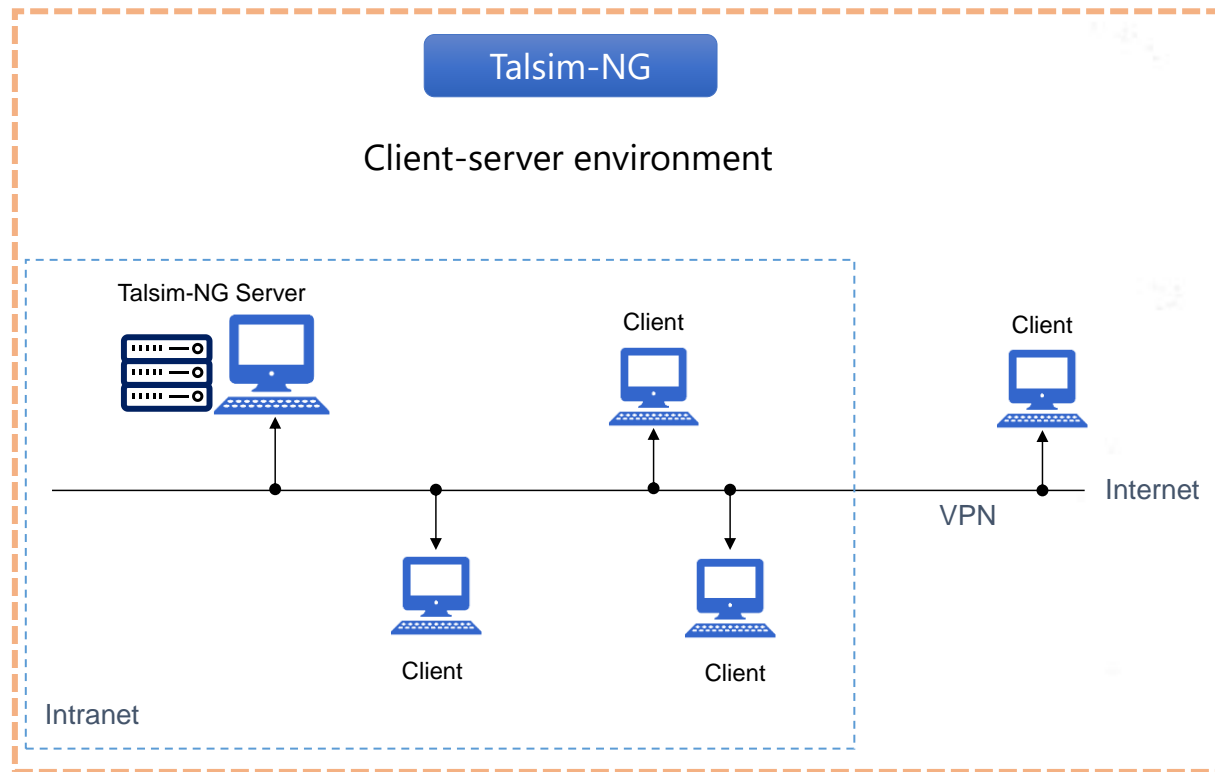


Talsim-NG - River Basin and Water Management Model

Introduction to Talsim-NG



If you wish, we could also switch to this configuration at a later point in time. The big advantages are consistent input time series and easy exchange between users.



We will be using this configuration to avoid permanent internet connection



Before we start !

Settings:

- Decimal delimiter = „.“ (dot)
- Date / Time Settings = dd/MM/yyyy or dd.MM/yyyy

Date and time formats

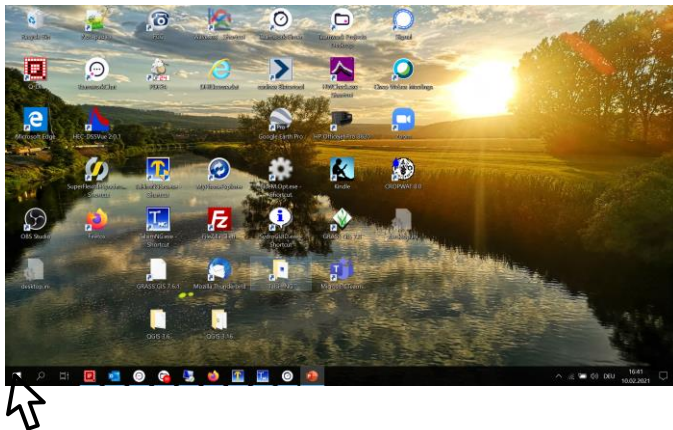
Short date:	dd.MM/yyyy
Long date:	dddd, d. MMMM yyyy
Short time:	HH:mm
Long time:	HH:mm:ss
First day of week:	Montag

Decimal symbol:	.
No. of digits after decimal:	2
Digit grouping symbol:	,
Digit grouping:	123,456,789
Negative sign symbol:	-
Negative number format:	-1.1
Display leading zeros:	0.7
List separator:	!
Measurement system:	Metric

Running the software



The Talsim-NG Server must be started first before you start the client software



Startmenu and look up Talsim-NG Server



Or

Create a shortcut on your desktop





Content

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[Go](#)

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[U201] Hydropower station

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[T100] Reservoir

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Reservoir – Storage capacity curve

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Reservoir – Release functions

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How to create *Patterns*

[Go](#)

How to create *Time Series*

[Go](#)

States – Control Clusters –
Operation Rules

[Go](#)

State variables

[Go](#)

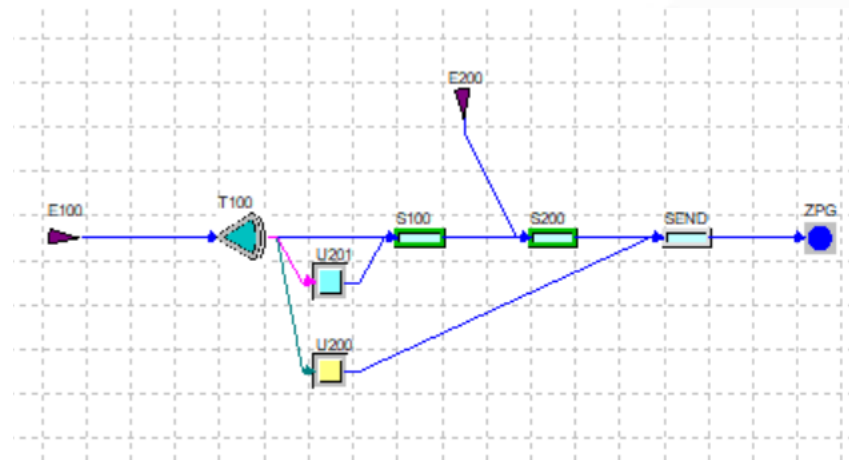
Control clusters

[Go](#)

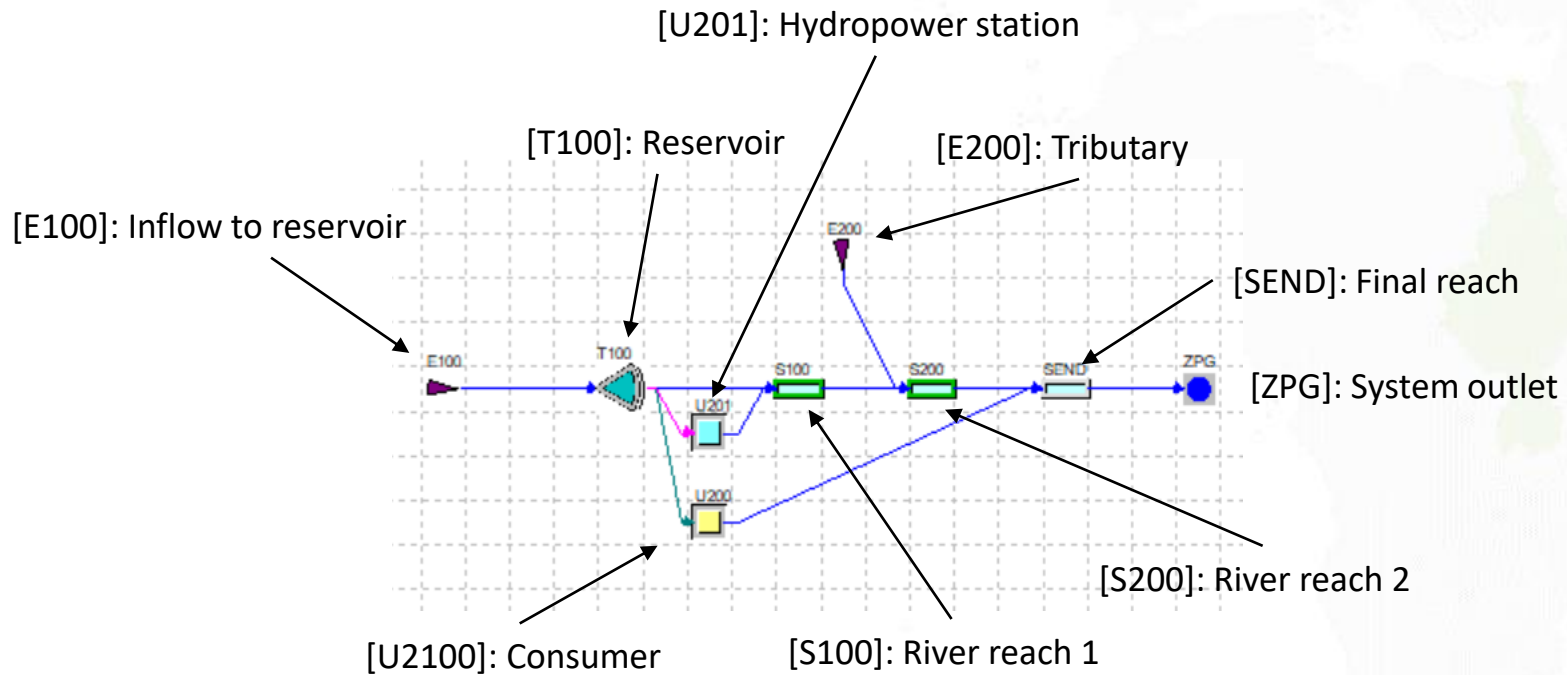
Link States/Clusters with a reservoir

[Go](#)

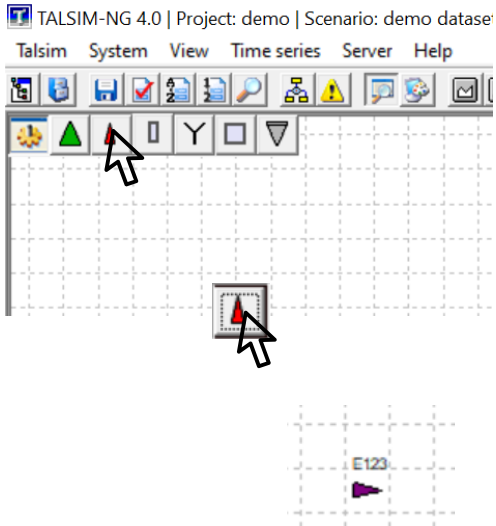
Introductory Example 1



Introductory Example 1



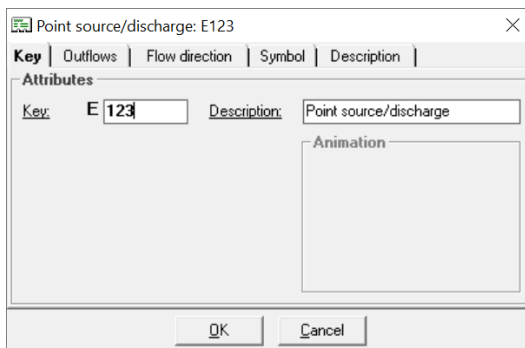
How to create an element?



1. Select the element type you want to be generated

2. Drag and drop the element to a location

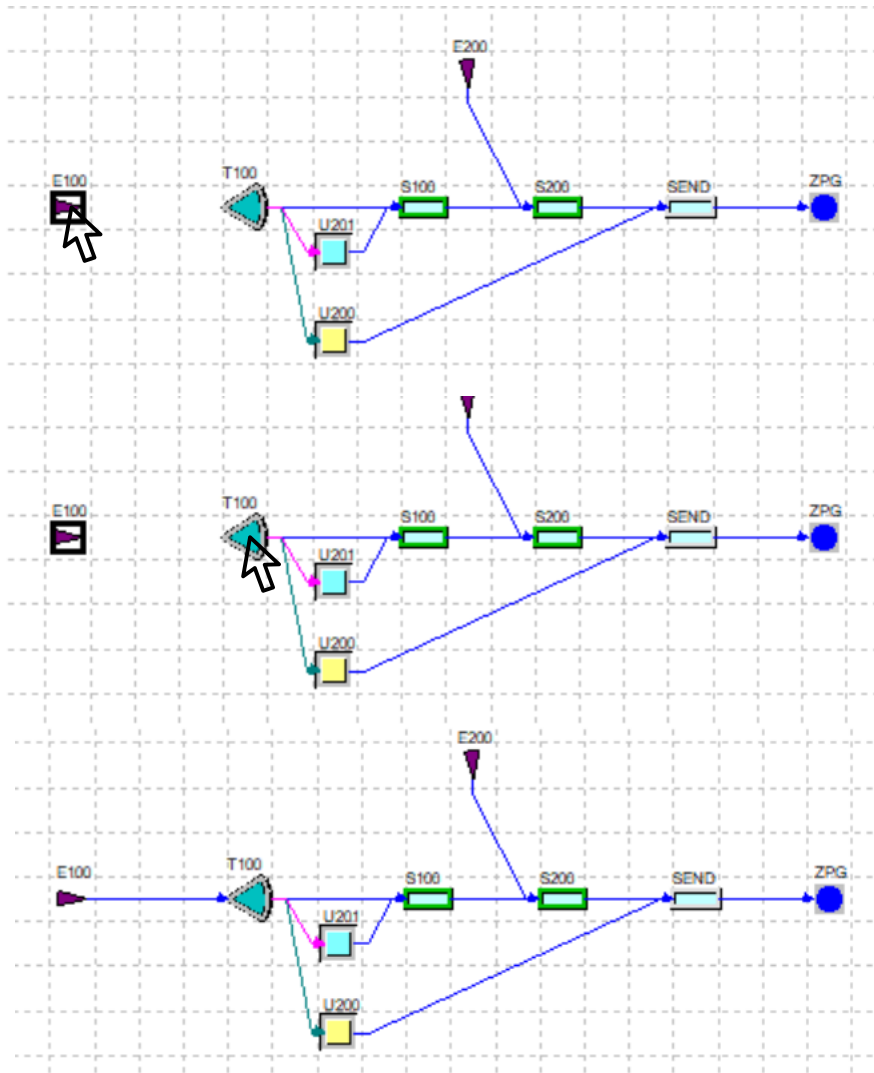
3. Drop the element



4. Provide a unique key and meaningful short description

Repeat the process to generate other elements

How to connect and disconnect elements?

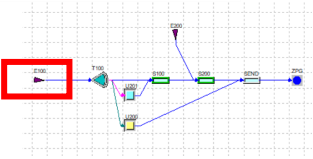


Connect elements

1. Connect two elements by holding down the CTRL key and dragging the element on top of another element.
2. Drop the element on top of your target element and a flow arrow is generated.

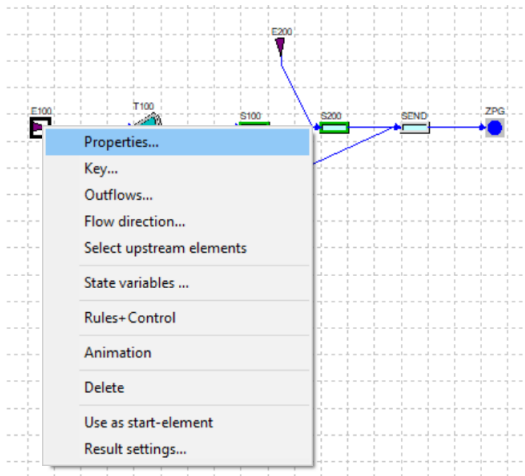
Disconnect elements

Repeating the process for an existing connection removes the connection.



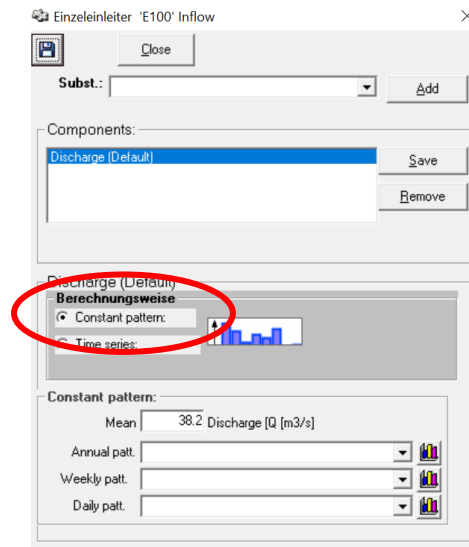
[E100]: Inflow to reservoir

1. Click on E100
2. Right mouse click
3. Select Properties



Calculation options

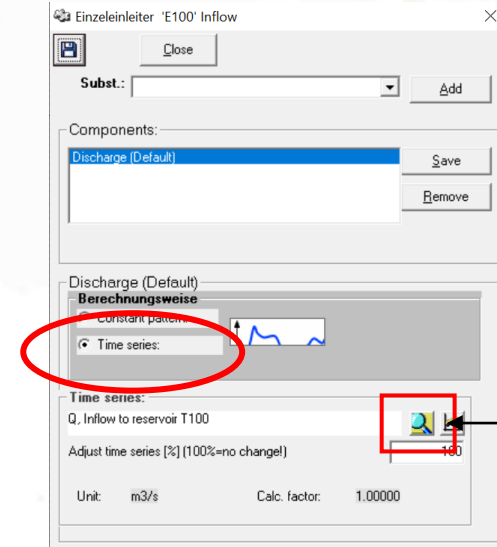
Constant pattern



Selection of monthly, weekly or daily values or a combination thereof is possible. A pattern must be generated before they can be selected.

How to generate Patterns see section **Patterns**.

Time series



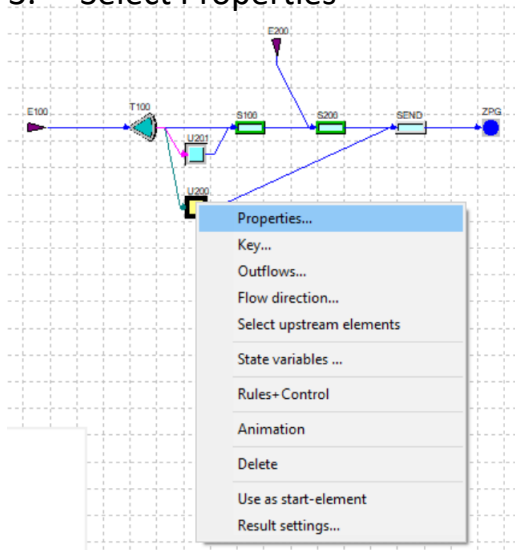
Click to open the time series manager

Selection of a time series from the time series manager is possible. You can remove an already selected time series by selecting the time series name and pressing „Remove“.

How to generate a time series see section **Time series**.

[U200]: Consumer

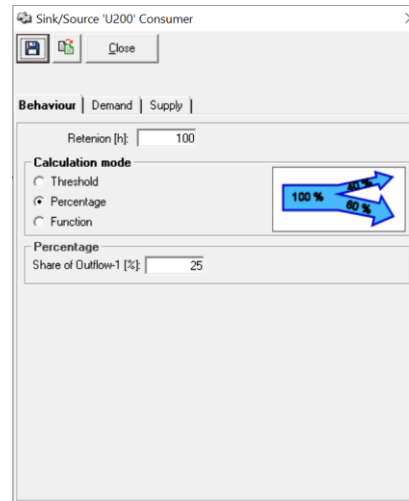
1. Click on U200
2. Right mouse click
3. Select Properties



Behaviour

A consumer has a **Behaviour** describing how inflow is returned to the system and has options for water demand and possible water supply. While **Behaviour** is mandatory, demand and supply are optional.

Behaviour:

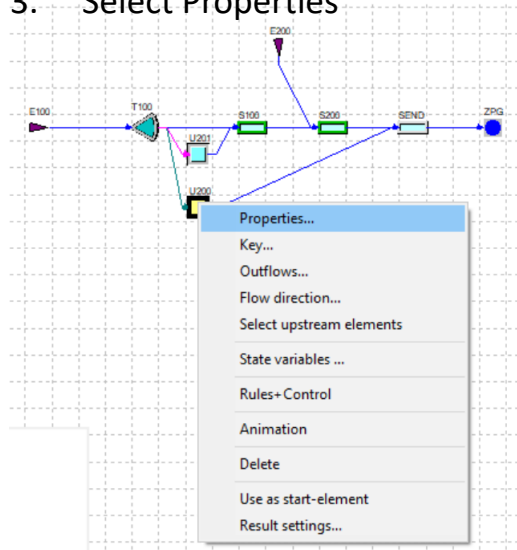


Retention describes the time lag of return flow as storage coefficient in hours.

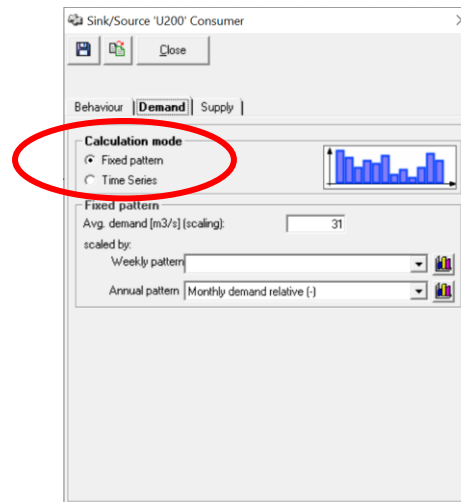
The calculation mode determines how much inflow is returned. For example, a percentage of 0 means no return flow at all.

[U200]: Consumer

1. Click on U200
2. Right mouse click
3. Select Properties



Constant pattern



Selection of monthly or weekly values or combination thereof is possible.
A pattern must be generated before it can be selected.

How to generate patterns see section *Patterns*.

Demand

Time series



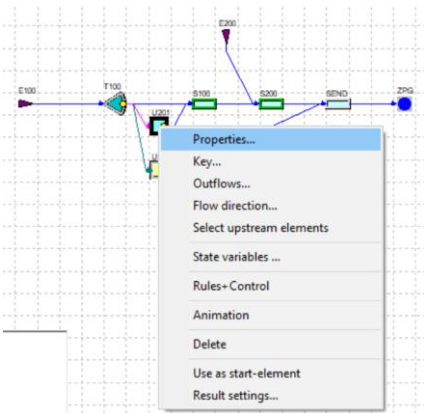
Click to open the time series manager

Selection of a time series from the time series manager is possible. You can remove an already selected time series by selecting the time series name and pressing „Delete“ on your keyboard.

How to generate a time series

[U201]: Hydropower station

1. Click on U201
2. Right mouse click
3. Select Properties

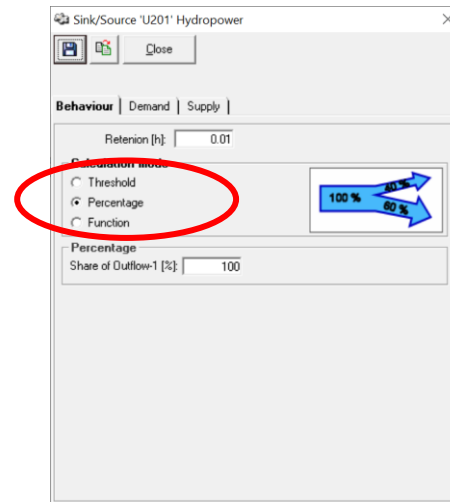


Behaviour

The **Behaviour** of U201 should be consistent with a turbine station. In this case we assume no losses and 100% of inflow goes back into the system.

There is no considerable time lag between inflow and outflow, therefore, Retention in [h] is very small.

Behaviour:



Demand:

none

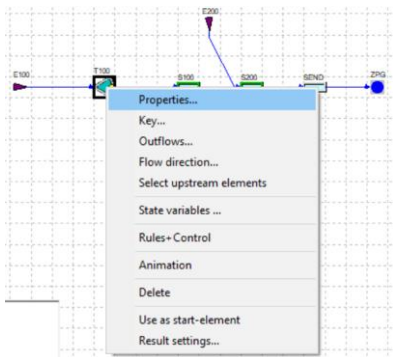
Supply:

none

Use percentage. 100% of inflow goes back into the system.

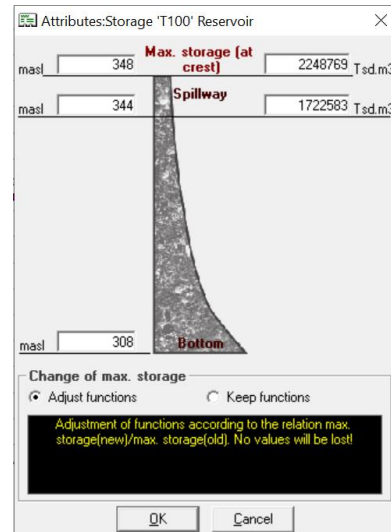
[T100]: Reservoir

1. Click on T100
2. Right mouse click
3. Select Properties



General Properties

The **General properties** determine the basic data of a reservoir. The first time a new reservoir is accessed, this window pops up. Once the data is filled the default reservoir window appears.



Parameter	Value	Unit
Max. storage (at crest)	2248769	Tsd.m3
Spillway	1722583	Tsd.m3
Bottom (masl)	308	masl

Change of max. storage
☒ Adjust functions ☐ Keep functions
 Adjustment of functions according to the relation max. storage(new)/max. storage(old). No values will be lost!

Max. storage and max. elevation refers to either the crest level or to a fictitious maximum level that is only used as a ceiling for calculation.

The spillway level is an informative value and has no meaning for the calculation. The real spillway is determined as a release function and is described [here](#).

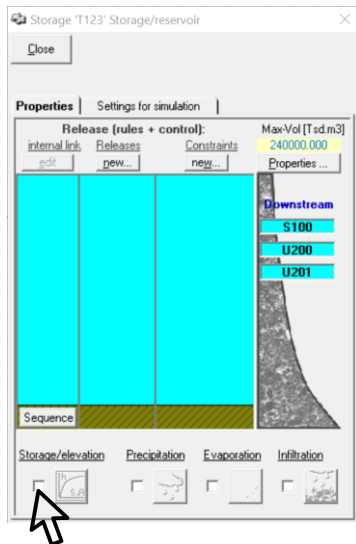
The bottom level is used as the lowest possible elevation and allows validity checks when the user enters values.

[T100]: Reservoir

Storage-Elevation-Surface relationship

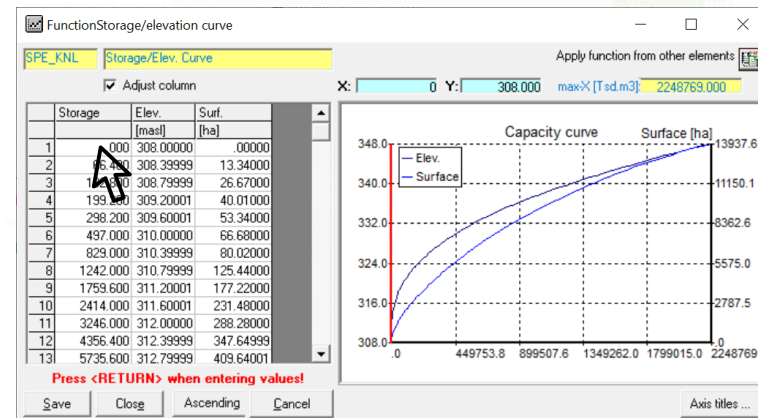
The **Storage-Elevation-Surface** relationship is mandatory. All eventually created release functions must be defined within the min-max range of the **Storage-Elevation-Surface** relationship.

1. Tick Storage/elevation and confirm.
2. Prepare three columns:
1) Storage [Tm³]
2) Elevation [masl]
3) Surface [ha]
3. Select the utmost left cells and paste CTRL+V



and copy it with CTRL+C

Storage	Elevation	Surface
Tm3	masl	ha
0	308	0.00
66.4	308.4	13.34
132.8	308.8	26.67
199.2	309.2	40.01
298.2	309.6	53.34
497	310	66.68
829	310.4	80.02
1242	310.8	125.44
1759.6	311.2	177.22
2414	311.6	231.48
3246	312	288.28
4356.4	312.4	347.65
5735.6	312.8	409.64
7417.6	313.2	474.28
9451	313.6	541.61
11890	314	611.57



Min. storage must be 0!
Max. storage must be consistent to what was given in the **General Properties** (see [here](#))

Min. and max. Elevation must be consistent to what was given in the **General Properties** (see [here](#))

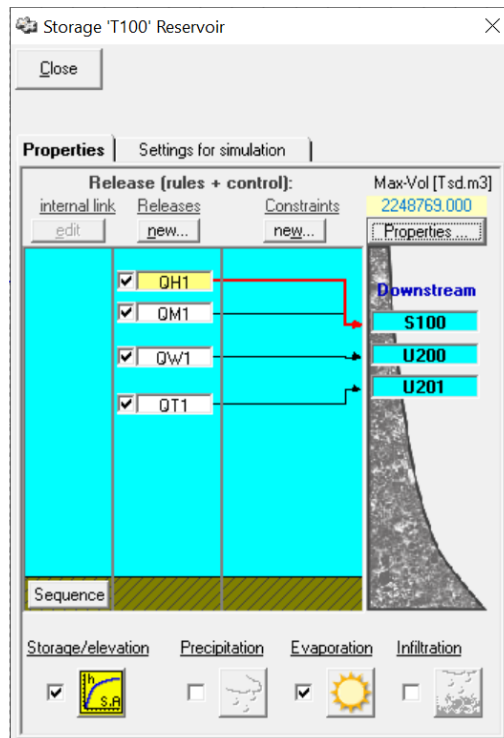
Min. Surface must be 0!

[T100]: Reservoir

Creating a release function

A **Release function** is the general term used for all kinds of releases from the reservoir. The requirement for a release function is its dependency on the storage volume. Usually, a **spillway** is a release function, driven by hydraulic parameters or by a functional relationship as $\text{Release} = \text{function}(\text{Storage})$.

It is recommended to determine separate release functions for each purpose, e.g. one for water supply, one for flood response, one for hydropower, one for minimum flow and so on. In so doing, operating rules can be assigned individually.



Goto General Properties of the reservoir

Shows the connected elements

Can be used to create Rainfall, Evaporation from the reservoir surface or Leakage into the underground.

QH1 = Spillway
QM1 = Minimum flow
QW1 = Water supply
QT1 = Turbine

[T100]: Reservoir

Creating a release function

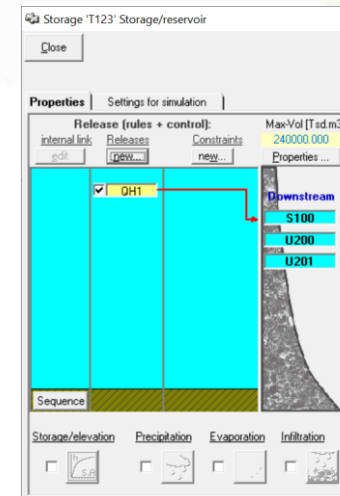
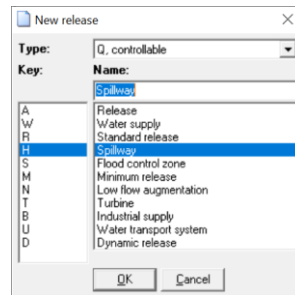
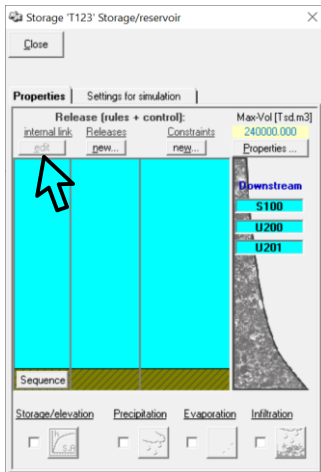
1. Click **New** below Releases

2. Select from the list

2. Link the Release to an outlet

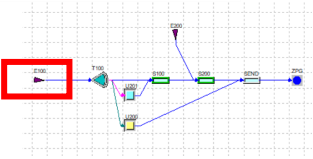
NOTE: the most flexible one is **Release** while other types have restrictions on how to define operation rules.

NOTE: An outlet is created by connecting the reservoir with other elements (see [here](#)). It is recommended to connect and save elements before defining releases.



1. Select the release
2. Drag and drop it on top of an outlet.

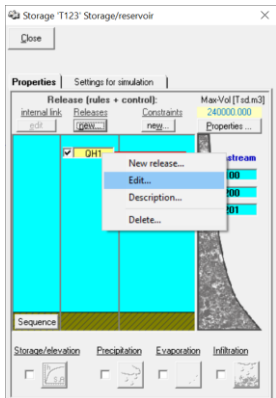
A line will be drawn showing to which outlet the water will flow.



[T100]: Reservoir

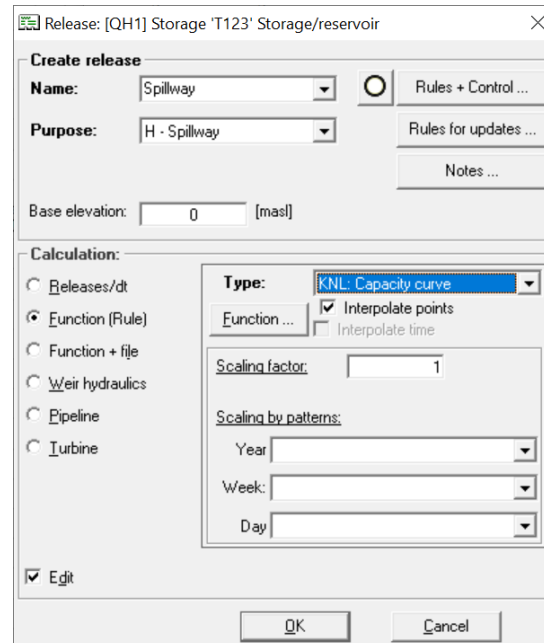
Creating a release function

- Right mouse click on the release and select **Edit** opens the **Release Editor**



- Editing a release

Provide a meaningful name with max. 50 characters.
Enter the elevation of the outlet.



Select the calculation mode:

Function (Rule): Default, Requires a function of the storage volume that is scaled by a combination of a static factor and patterns (patterns see [here](#)).

Function + file: Requires a function of the storage volume that will be scaled by values from a time series.

Weir hydraulics: Determines releases by means of a hydraulic function.

Pipeline: Determines releases by means of hydraulic parameters describing pressure flow in pipes.

Turbine: Determines releases by using a turbine efficiency curve.

NOTE: hydropower generation can be incorporated much more flexible by means of [States + Clusters + Operation Rules](#).

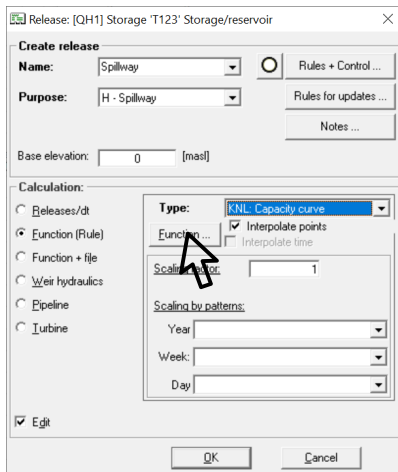
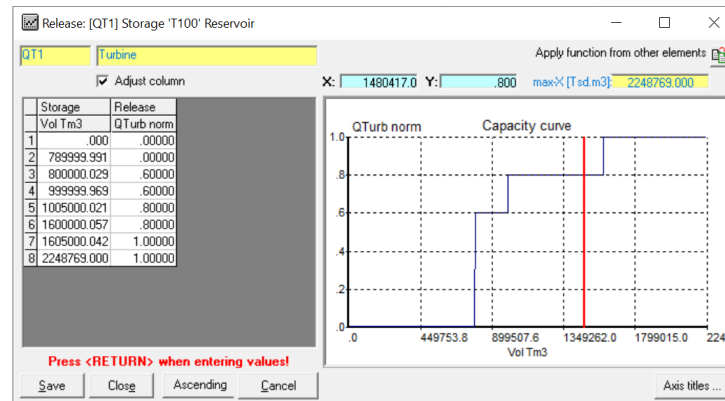
[T100]: Reservoir

Creating a release function

6. Click on **Function** to edit values

7. Edit the function

A function can have up to 200 x-y nodes

Values can be entered by hand or by copy-paste, for example from Excel.

Save, close and reopen the window helps refresh the graph.

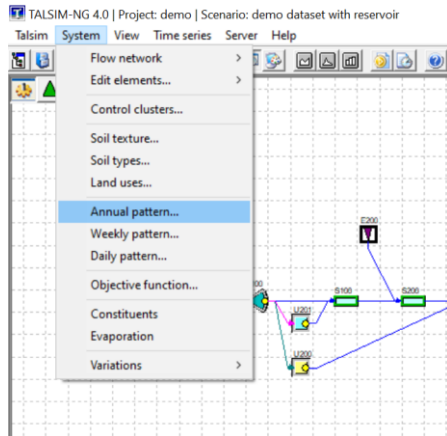


X-values must have an ascending order, y-values do not.

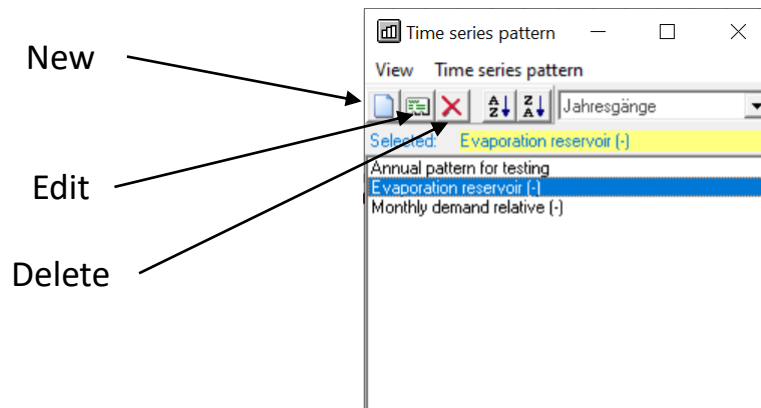
No duplicates for x-values allowed.

Pattern - How to create a pattern?

1. Open the System menu and navigate to *Annual pattern*, *Weekly pattern* or *Daily pattern*



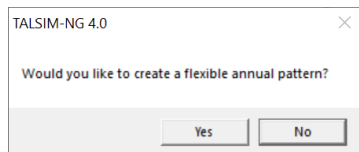
2. The list of patterns appears where you can select an existing one, create a new or delete a pattern.



Pattern - How to create a pattern?

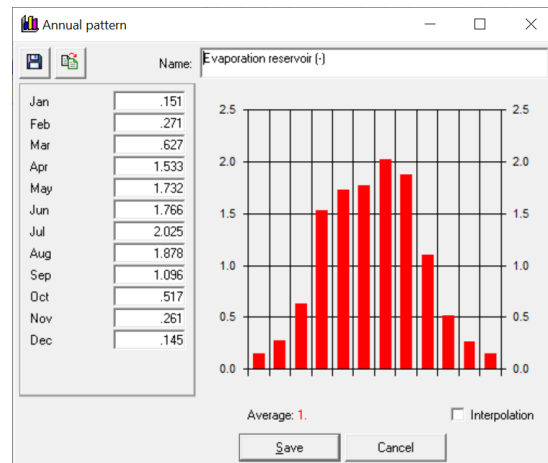
Annual pattern

There are flexible annual patterns or static (monthly) patterns. You will be asked which one you want to create.



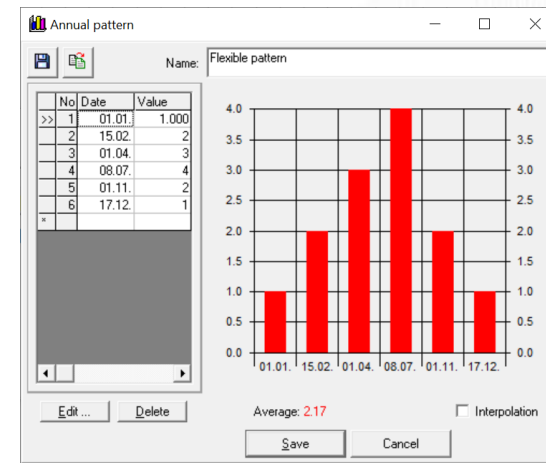
Static (monthly) pattern

This is the common approach. One value can be assigned to each month. Values can be interpolated.



Flexible annual pattern

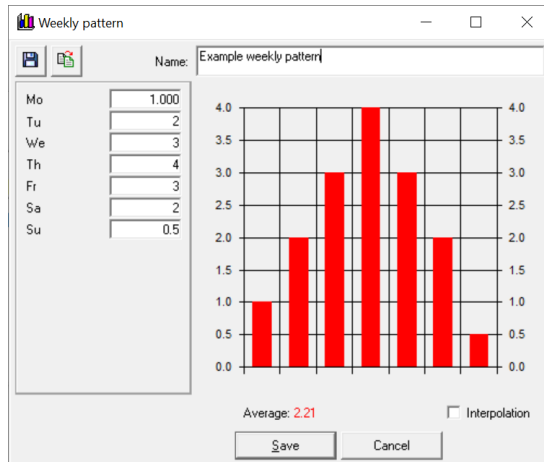
Any date in the year can be used to assign a value to it. Up to 365 values are theoretically possible. Values can be interpolated.



Pattern - How to create a pattern?

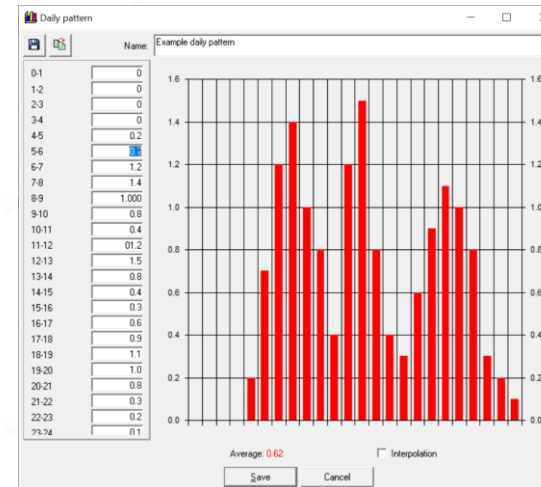
Creating an *Weekly pattern*

A weekly pattern contains one value for each day of a week. Values can be interpolated.



Creating an *Daily pattern*

A daily pattern consists of 24 values, one for each hour. Values can be interpolated.

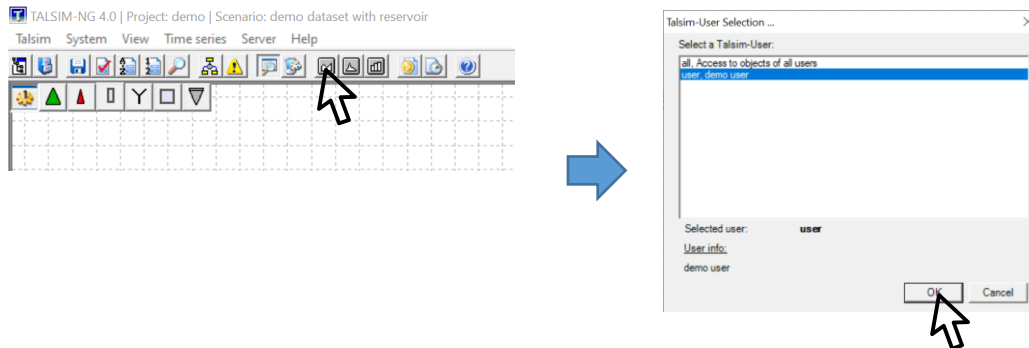


Time series - How to create a time series?

1. Prepare your time series as date/value pairs, best done in Excel
Date must be: dd.MM.yyyy or dd/MM/yyyy

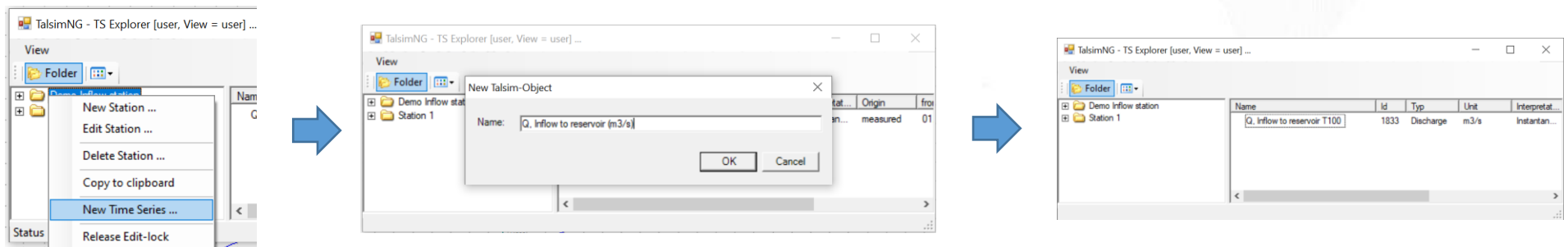
10	Date	Inflow m3/s
11	01.01.1995	119.3
12	02.01.1995	71.3
13	03.01.1995	59.9
14	04.01.1995	46.7
15	05.01.1995	46.9
16	06.01.1995	36.2

2. Open Time Series Manager and **make sure you select your user name!**



The time series server requires that the logged-in user and the selected user are identical.

3. Select the relevant station or create a new station. Select the station, right mouse click and select **New Time Series**. Provide a name (not more than 50 characters!) and press OK
The new time series appears in the the time series manager with default properties Type=Discharge, Unit=m3/s

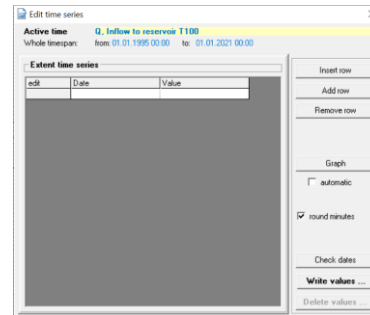
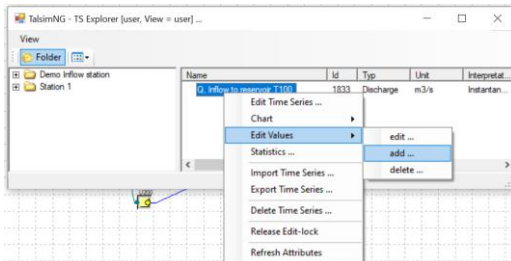


Time series - How to create a time series?

- Make sure your time series has correct properties!
Right mouse click and select **Edit Time Series** to see the properties.

! The time series server requires that the logged-in user and the selected user are identical.

- Right mouse click on the time series, select **Edit Values** and **add ...**
As long as the time series is still empty, a message pops up saying that no time series could be found. Please confirm. The **Edit Time Series** window appears where you can paste the date/value pairs.

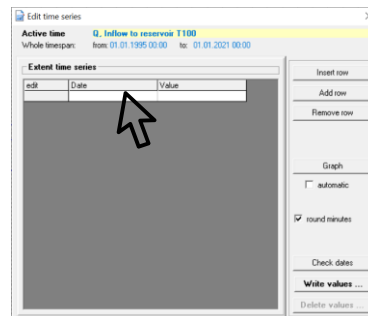


Mark and copy values

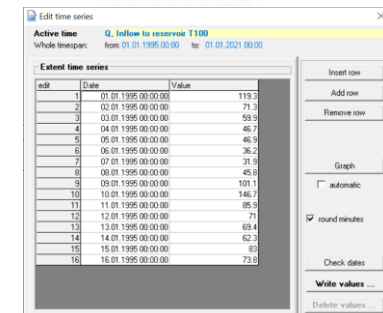
y	Date	Inflow m3/s
11	01.01.1995	119.3
12	02.01.1995	71.3
13	03.01.1995	59.9
14	04.01.1995	46.7
15	05.01.1995	46.9
16	06.01.1995	36.2
17	07.01.1995	31.9
18	08.01.1995	45.8
19	09.01.1995	101.1
20	10.01.1995	146.7
21	11.01.1995	85.9
22	12.01.1995	71
23	13.01.1995	69.4
24	14.01.1995	62.3
25	15.01.1995	83
26	16.01.1995	73.8



Click once into the first left cell

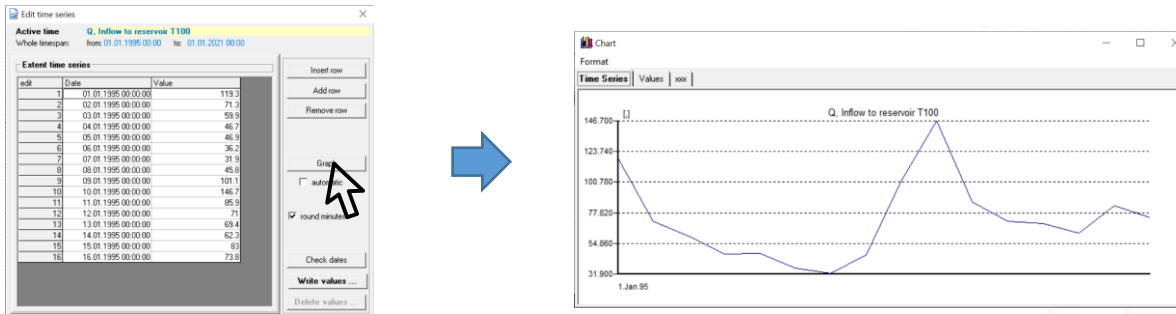


CTRL+V pastes the values into the spreadsheet

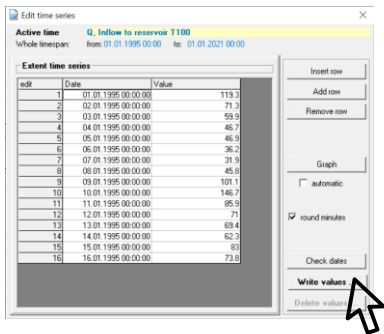


Time series - How to create a time series?

6. Hint: Press Graph and check your time series visually



7. Press **Write Values ...** and your time series will be saved by the time series manager and uploaded to your connected Talsim-NG Server. A success message should pop up. Close the **Edit Time Series** window.



You can repeat the process several times for the same time series. Always use **Edit Values** and **add ... !!!**
Every time you do that, new values are uploaded and overwrite old values if values for the given time period already exist.

States – Control Clusters – Operation Rules

Operation rules are defined by means of [States](#) and [Control Clusters](#).

Each element has a set of states specific for its hydrological context like inflow, outflow, water level, flow velocity, actual evaporation and so on. The states for a sub-basin with precipitation-runoff modelling is of course different to the states of a reservoir. Generally, all states can be used to determine a operation rule. The concept is simple:

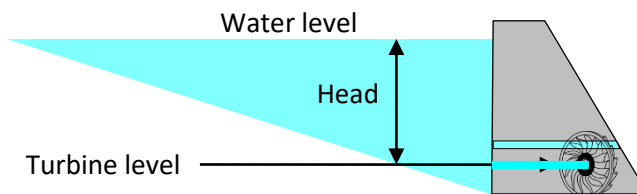
1. Create a state you want to use as a driver for an operation rule
2. Use either *current values* or determine a *transformation function* for the state to be used for the operation rule

Current value: refers to the current value during the simulation for each time step.

Example: When the water level of a reservoir is needed, it will be updated every time step and an operation rule can use the updated water level.

Transformation function: The state uses a functional relationship in order to transform the state into the information required for the operation rule.

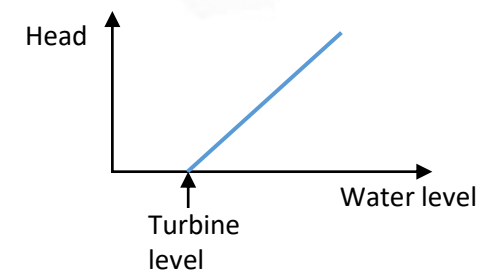
Example: The head for a turbine depends on the current water level and the elevation of the turbine. The transformation function uses both to calculate the head.



Transformation
function



$$\text{Head} = \text{Water level}(t) - \text{Turbine Level}$$



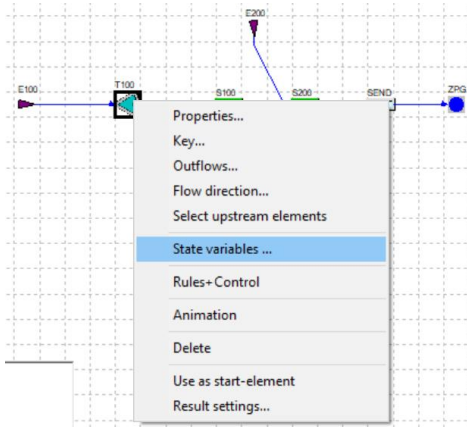
3. Link the output to a release function at a reservoir, which is described [here](#).

States

1. In order to **create a state** the element must be selected that holds the state that is required

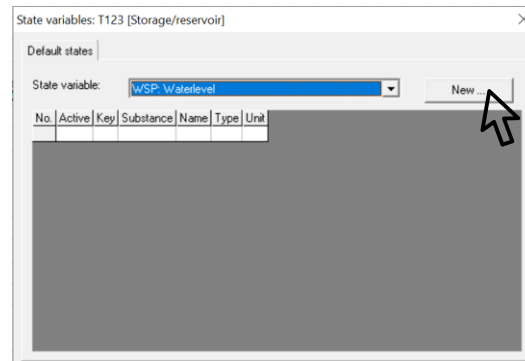
Example:

Water level of a reservoir

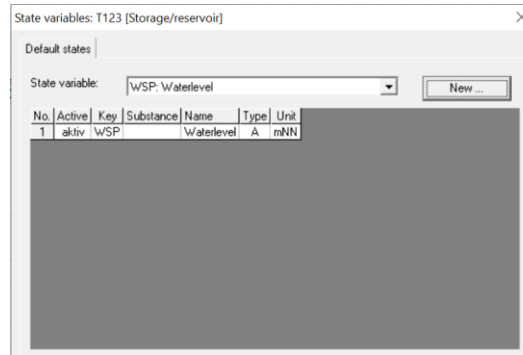


2. Select the state and press **New**

Releases once they are created become visible in the Tab **Releases**

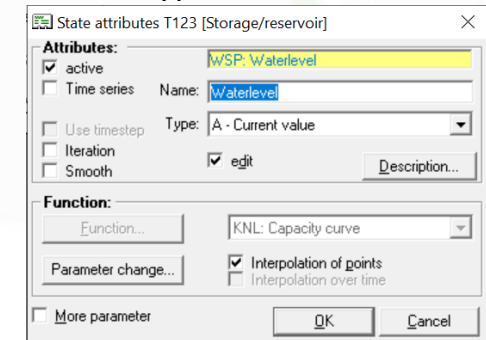


The new state appears in the table



3. Double click on the entry in the table opens the **State Editor**

Default type is **Current Value**



To create a transformation function select **Function** in the **Type** combo box and press the button **Function**.

The **Function Editor** appears where the relationship can be set (see [here](#))

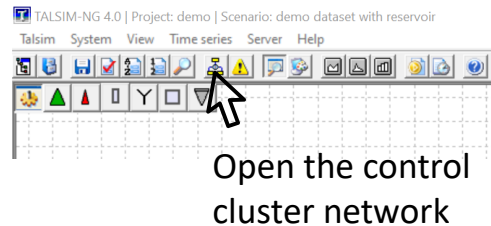


Control- (or State-) Clusters

A **Control Cluster** combines states and creates a logical state that can be used for operation rules. Examples are:

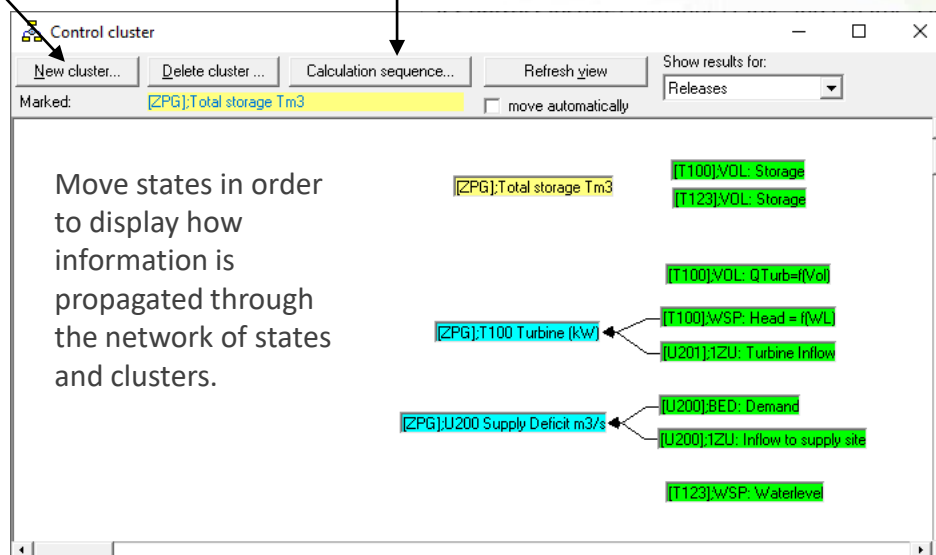
- virtual total storage volume as sum of more than one current storage of reservoirs
- sum of different lateral inflows that might impact on a downstream river reach
- total water demand from various sites that must be fulfilled by a reservoir

States must have been created beforehand in order to combine them. All states and clusters are displayed in the control cluster network.



Create a **New Cluster** here

Determine **Calculation order** of clusters



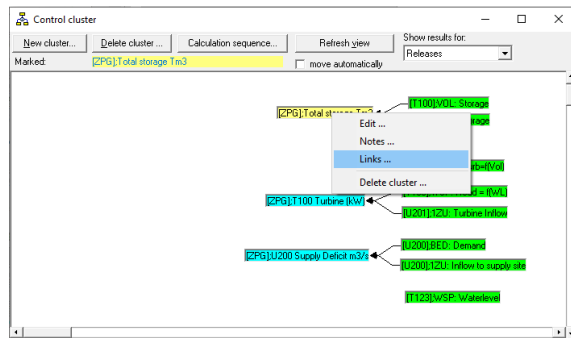
Link states/clusters by holding CTRL and dragging/dropping them on top of another one

Control- (or State-) Clusters

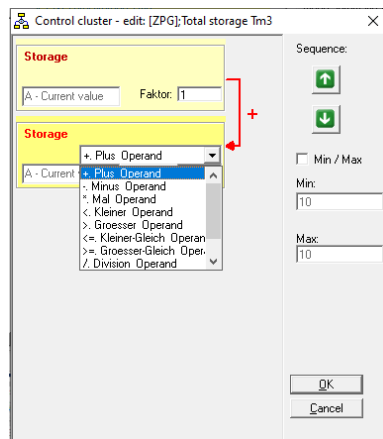
Each cluster has attributes and links to predecessors.

Links to predecessors

Select a cluster, right mouse click and select *Links*

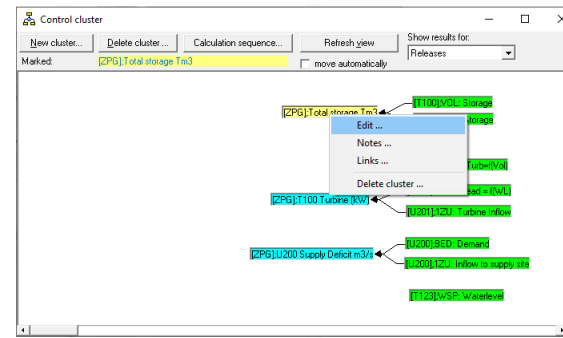


Select how predecessors shall be linked

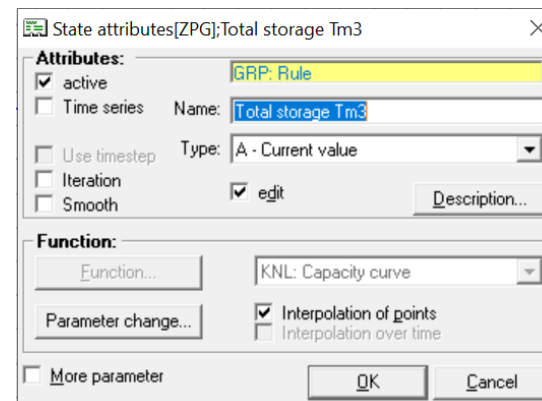


Edit a cluster

Select a cluster, right mouse click and select *Edit*



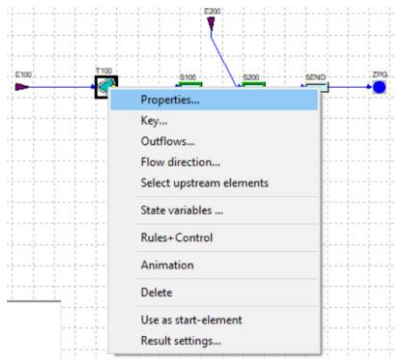
The *State Editor* appears, which is described [here](#)



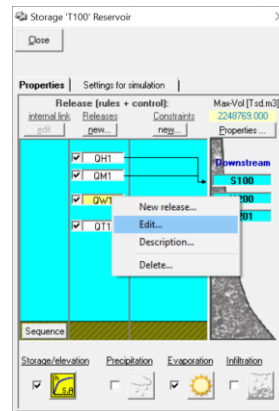
Link States/Clusters to release functions at a reservoir

1. Select the reservoir, which contains the release you want to link.

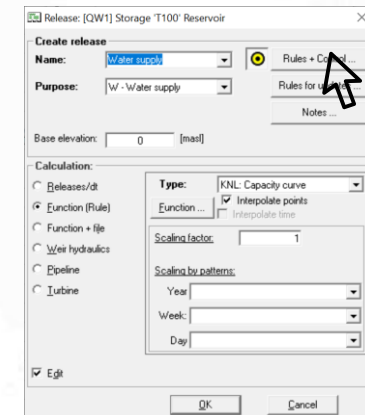
- Right mouse click
- Select **Properties**



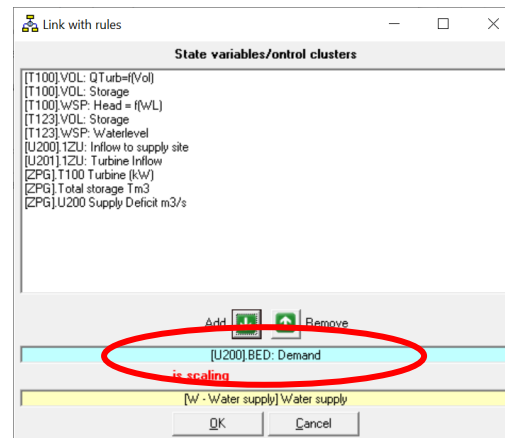
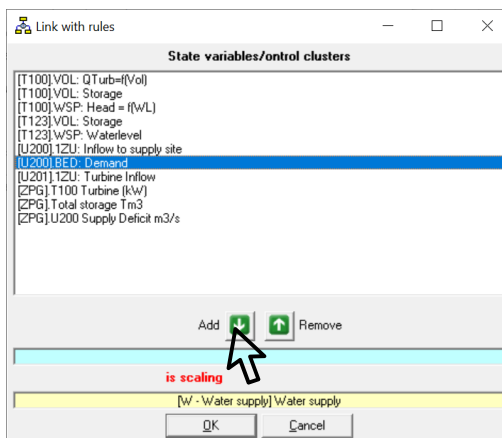
2. Select the **Release**
 - Right mouse click
 - Select **Edit**



3. Click **Rules+Control**



4. Select the State variable or Control Cluster and click **Add**, The selected element appears in the Scaling Box



To remove a connection click *Remove*