

Real-time monitoring using the INOWAS platform

Tutorial: Utilizing the real-time monitoring tool to import time-series data

Developed within:



Project funded by:



Federal Ministry
of Education
and Research



Research
Promotion
Foundation



2017 JOINT CALL

Real-time monitoring tool

INTRODUCTION

Real-time monitoring tool

Main objective:

Add monitoring (time series) data to the web-based INOWAS platform

Specific objectives:

- Collection of (real-time) time series data from the in-situ site-specific observation systems in one data base
- Process the monitoring data to extract outliers, default values, change the time resolution, ...
- Visualize the sensor data to compare various sites
- Prepare the data for further usage in other tools on the INOWAS platform:
 - Numerical groundwater modelling and observation (T03)
 - Heat transport (T19)
 - Real-time groundwater model (T20)

Real-time monitoring tool

Tool setup:

1. Sensor setup
2. Data processing
3. Visualization

Online documentation available under:

<https://inowas.com/tools/t10-real-time-monitoring/>

The screenshot displays the INOWAS real-time monitoring tool interface. The top navigation bar includes 'DASHBOARD' and 'DOCUMENTATION', with the user 'Jana Glass' logged in. The breadcrumb trail shows 'Tools > T10. Real time monitoring > Pirna'. The left sidebar contains 'SENSORS' with sub-options for 'Setup', 'Processing', and 'Visualization'. The main area features a list of sensors: F13, F15, F16, F12, and Elbe river. A map of Pirna shows the location of F13 on the Elbe river. The right panel is titled 'Add' and contains a form for sensor configuration. The form includes fields for 'Name' (F13), 'Lat' (50.965896), and 'Lon' (13.923835). Below these is a table for 'Parameter' and 'Sources':

Parameter	Sources
Electrical conductivity	1
Water level	1
Temperature	1
Dissolved oxygen	1
Other	0

At the bottom, there is a 'Data sources' section with a table for 'Type' and 'Time range':

Type	Time range
online	- 2020/11/18

Below the data sources is a 'Chart' section showing a bar chart with a value of 0.44. The interface also includes a 'JPG' and 'CSV' download button.

Real-time monitoring tool

1. Sensor setup

- New sensors can be setup including location
- Parameters can be added to the sensor (e.g. water level, electrical conductivity)
- Data sources can be defined:
 - CSV upload
 - Connection of online sensors
 - External online services (via Prometheus)

The screenshot displays the 'Sensor setup' interface. On the left, a sidebar shows 'SENSORS' with options for 'Setup', 'Processing', and 'Visualization'. The main area features a list of sensors: FI3, FI5, FI6, FI2, Elbe river, and 'New Sensor'. A map shows the location of the 'New Sensor' on the Elbe river. A 'Changes not saved!' warning is visible. The 'New Sensor' form includes fields for 'Name' (New Sensor), 'Lat' (50,965572), and 'Lon' (13,92492). Below the map, a table lists parameters and sources:

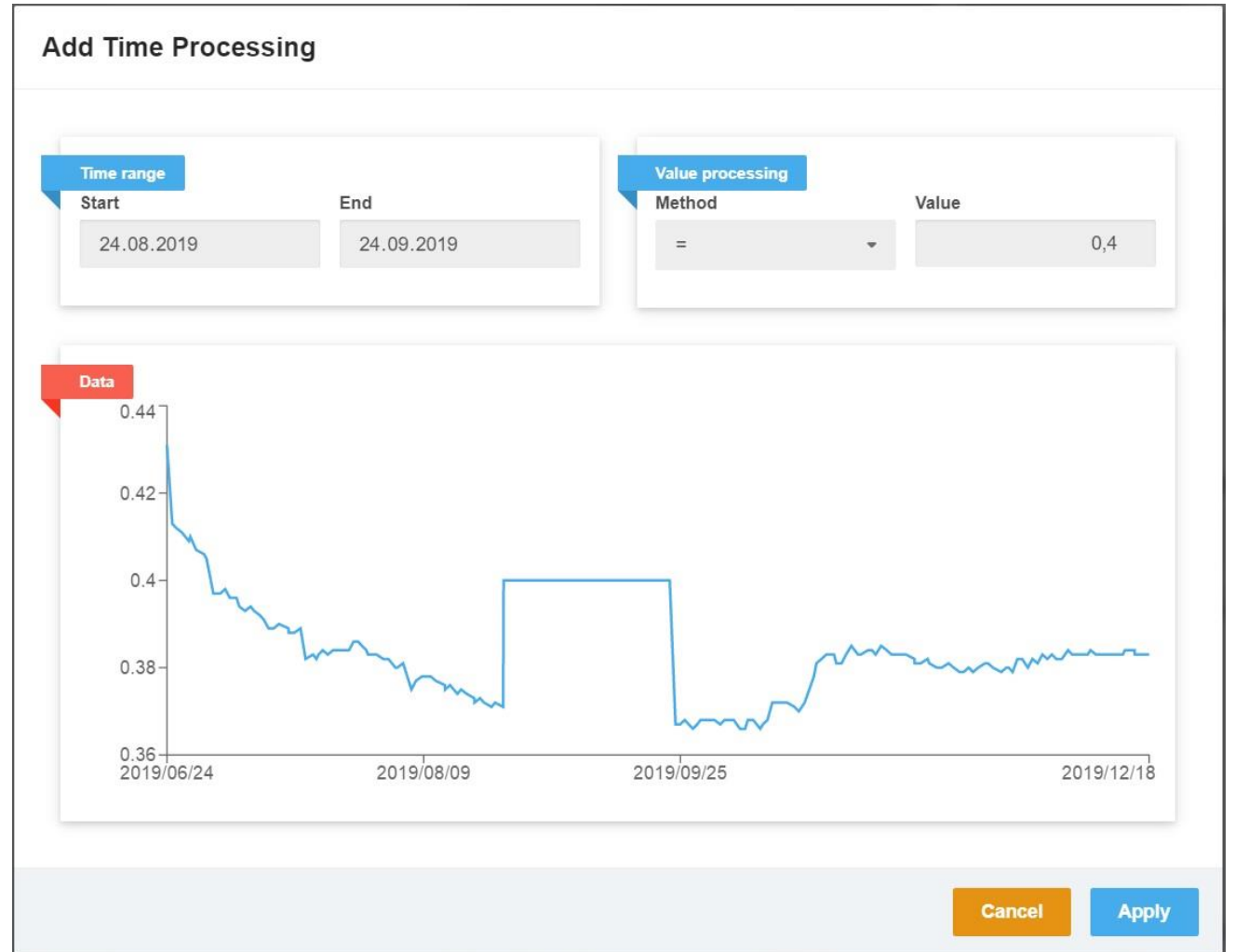
Parameter	Sources
Water level	0

An 'Add' button is present below the table. A dropdown menu is open, showing 'CHOOSE TYPE' with options: Dissolved oxygen, Electrical conductivity, Water level, pH, Pressure head, Redox potential, Temperature, Water content, and Other. Below the table, a 'Data sources' section is visible with columns for 'Type' and 'Time range'.

Real-time monitoring tool

2. Data processing

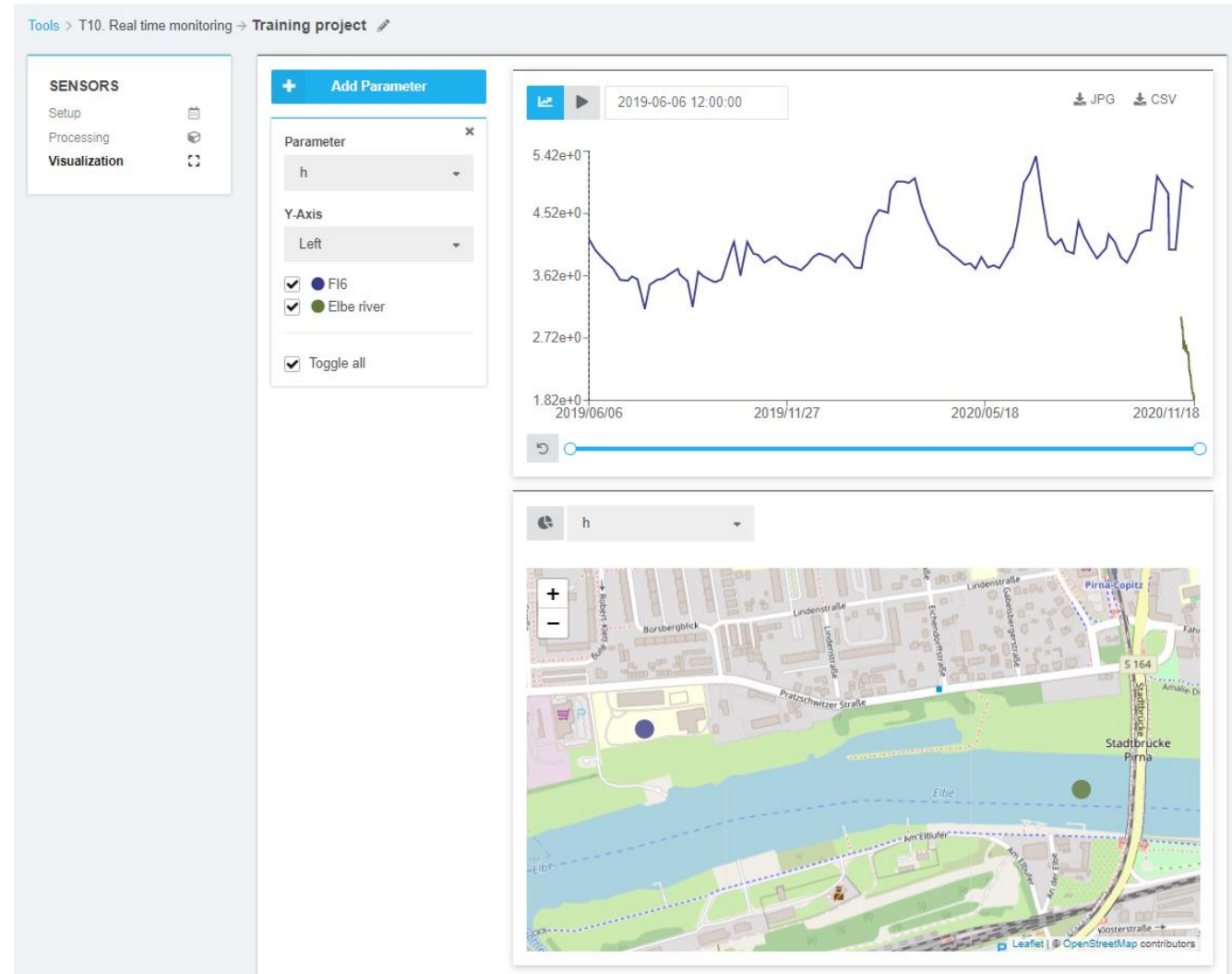
- Time processing:
 - change the time resolution of a time series
 - cut time series (define beginning and end that will be used)
- Value processing:
 - Various processing algorithms e.g. =, +, -, *, /, >, <
- Export of resulting time series via CSV or JPG



Real-time monitoring tool

3. Data visualization

- Visualize and compare various time series of one parameter at different locations
- Two parameters on one or two y-axis can be added
- Displayed time range can be adapted
- Export via CSV or JPG



Learn how to use the real-time monitoring tool and get to know the main features

INTERACTIVE STEP-BY-STEP TUTORIAL

Overview of the interactive tutorial

- Login to the INOWAS platform
- Learn how to navigate to the various tools, how to save a project
- Set up a monitoring project including two sensors (FI6, Elbe river) from the test site in Pirna, Germany
- Add parameters to the sensor
- Add sensor data via CSV, online sensor and add an external web service (via Prometheus)
- Manipulate the sensor data using time and value processing capabilities
- Visualize and compare the time series

Login to the INOWAS website

Go to

inowas.com

And **login** with your **personal user name** and **password**.

If you aren't registered yet, please sign up on the following webpage: <https://dss.inowas.com/signup>

Start Tool T10: Real-time monitoring

- Navigate to T10 in the Dashboard
- Create a new project
- Define a name for your project
- Choose whether to save it private or public (can be later changed)

The screenshot shows the dashboard interface with the following components:

- TOOLS List:** A vertical list of tools. 'T10: Real time monitoring' is highlighted with a blue box. A blue circle highlights the '+ Create new' button next to it.
- Instances of T10: Real time monitoring Table:** A table with columns: No., Name, Tool, Date created, Created by. It lists 12 instances.
- Footer:** Contains release information (v1.2.1), contact imprint, logos for INOWAS, Technische Universität Dresden, and the Federal Ministry of Education and Research.

No.	Name	Tool	Date created	Created by
1	Berlin	T10	11/27/2019 07:51	jana.glass
2	Pirna	T10	11/05/2019 12:04	jana.glass
3	Pirna 2	T10	10/21/2020 14:24	ralf.junghanns
4	Pirna (clone) 123	T10	11/14/2019 13:15	ralf.junghanns
5	Berlin (clone)	T10	11/29/2019 13:09	christian.menz
6	Berlin (clone) (clone)	T10	08/31/2020 10:04	catalin.stefan
7	New monitoring project	T10	10/15/2020 18:32	ralf.junghanns
8	Pirna	T10	10/21/2020 13:02	michael.rustler
9	Heat Transport 1	T10	10/27/2020 06:43	christian.menz
10	Heat Transport 1 (clone)	T10	11/02/2020 15:05	catalin.stefan
11	Pirna (clone)	T10	11/11/2020 12:53	ralf.junghanns
12	Training project	T10	11/13/2020 14:28	jana.glass

Sensor setup: add new sensor

A new sensor can be added by using the “+Add” button.

The sensor location needs to be defined by **clicking on the specific location on the map** using the GIS functionalities of the INOWAS platform or by **specifying the latitude and longitude** of the sensor.

The INOWAS platform uses WGS84 as the standard coordinate system.

Please include the following sensor as an example:

Name: **FI6** in Pirna, Germany

Latitude: **50.965852**

Longitude: **13.923834**

Add new Sensor

Add Sensor

Name

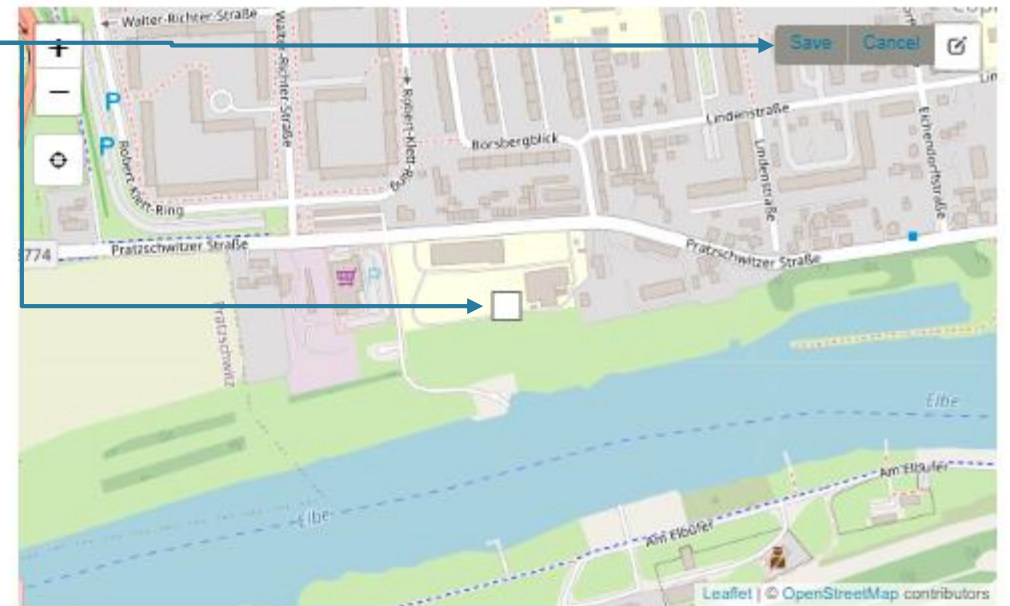
FI6

Lat

50.965852

Long

13.923834



Cancel

Create sensor

Sensor setup: add parameter

Tools > T10. Real time monitoring → Training project

SENSORS

- Setup
- Processing
- Visualization

Add

FI3

Name: FI3

Lat: 50.965896 Lon: 13.92334

Parameter	Sources

+ Add

- CHOOSE TYPE
- Dissolved oxygen
- Electrical conductivity
- Water level (m)**
- pH
- Pressure head (m)
- Redox potential
- Temperature (°C)
- Water content
- Other

→ **Add water level to your sensor**

After creating the sensor, the metadata including the name and location (WGS84) can be edited and parameters can be added using the following categories:

- Electrical conductivity
- Water level
- Pressure head
- Dissolved oxygen
- Temperature
- pH
- Water content
- Redox potential
- Others

Sensor setup: add data source - online sensor

The screenshot shows the INOWAS sensor setup interface. On the left, a sidebar contains 'SENSORS', 'Setup', 'Processing', and 'Visualization'. The main area is titled 'Tools > T10. Real time monitoring -> Training project'. A map of Pirna, Germany, is displayed with a red location pin. To the right of the map, a form for adding a sensor is shown. The 'Name' field contains 'FI6', and the 'Lat' and 'Lon' fields contain '50.965896' and '13.92334' respectively. Below this, a table lists parameters and their sources:

Parameter	Sources
Water level	0

An 'Add' button is visible next to the 'Water level' parameter. Below the table, a 'Data sources' dropdown menu is open, showing options: 'file', 'online', and 'prometheus'. The 'online' option is circled in blue. The 'Water level' parameter is highlighted with a red box.

For each parameter, time series data can be added as **CSV**, as **online** sensors using a server connection or via **prometheus** for public available data .

Groundwater sensors of the company [UIT](#) can be connected via FTP and SensoWeb to the INOWAS platform. For that the data source type "**Online**" is chosen.

The specific project, sensor and desired parameter needs to be selected. The time and value range can be specified in addition.

Sensor setup: add data source - online sensor

Add Datasource

Server
uit-sensors.inowas.com

Metadata
Project: DEU1
Sensor: I-6
Parameter: h

Time range
Start: YYYY/MM/DD
End: YYYY/MM/DD

Value range
Upper limit:
Lower limit: 1

Data
Line graph showing time series data from 2019/06/06 to 2020/11/13. The y-axis ranges from 3.0 to 5.4.

Buttons: Cancel, Apply

Please add an **online sensor** and choose the following settings as an example:

Project: **DEU1**
(for the test field in Pirna, Germany)

Sensor: **I-6**

Parameter: **h**

Lower limit: **1**

(due to maintenance / low battery some values are missing)

The chosen time series data is visualized in the graph.

Click on **"apply"** to save the time series to your project

Sensor setup: add data source - CSV file

The screenshot shows the INOWAS sensor setup interface. The top navigation bar includes 'DASHBOARD' and 'DOCUMENTATION' on the left, and the user name 'Jana Glass' on the right. The main content area is titled 'Tools > T10. Real time monitoring > Training project'. On the left, there is a sidebar with 'SENSORS' and 'Setup' options. The main area displays a map of the Elbe river area with a sensor location marked. The configuration panel for the 'F16' sensor is visible, showing the sensor name, coordinates (Lat: 50.965896, Lon: 13.923834), and a table of parameters and sources. A dropdown menu is open, showing a list of parameter types, with 'Temperature (°C)' highlighted.

Parameter	Sources
Water level	1
Temperature	0

Type	Time range
------	------------

- CHOOSE TYPE
- Dissolved oxygen
- Electrical conductivity
- Water level (m)
- pH
- Pressure head (m)
- Redox potential
- Temperature (°C)**
- Water content
- Other

→ Add a new parameter **"temperature"** to the F16 sensor

→ Add a new data source with the type **"file"**

Sensor setup: add data source - import csv file

Add Datasource

The screenshot shows the 'Add Datasource' interface with four main sections:

- Upload File:** A 'File' field contains 'Datei auswählen | FI6_Temperature.csv'. A 'Datetime format' field is set to 'DD.MM.YYYY H:i:s'. A 'First row is header' toggle is turned on.
- Metadata:** A 'Datetime' dropdown is set to 'timeStamp' and a 'Parameter' dropdown is set to 'value'.
- Time range:** 'Start' is set to '2019/06/06' and 'End' is set to '2020/11/13'.
- Value range:** 'Upper limit' and 'Lower limit' are both set to '0'.

At the bottom, a 'Data' section shows a line graph of temperature over time. The y-axis ranges from 6 to 14, and the x-axis shows dates from 2019/06/06 to 2020/11/13. A sharp dip in the temperature line is visible around 2019/11/27.

Download the provided **CSV file** on the Tutorial website and choose it on your computer. The name of the file is:

„FI6_temperature“

Choose as Datetime: **TimeStamp**

Choose as Parameter: **value**

The visible temperature minimum was during an infiltration test in October 2019

Sensor setup: add data source - prometheus

The screenshot shows a web interface for adding a sensor. On the left, a sidebar lists existing sensors: 'Fl6' and 'Elbe river'. A blue 'Add' button is circled at the top left. The main area features a map of the Elbe river in Pirna, with a red dot indicating the sensor location. To the right of the map is a form for the sensor details: Name (Elbe river), Lat (50.965047), Lon (13.933124), and a table for parameters and sources. The table has a red 'Water level' parameter and a source count of 0. A blue 'Add' button is at the bottom right of the table. Below the table is a 'Data sources' section with a table for 'Type' and 'Time range'. A dropdown menu is open, showing options: 'CHOOSE TYPE', 'file', 'online', and 'prometheus', with 'prometheus' circled.

Besides CSV upload and online sensors connected via FTP, it is possible to add time-series data of public available data via **prometheus**.

Add new sensor (Elbe river)

→ place it anywhere in the Elbe river

*→ Add **water level***

*→ Add data source **prometheus***

Sensor setup: add data source - prometheus

→ Change the **step size** to 10 000

→ Go on „**apply**“ to include the data into your project

Add Datasource

Server
prometheus.inowas.com

Time range
Start: 2020/11/06
End: YYYY/MM/DD
Step size: 120
Auto update:

Query
pegel_online_wsv_sensors(station="DRESDEN", type="waterlevel")/100

Data
3.25
3
2.75
2.5
2.25
2020/11/06 2020/11/08 2020/11/11 2020/11/13

Cancel Apply

Sensor Processing

→ Navigate to the **sensor processing** section

The following features are implemented:

- Time processing:
 - change the time resolution of a time series
 - cut time series (define beginning and end that will be used)
- Value processing:
 - Various processing algorithms e.g. =, +, -, *, /, >, <
- Export of resulting time series via CSV or JPG

→ Start **time processing** of the **water level** of **FI6**

The screenshot displays the INOWAS DSS web interface. The browser address bar shows the URL: `dss.smart-control.inowas.com/tools/T10/7310b35b-f7ee-4768-b335-f46311f1b2...`. The page title is "Tools > T10. Real time monitoring > Training project".

In the left sidebar, under "SENSORS", the "Processing" option is highlighted with a blue circle. A blue arrow points from this circle to the text "→ Start time processing of the water level of FI6".

The main content area shows the configuration for sensor "FI6". It includes a map of the Elbe river area, a configuration panel with the following details:

- Name: FI6
- Lat: 50.965896
- Lon: 13.92334
- Parameter: Water level (1), Temperature (1)
- Sources: 1 (for each parameter)

Below the configuration, there is a "Processings" section with a table:

Type	Time range	Method	Value
			+ Add

The "Add" button in the "Processings" table is highlighted with a blue circle. A blue arrow points from this circle to the text "→ Start time processing of the water level of FI6".

At the bottom of the interface, there is a "Chart" section showing a time series plot of water level data from 2019/06/06 to 2021/06/30. The y-axis ranges from 3 to 6. The plot shows a fluctuating blue line representing the water level over time.

At the bottom of the page, there is a footer with the following information:

- Release: v1.8.1+
- Developed by
- Supported by
- Funded by

Sensor data processing - time

Change the resolution of the time series data of the water level of FI6 from

1 d to 7 d

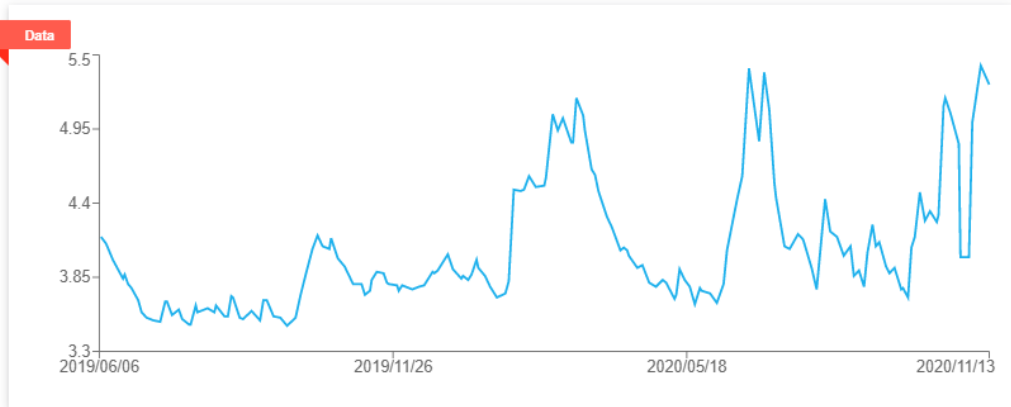
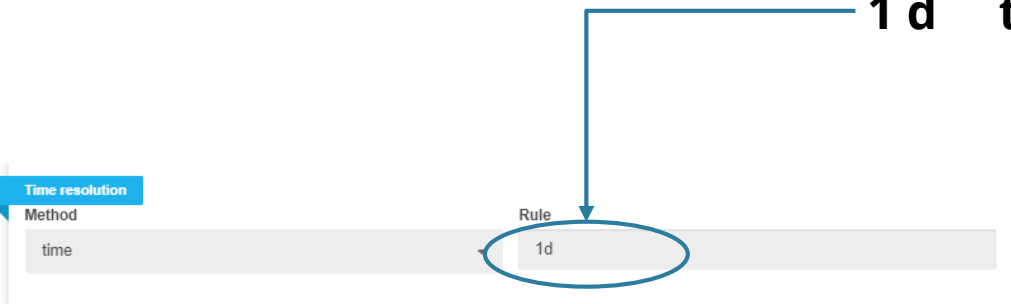
Time resolution

Method

time

Rule

1d



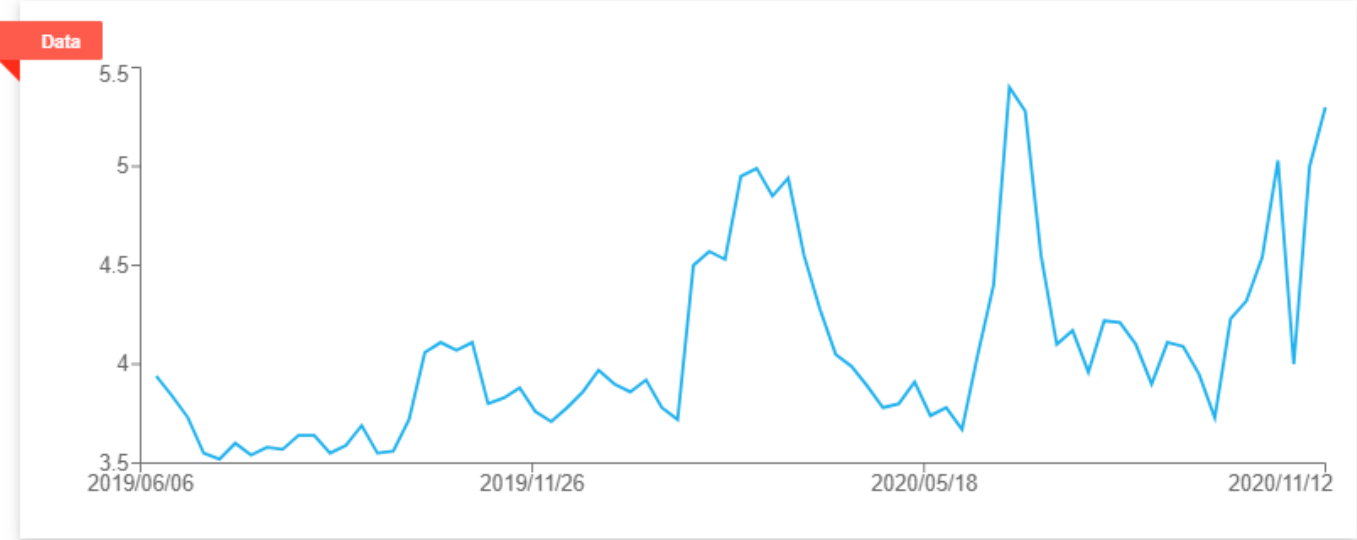
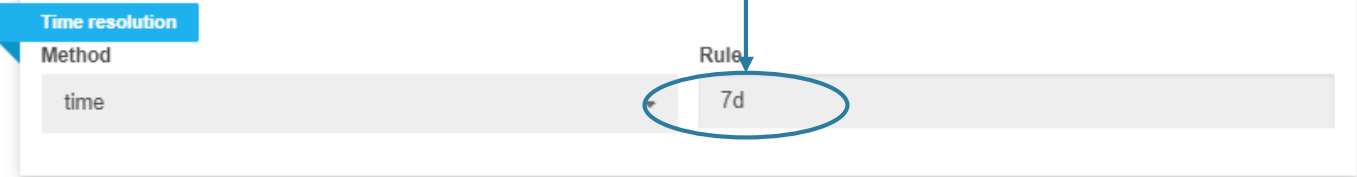
Time resolution

Method

time

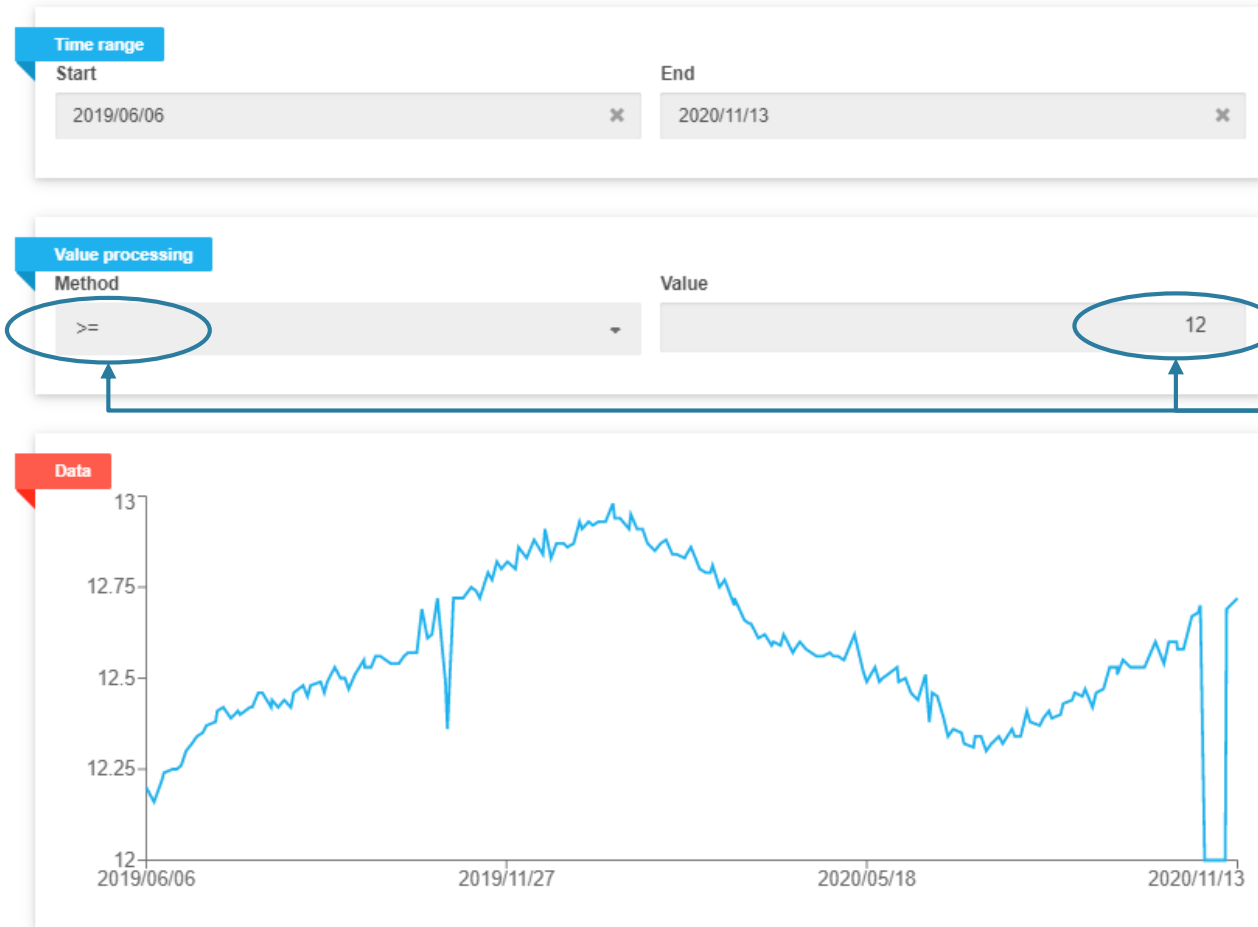
Rule

7d



Sensor data processing - value

Add Time Processing



→ Start **value processing** of the **temperature** of **FI6** to filter temperature values

Example:

Only show values ≥ 12

→ Click **"apply"** to save the changes

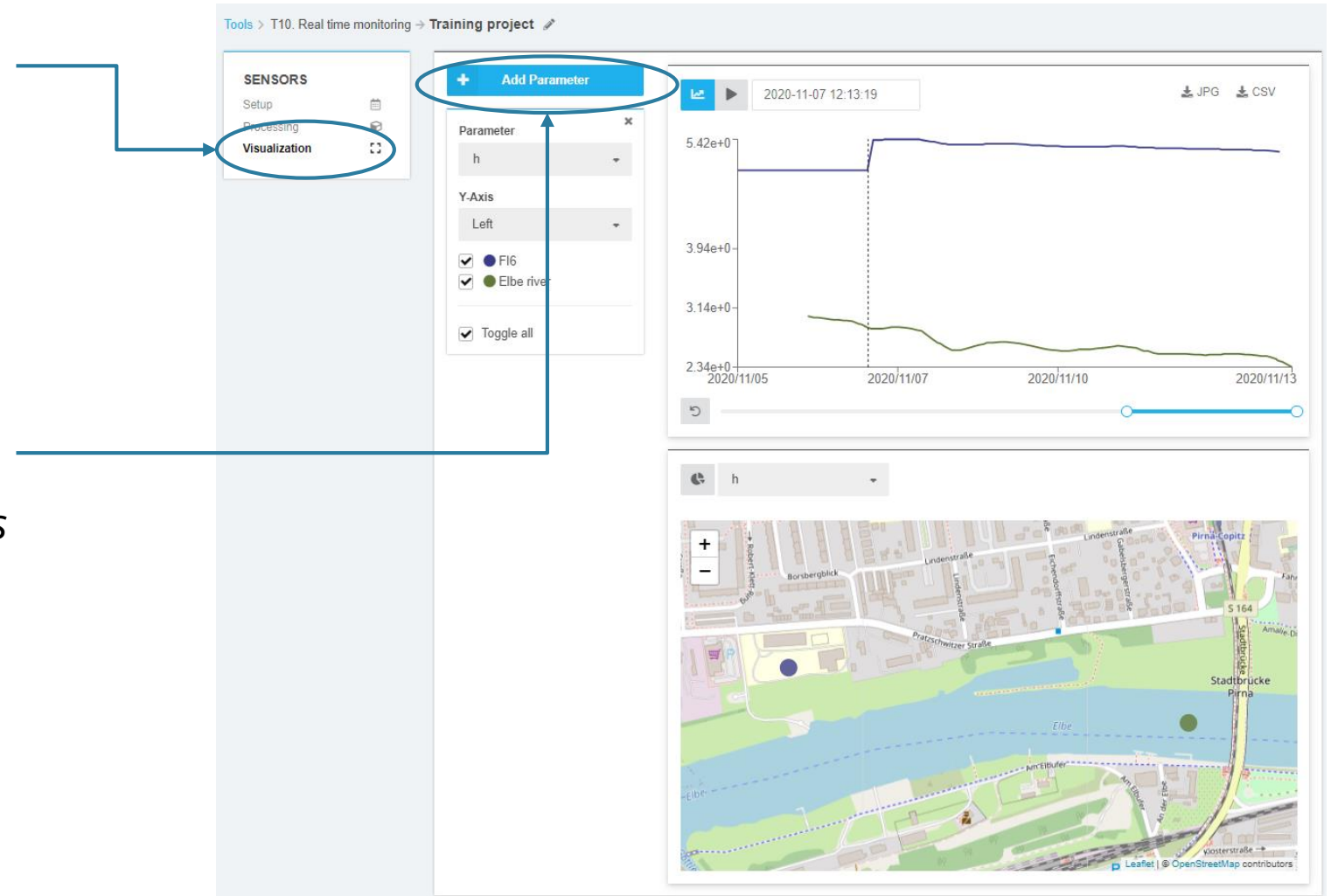
Sensor visualization

→ Navigate to the **visualisation** section

→ Compare various sensors or parameters

→ Using the add parameter button, a second parameter can be added, e.g. the temperature to the right y-axis

Be aware that new Elbe river data and water level data of the sensor FI6 are automatically integrated



Contact

Thank you for going through the tutorial. If you have any comments or questions, please contact us.



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