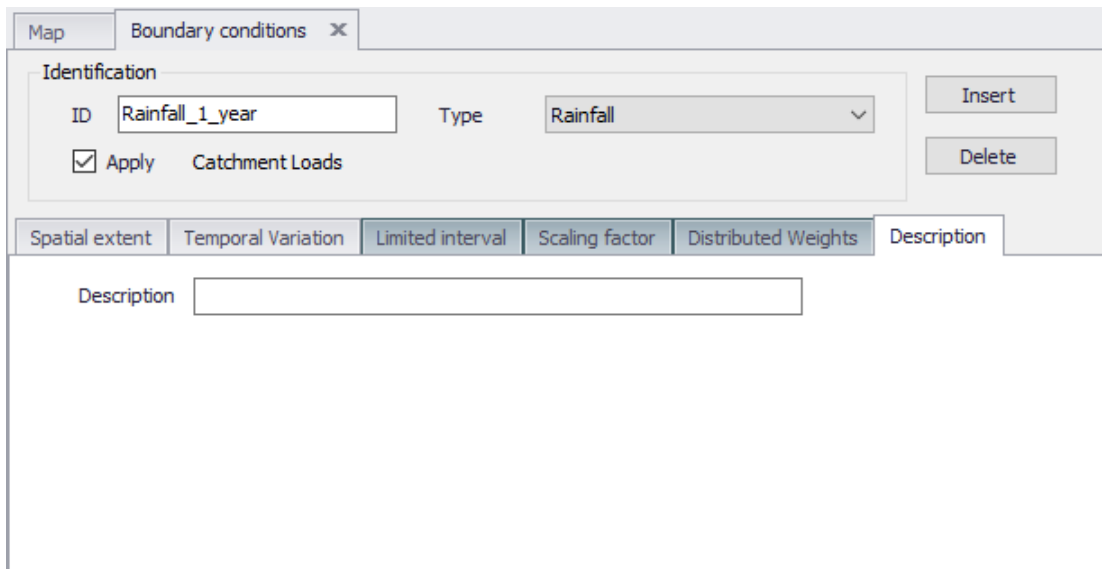


Figure 3.20 Boundary Conditions - Description

3.4 Results specification

3.4.1 Result Files

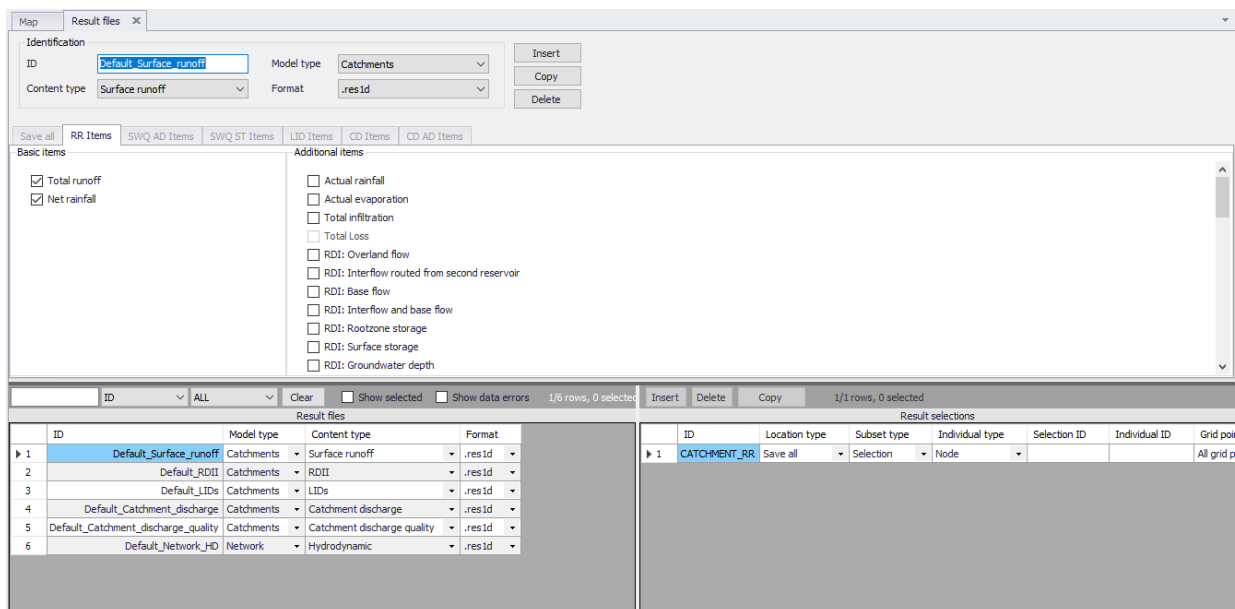


Figure 3.21 Result files

'Identification' box

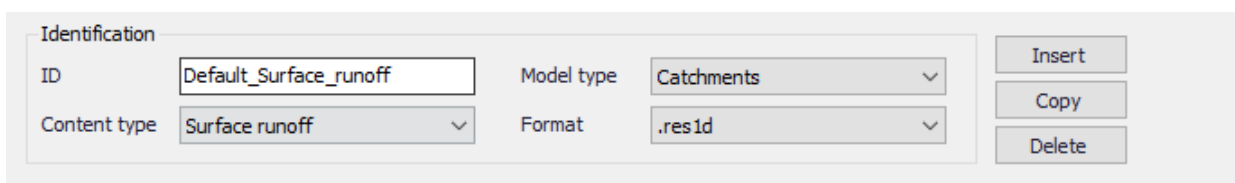


Figure 3.22 Identification box

Contains basic information about the result file:

- ID: ResultFileID is a part of the unique result file name, which is created as: SimulationID+ScenarioID+ResultFileID+format extension
- Model Type: Makes a distinction between 'Catchments' model and 'Network' model. This distinction controls possible contents types and formats.
- Content type: Each of the above model types can generate various contents. Result file may contain just one type of contents (keeps various types of results in separate files), or the contents may be mixed (puts various types or results in one result files)
- Format: various types or results may be saved in various formats: res1d and dfs0

Default result files

For each model type, MIKE+ database contains several definitions for default result file contents for each type of simulation.

Simulation results are distinguished as 'basic items' and 'additional items'

Default content may be user-modified to include or exclude specific result items.

Default result files contain results for the entire model.

List of accessible default result file definitions adjusts dynamically, depending on the activated modules.

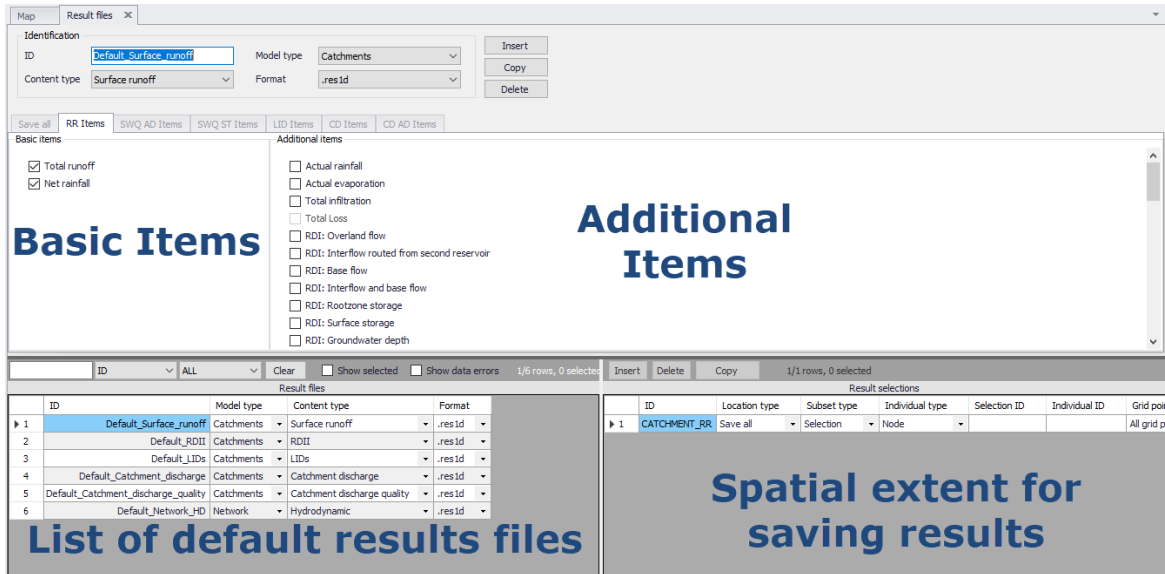


Figure 3.23 Result files

User-specified result files: Content types

The default list of result files can be extended to include any number of result file definitions, distinguished by the format, contents type and geographical extensions.

User-specified result files may include mixed-contents from the same model type. E.g., a mixed-content result file may include both runoff and surface pollutant results in one file. Of course, user-specified result file may be limited to include only one type of content.

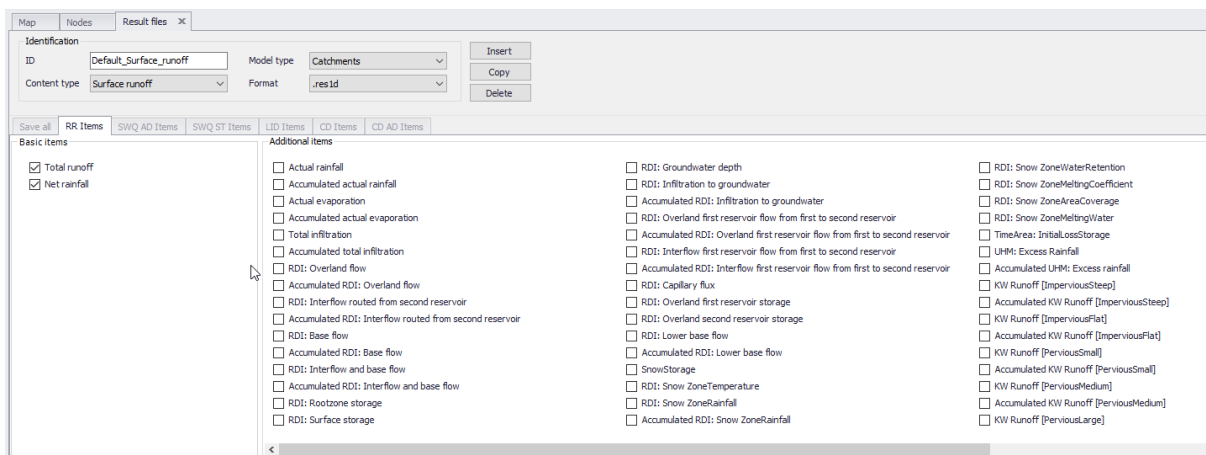


Figure 3.24 Additional Results

Various result items are accessible through currently active tabs. The tabs activity depends on the selected model type, content type and active modules.

User-specified result file: Location

All specified results will be saved only as the specified locations

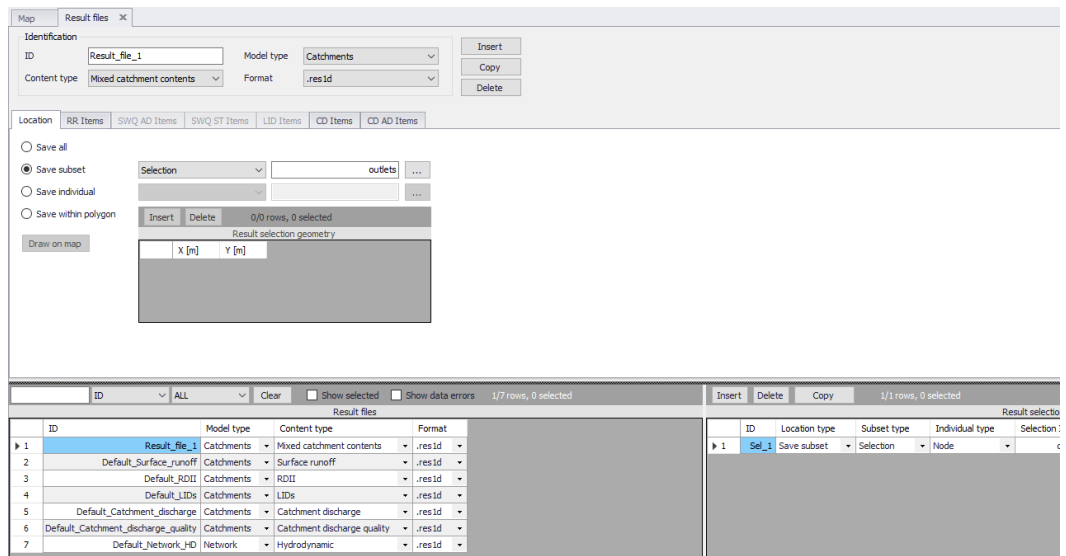


Figure 3.25 Result files location

Saving result may be specified at:

- Save all: saves the wanted results at all model elements
- Save subset: saves the wanted results for model elements included in the chosen selection
- Save individual: saves the wanted results for the specified individual model element
- Save within polygon: saves the wanted results for the model elements located within a polygon drawn on the map

'Location' for one result file may be defined by any number of location definitions. Overlapping location definitions are ignored (the results are saved only once).

3.4.2 Network summary

Any number of summary contents can be specified and associated with network model simulations

Map Network summary ×

Identification

ID

Tables with min, max and accumulated values for

Nodes Grid points, water levels
 Weirs and orifices Grid points, discharge
 Pumps Links, velocity
 Links and structures

Summary of input data

Links and structures

Use selection to reduce summary tables

Node selection
 Link selection

ID Show selected Show data errors 1/1 rows, 0 selected

	ID	Nodes	Weirs & orifices	Pumps	Links	Grid points, water levels	Grid points, discharges	Links, velocity	Link
▶ 1	Summ_1	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	

Figure 3.26 Network summary

3.5 Simulation setup

3.5.1 'Identification' box and function buttons

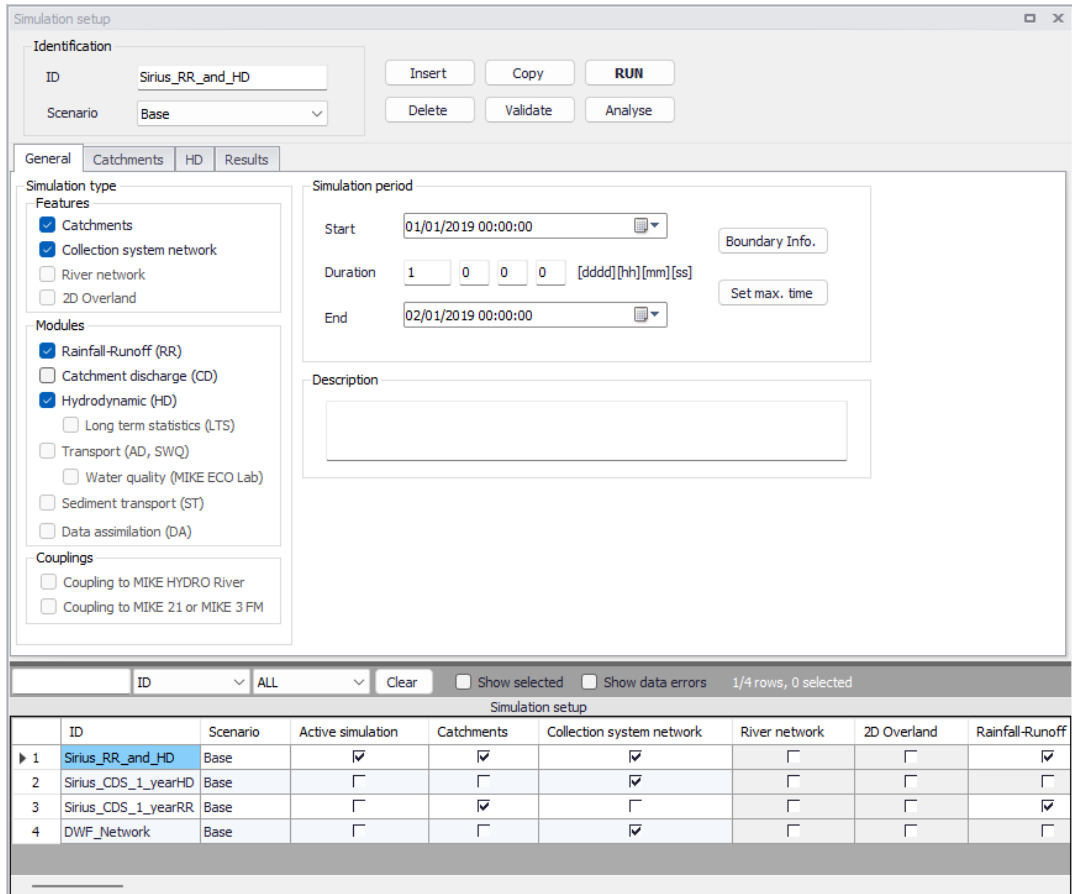


Figure 3.27 Simulation setup

- ID: Unique simulation ID, used in the result file name
- Scenario: Scenario to be used for the current simulation. In some cases, model setup based on selections (e.g. requested result outputs, boundary conditions, etc.) may conflict with the contents of the selected scenario
- Insert button: Inserts a new simulation setup
- Copy button: copies a specified simulation setup (increased productivity)
- Delete button: deletes current simulation setup record
- RUN button: Executes the current simulation setup record

Access to various functionalities related to executing simulations, under 'Simulations'

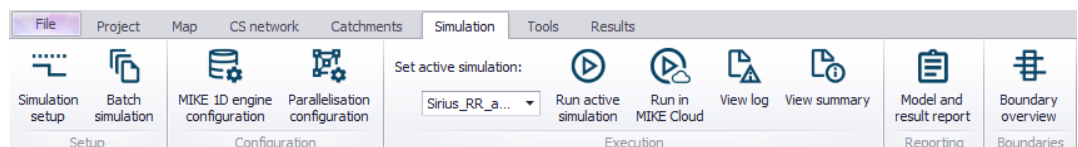


Figure 3.28 Simulation ribbon tools

3.5.2 'General' tab

The screenshot shows the 'Simulation setup' dialog box with the 'General' tab selected. The 'Identification' section at the top shows 'ID' as 'Sirius_RR_and_HD' and 'Scenario' as 'Base'. Below this are buttons for 'Insert', 'Copy', 'RUN', 'Delete', 'Validate', and 'Analyse'. The 'Simulation type' section includes 'Features' (Catchments, Collection system network, River network, 2D Overland) and 'Modules' (Rainfall-Runoff (RR), Catchment discharge (CD), Hydrodynamic (HD), Long term statistics (LTS), Transport (AD, SWQ), Water quality (MIKE ECO Lab), Sediment transport (ST), Data assimilation (DA)). 'Couplings' include 'Coupling to MIKE HYDRO River' and 'Coupling to MIKE 21 or MIKE 3 FM'. The 'Simulation period' section shows 'Start' as '01/01/2019 00:00:00' and 'End' as '02/01/2019 00:00:00', with a 'Duration' of 1 0 0 0. There are buttons for 'Boundary Info.' and 'Set max. time'. A 'Description' text area is empty. At the bottom, there is a table with columns: ID, Scenario, Active simulation, Catchments, Collection system network, River network, 2D Overland, and Rainfall-Runoff. The table contains four rows of simulation data.

ID	Scenario	Active simulation	Catchments	Collection system network	River network	2D Overland	Rainfall-Runoff
1	Sirius_RR_and_HD	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
2	Sirius_CDS_1_yearHD	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3	Sirius_CDS_1_yearRR	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
4	DWF_Network	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Figure 3.29 Simulation setup

- Simulation Type: Choice of modules to be included in the simulation. Accessible modules depend on module activation, model setup data and module dependency
- Simulation Period: start and end time for the simulation, limited by the active boundary conditions (note some exceptions!)
- Description: user-specified reminder information about the actual simulation
- Boundary Info: provides overview of the extent of the active boundary conditions
- Set max. time: sets the maximum extent of the simulation (the earliest possible start time and the latest possible end time), based on active boundary conditions

3.5.3 Module tabs

- Catchments tab: Contains data for any catchment simulation (runoff, SQW, catchment discharge)
- HD tab: Contains data for network hydraulics simulation setup
- AD and WQ: Contains pollution transport and WQ – specific data for network simulation setup
- LTS: Contains LTS-specific simulation setup data

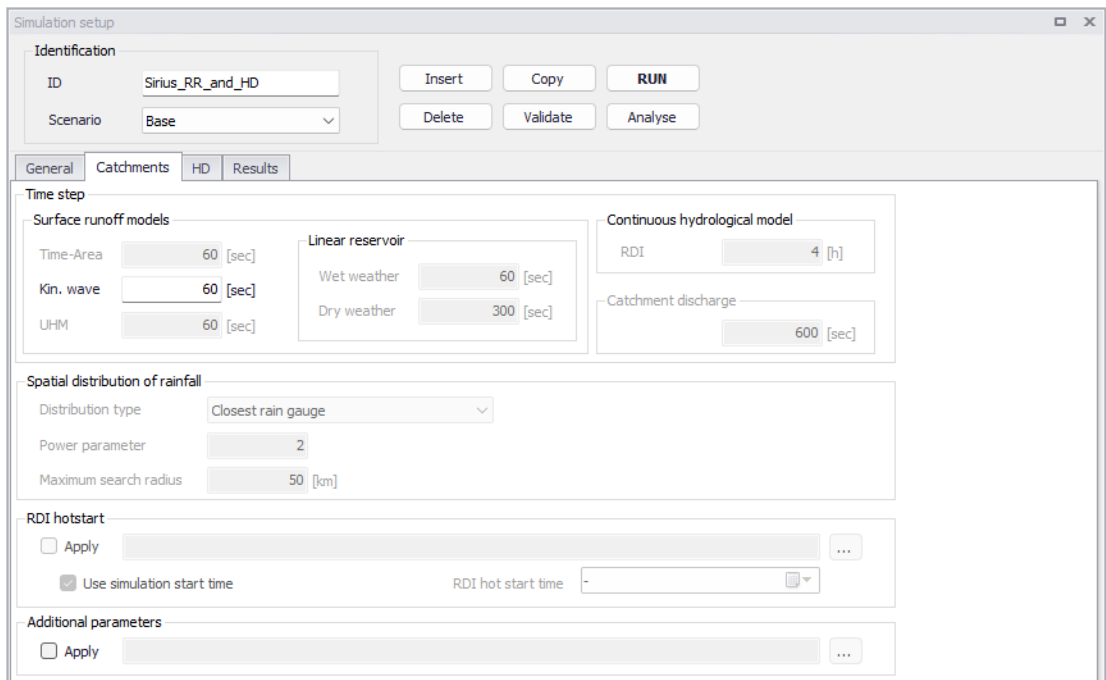


Figure 3.30 Simulation setup

3.5.4 'Results' tab

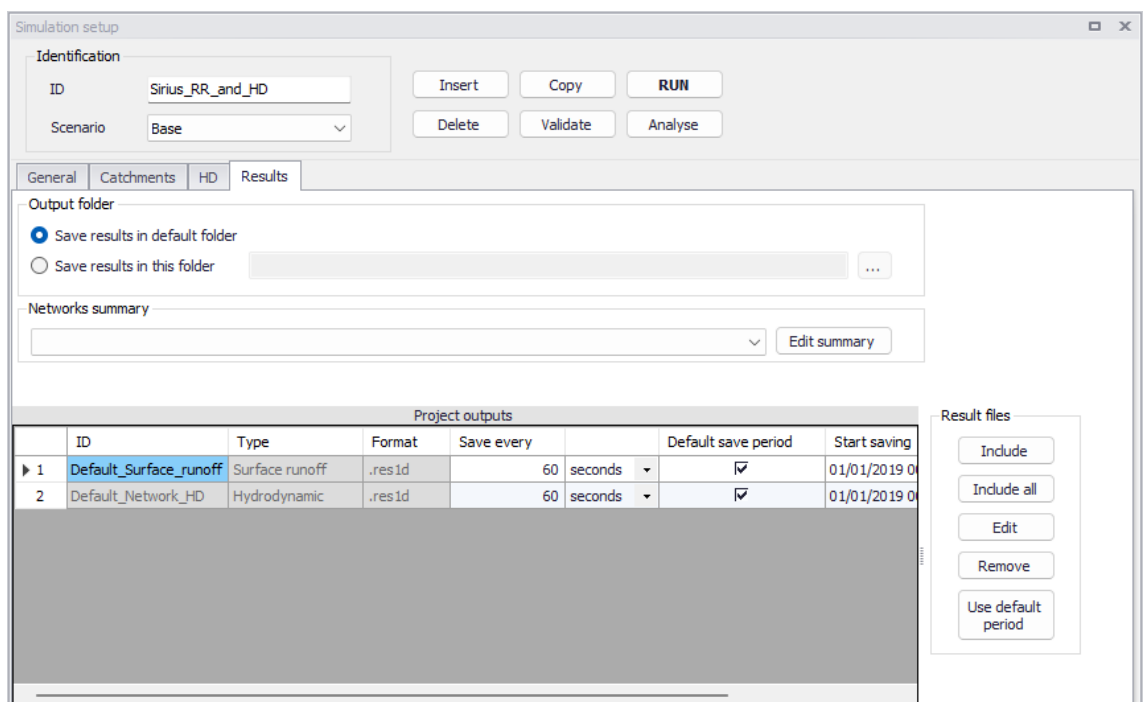


Figure 3.31 Results specifications

- Output folder: Default (= Project folder) or user-specified location
- Summary: reference to a network summary definition

- Result files: List of selected result files. Initially, the output list include default result files for all modules included in the simulation. This list can be modified by deleting the unwanted result files and including user-specified result files.

3.6 Results

Result presentation supports 'ordinary' time series result presentation, as well as LTS statistics.

3.6.1 Loading result files

Per default, results from current simulations are automatically loaded for the presentation. This feature can be toggled ON/OFF in 'User preferences':

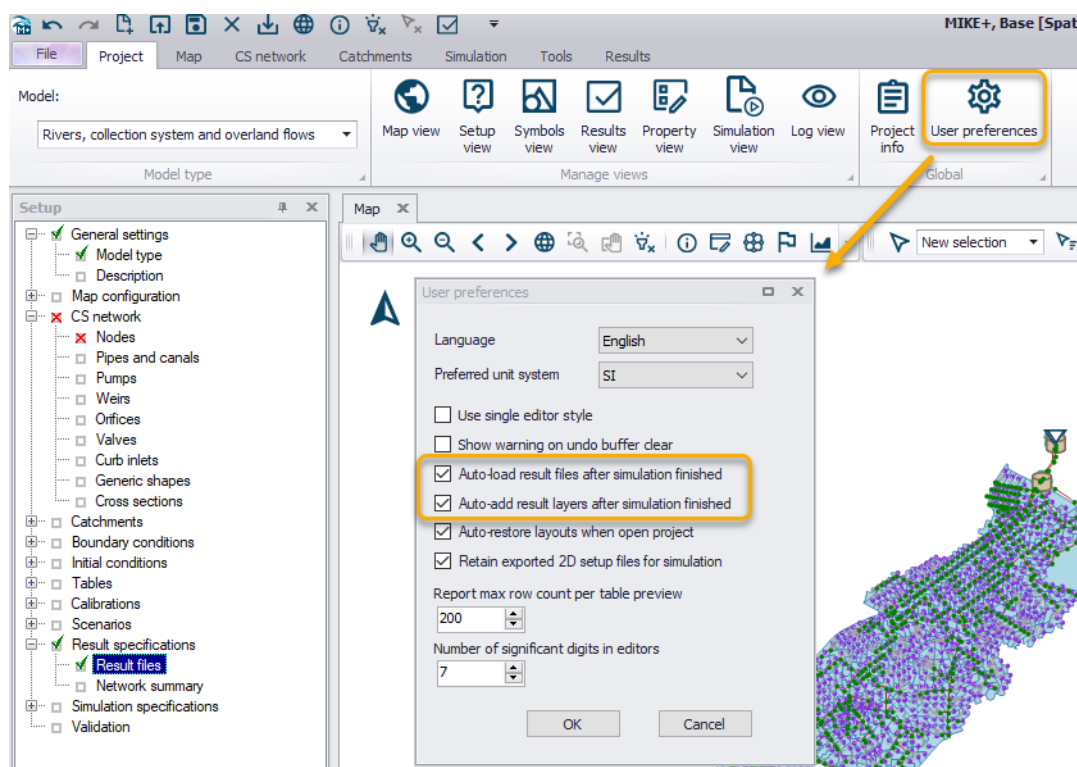


Figure 3.32 User preferences

Results are accessible through 'Results' view.

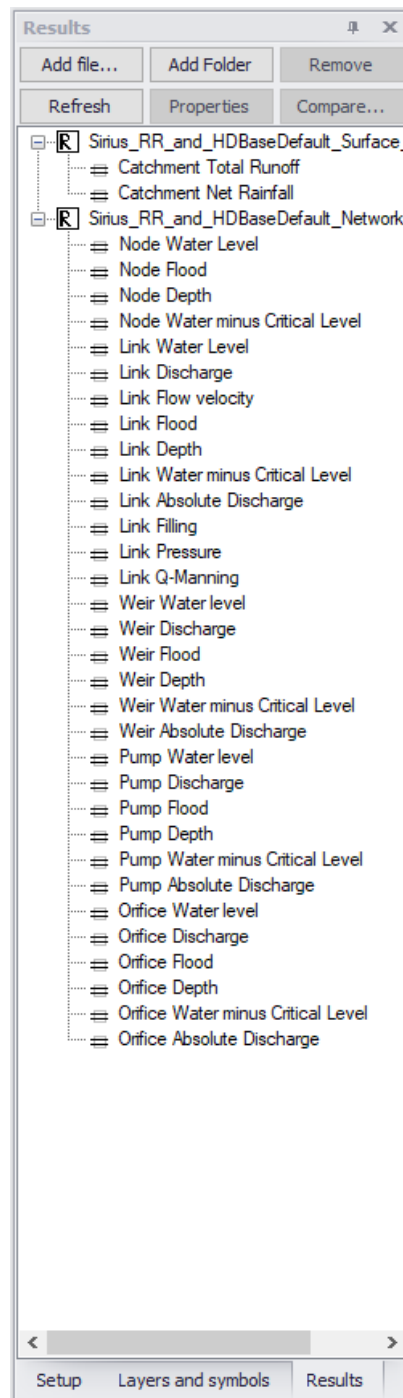


Figure 3.33 Results selection

3.6.2 Results in the map

- Animation
- Minimum
- Maximum
- Average
- Single time step
- LTS results

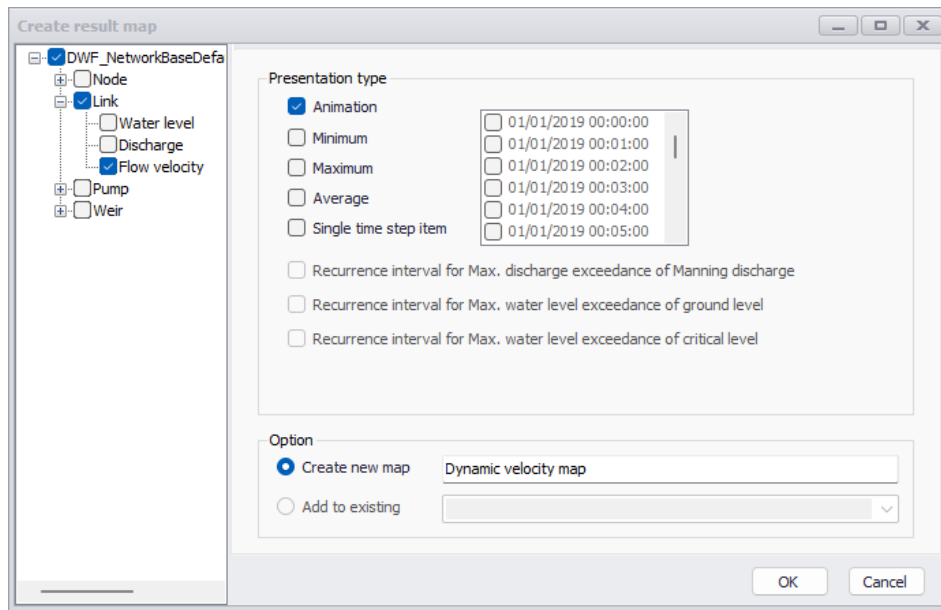


Figure 3.34 Results map configuration

3.6.3 Results TS Plot & table

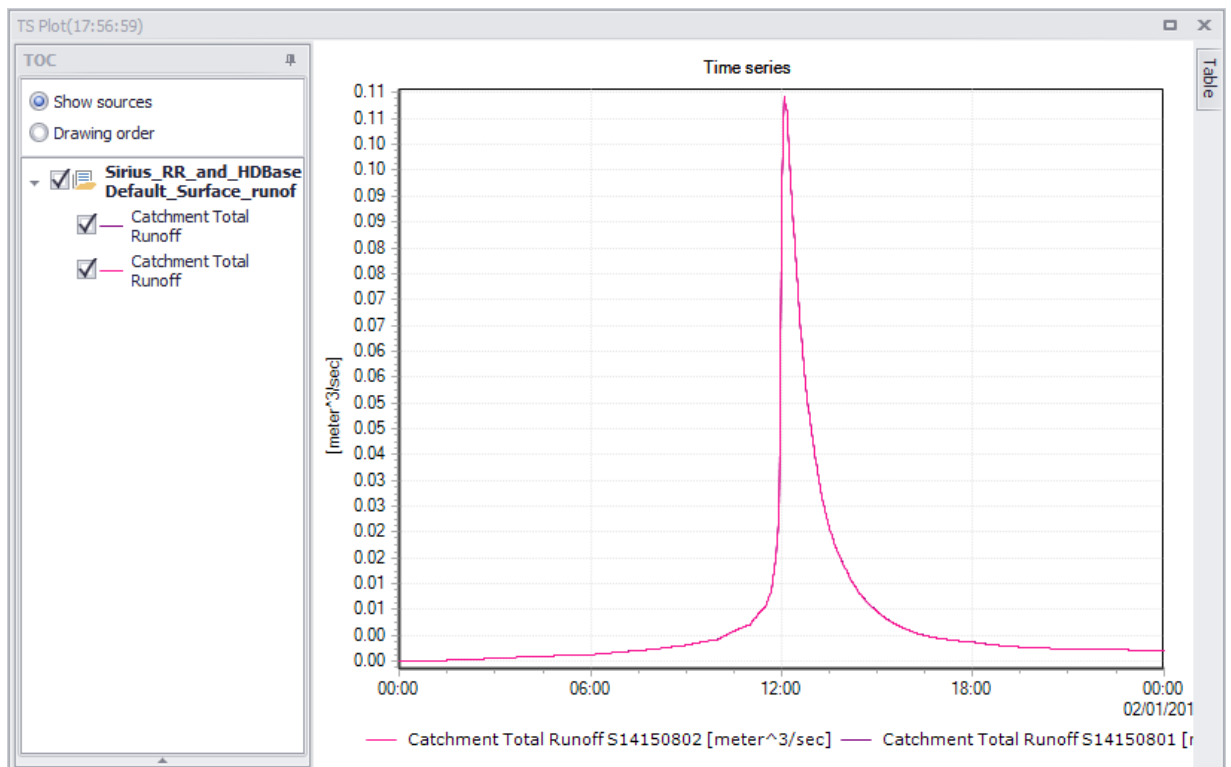


Figure 3.35 Time series plot

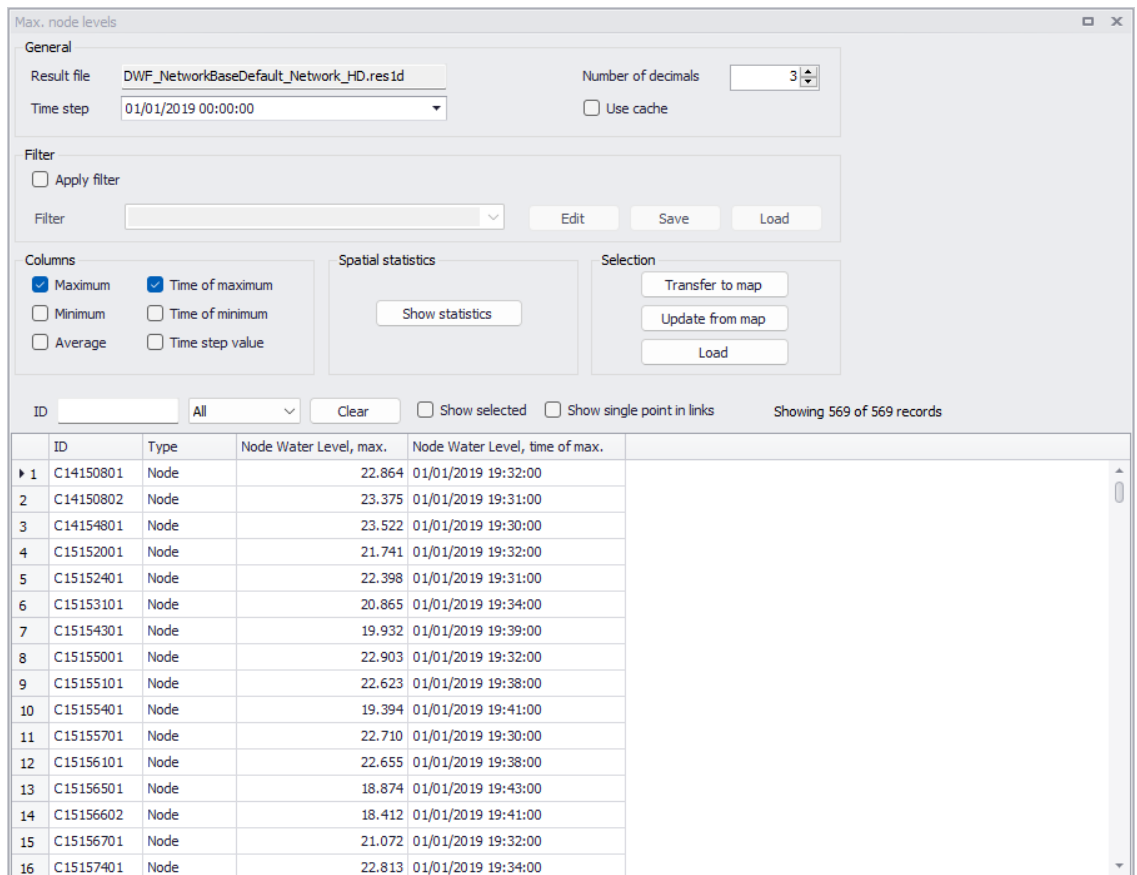


Figure 3.36 Tabular results

3.6.4 Results in Long profile

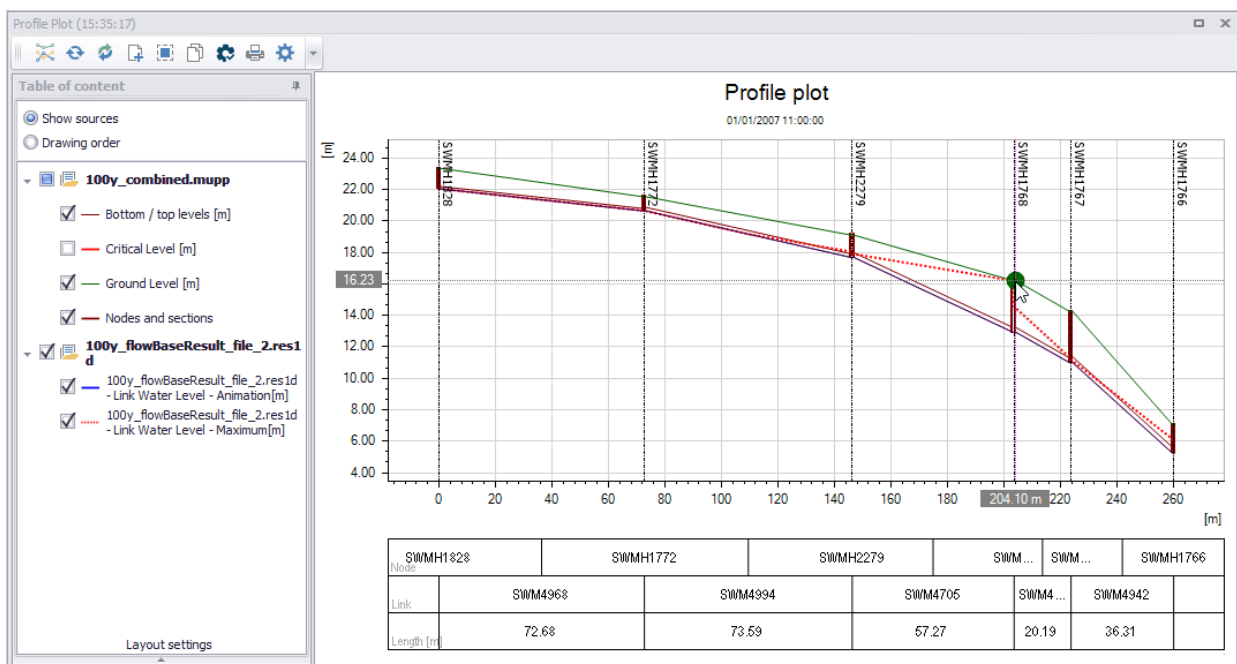


Figure 3.37 Longitudinal profile and results

3.6.5 Results in Bar-chart

Used for LTS chronological results (annual and monthly statistics)

3.6.6 Results: LTS reports

Used for reporting LTS statistics results in tabular form.

4 Import MIKE URBAN model to MIKE+

A step-by-step description is provided on how to import existing models into MIKE+.

The first step is to open MIKE+ and then follow the steps described in the following.

4.1 Prerequisites

As the first step, before importing existing MIKE URBAN models to MIKE+, the MIKE URBAN model needs to be updated to MIKE URBAN 2020 Update 1 version.

4.2 File | New

Under File menu you have various options available:

- New (project)
- Open (an existing project)
- Recent projects,
- User preferences
- Install Examples
- About
- Exit (application)

Chose File | New to create a new project.

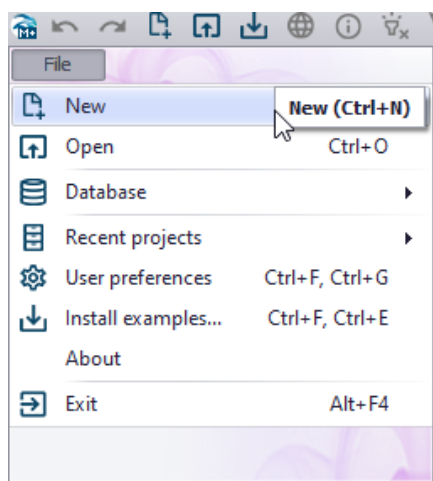


Figure 4.1 File | New

4.2.1 Module Selection

In the 'Model Selection' tab, you have the following options:

- Model type:
 - Water Distribution
 - Rivers, collection system and overland flows
 - SWMM5 collection system and overland flows
- Unit system:

- Selection of unit system for the model, SI or US.
- Database type: Two options available
 - SQLite (installed with MIKE+)
 - PostGIS (installed separately – please follow the installation guide)
- Database setting: File path for model database
- Project setting: Project file (*.mupp)

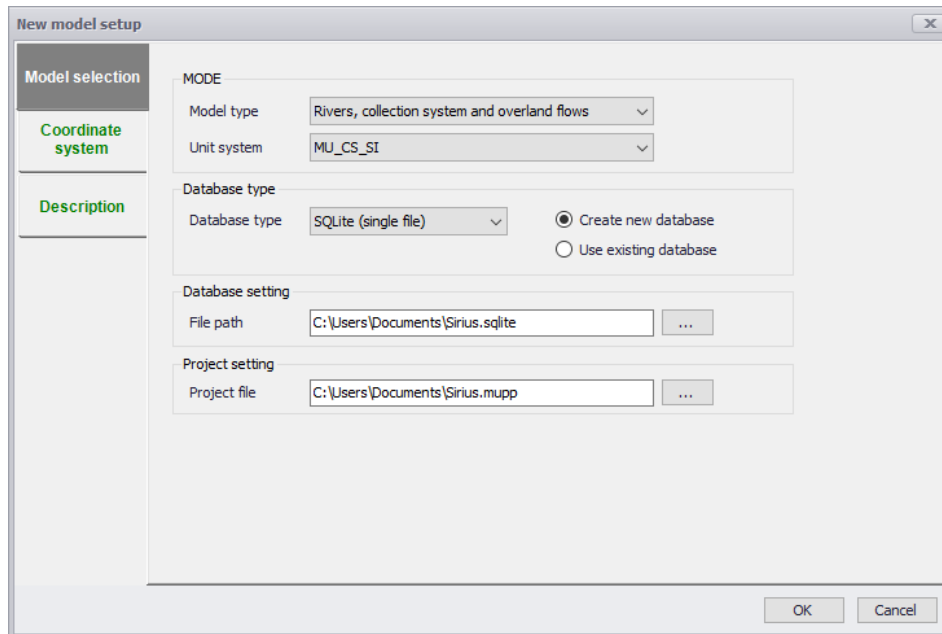


Figure 4.2 Selection of module, unit and database

4.2.2 Coordinate System

At the Coordinate System tab, the local coordinate projection can be set. This projection will be overwritten with the map projection used in the MIKE URBAN model during the import.

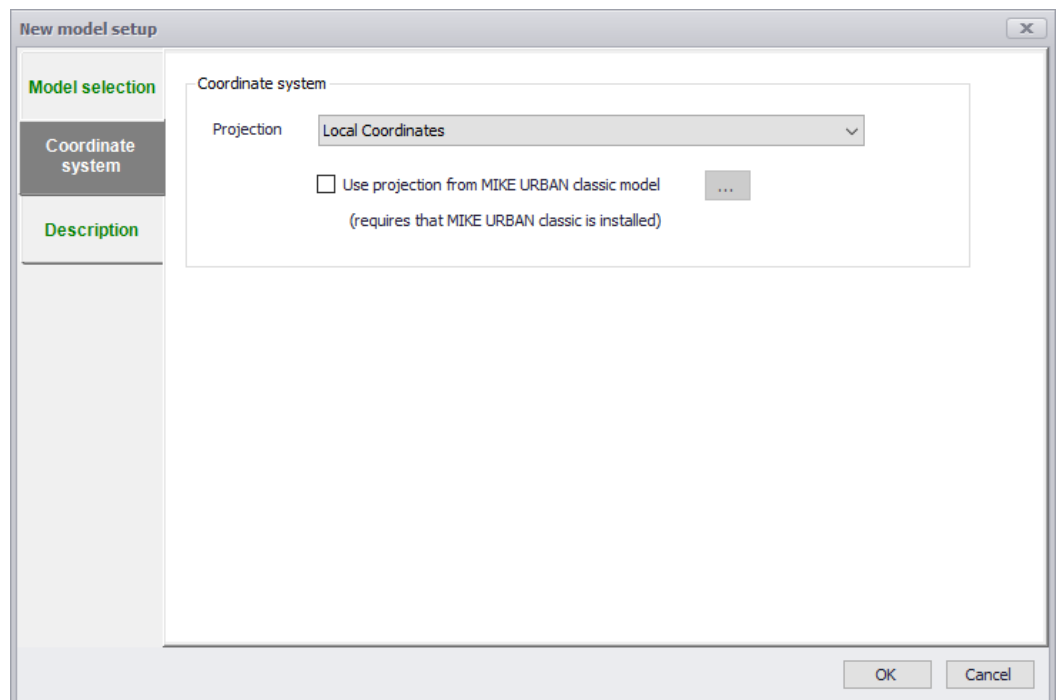


Figure 4.3 Selection of projection or use from existing model (to be imported or another model)

4.2.3 General settings | Model type

In the General settings | Model type, the different features and modules available for Collection System or Water Distribution can be activated for the model to get the complete overview of the data groups available.

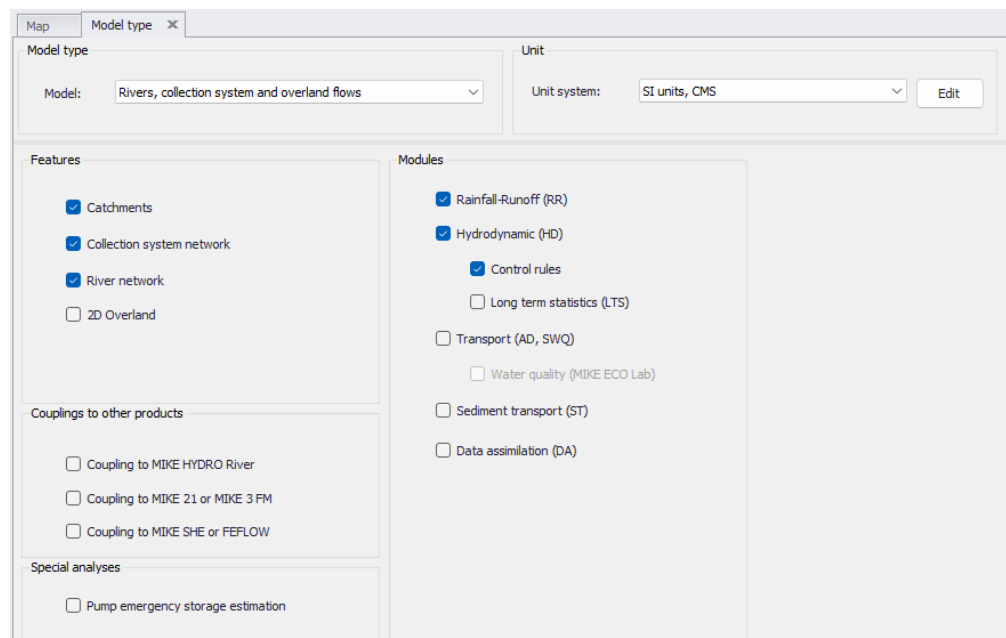


Figure 4.4 Model type selection for the project. Can be toggled on/off any time

4.3 File | Import

The File | Import provides a quick access to import existing models:

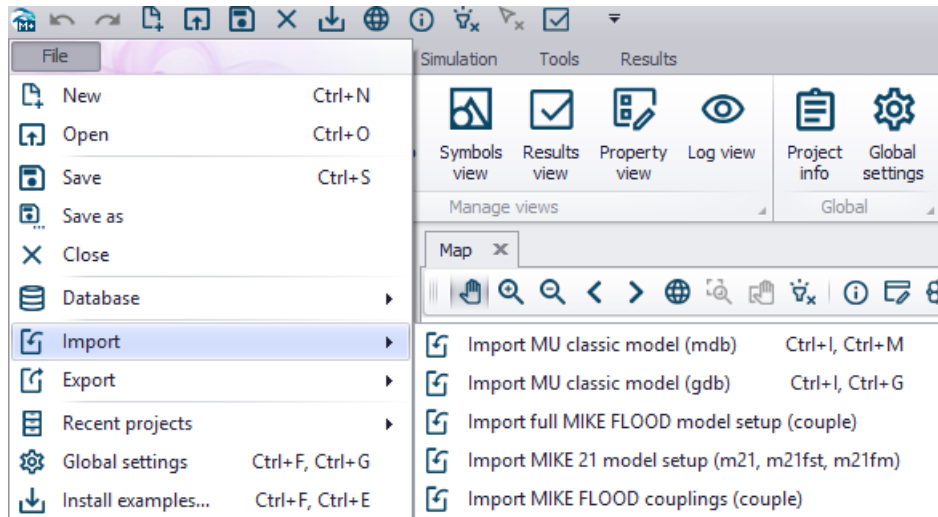


Figure 4.5 Fast import options of existing models

To import a MIKE URBAN model, either select:

- Import MU Classic model (mdb) requires that MIKE URBAN is installed.
- Import MU Classic model (gdb) does not require that MIKE URBAN is installed.

These imports have been developed to make it easy for users to import existing MIKE URBAN models. If customised imports are required, then the general 'Import and export' tool found under Tools tab can be used.

When clicking on e.g. 'Import MU Classic model (mdb)', the dialog below appears for selecting the MIKE URBAN file.

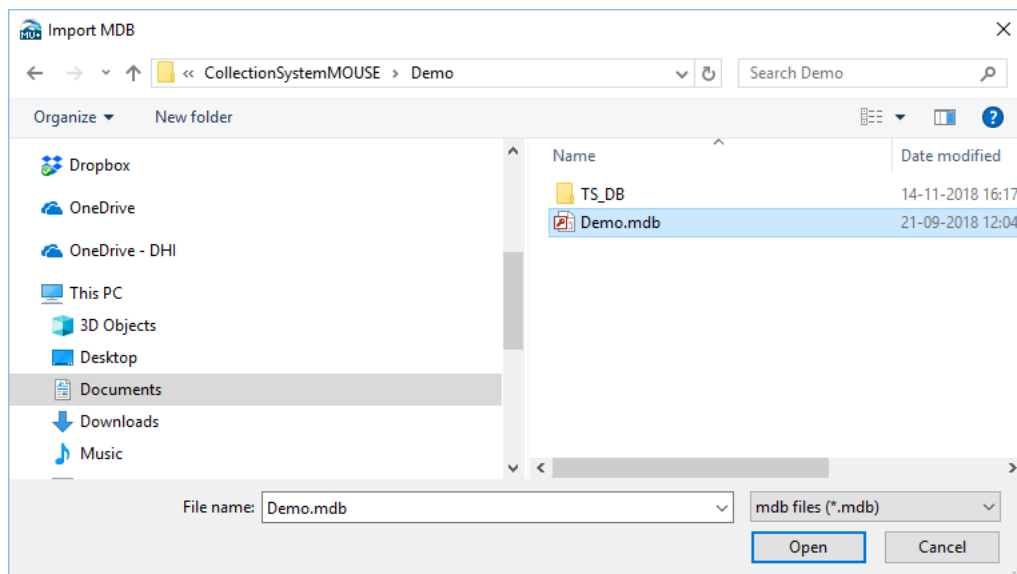


Figure 4.6 Browser for selecting MIKE+ model

The import process starts after clicking Open.

After import of the MIKE URBAN model, then it could look like this.

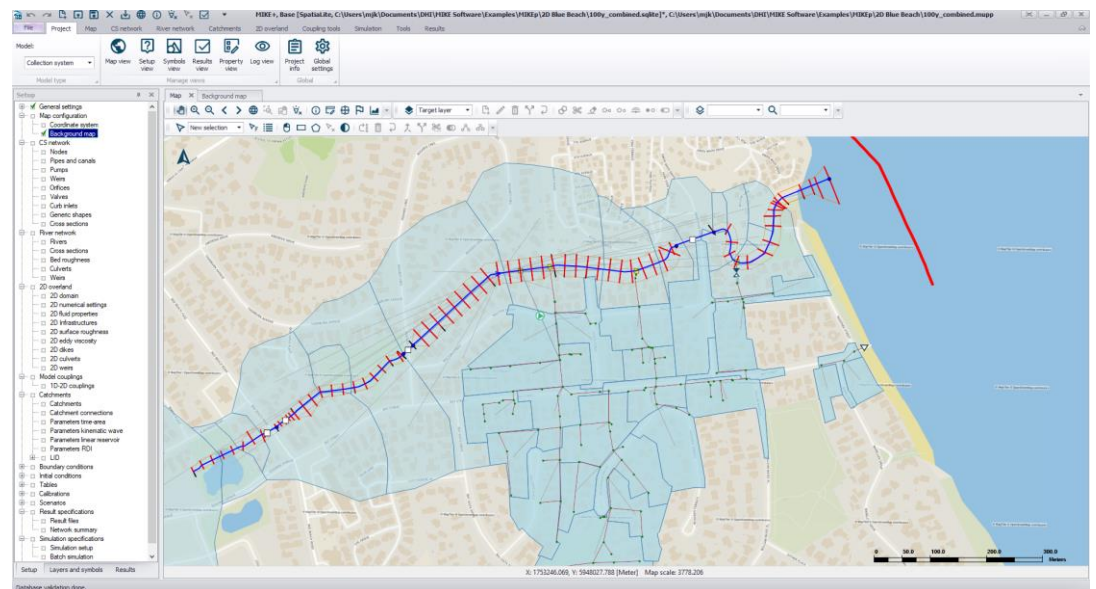


Figure 4.7 Imported MIKE URBAN model to MIKE+

At the right side in the setup tree, data has been grouped and instant data validation is performed. If there are any errors in the data, a red cross will appear. If there are no errors in the data, a green check mark or no mark will be displayed.

4.4 Status after import

All features in Water Distribution including Water Hammer is supported in MIKE+, so all models that run in MIKE URBAN 2020 or EPANET 2.0 can be imported into MIKE+. The same applies to SWMM models.

For Collection System and 2D Urban Flood models, it is expected that most running MIKE URBAN 2020 models based on MIKE 1D will be running in MIKE+ with the exception of models including features listed in 4.5.

4.5 MIKE+ unsupported features

In Table 4.1, the features which are not supported in MIKE+ are listed.

Table 4.1 Overview of features with limited support in MIKE+

Feature	Status
MOUSE UWC (User Written Control)	If MOUSE UWC has been applied, this cannot be transferred to MIKE 1D. Those UWC controls needs to be recoded into MIKE SDK. The MIKE 1D is in general much more open for user control than MOUSE.
MOUSE Storage Nodes	Not supported in MIKE 1D.
Special feature: MOUSE PCS	Not supported in MIKE 1D. Expected to be developed later.
MIKE 1D – RTC	Imports existing models using RTC. However, if some Actions have been reused, then they have to be added manually as individual Actions. This is an improvement of how Actions are handled in the model with unique ids, but it is impossible to update the model automatically.
Sub Model Manager	Replaced by a new version of Submodel Manager.

