Building a New Generation of Sensor Web Implementations for Hydrology

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Overview

- Background
- Sensor Web Enablement
- Aims of the project
- Generalisation of sensor data
- Validation of sensor data/alerting
- Open Source SWE client implementations
- Summary and outlook

Background

- Sensor Networks of BAW
  - Federal hydrometric network (about 1.600 monitoring stations)
  - Groundwater monitoring networks along the Federal Waterways (> 10000 sites)
  - Monitoring networks to secure waterway structures (>1.000 sites)
- Lacking standards in data acquisition, data distribution and data archiving
- Demand of data integration is very high

Background

- Project funded by the DLZ-IT BMVBS (BAW Ilmenau)

- Close cooperation with the Wupperverband

- Started in October 2009

- Duration ~ 1 year

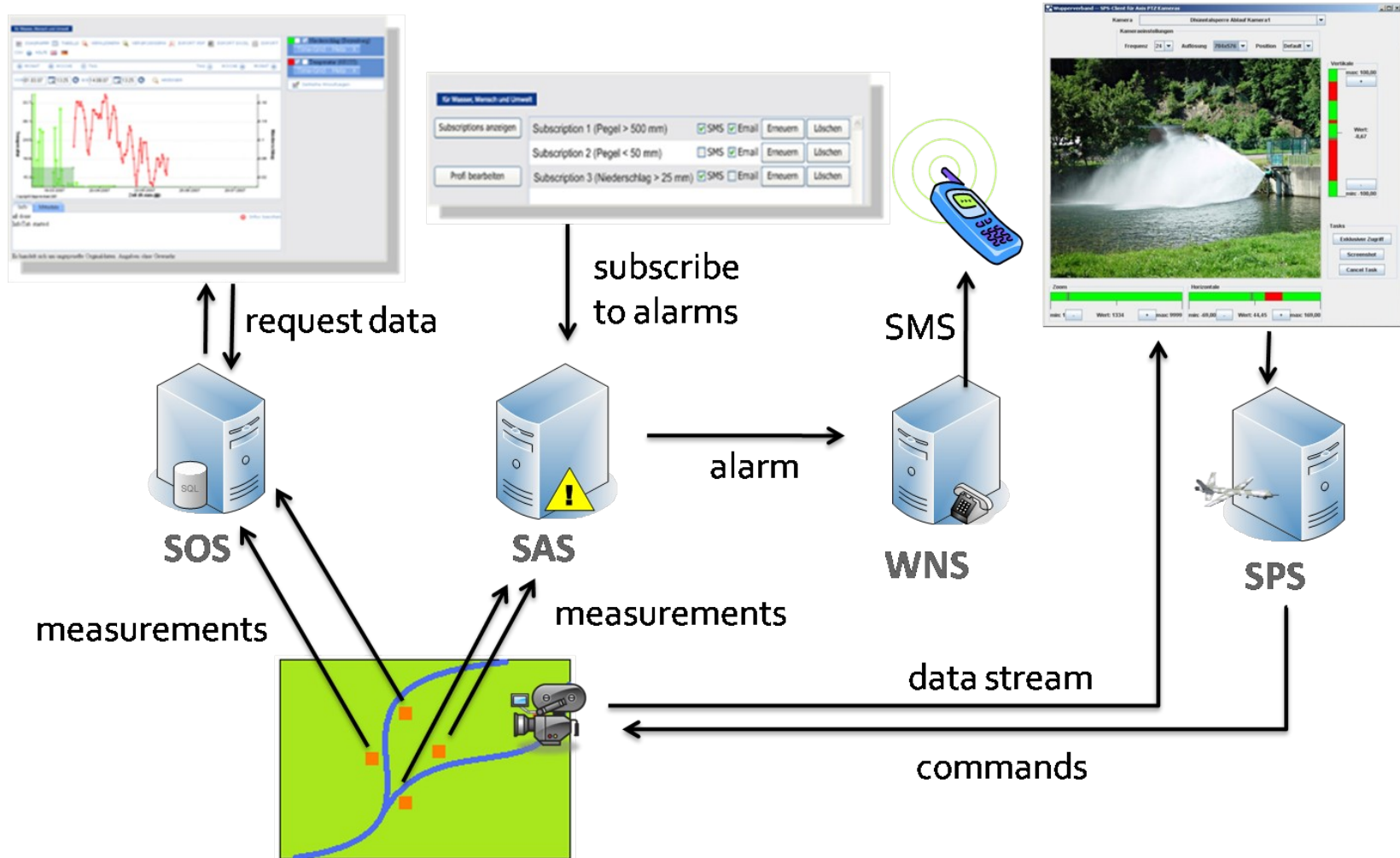- Aiming at improving and advancing several aspects of Sensor Web

Sensor Web Enablement

- Standardization of data formats as well as (web) service interfaces

- Integration of sensors and sensor data into spatial data infrastructures

- Hide the heterogeneity of sensor interfaces and low level sensor network protocols

- Foundation for realizing "plug-and-play" web based sensor networks

Sensor Web Enablement

- OGC Working Group
- Standards for
  - Encoding sensor measurements
  - Accessing real time measurement data as well as time series data
  - Controlling sensors and simulation models
  - (Discovering sensors and sensor data)
  - Describing metadata of sensors and sensor observations

Sensor Web Enablement

request data

subscribe to alarms

SMS

alarm

SOS   SAS   WNS   SPS

measurements   measurements

data stream

commands

Aims of the Project

- Improve the performance of Sensor Web applications

  – Generalisation of sensor data

- Validate sensor data for alerting purposes

  – Support of complex alerting criteria

  – Editing of alerting rules

- Include these enhancements into new Sensor Web client applications

Generalisation of Sensor Data

- Often high temporal resolution of sensor data (e.g. one measurement per minute)

- Usual visualisation of time series data: diagrams

- Display of data for large time spans (e.g. 10 years) → (much) more data available than necessary for visualisation

- For time series display: the width of the diagram in pixels is equivalent to the number of needed measurements

Generalisation of Sensor Data

- Generalisation techniques allow
  - Reducing the amount of transmitted data
  - Improving the selection of measurements when creating time series visualisations
- Implementation relies on the Douglas-Peucker-Algorithm
- Originally intended for map generalisation (reducing the number of points in curves)

Generalisation of Sensor Data

- Implemented as plug-in for the 52° North SOS

- Generalised data are provided via a new procedure (virtual sensor)

- Will be included in the next SOS release

Validation of Sensor Data/Alerting

- Sensor measurements can be erroneous (e.g. due to defective sensor hardware)

- Critical for alerting applications

- Solution: Define reliable alerting criteria (e.g. comparison with neighbouring stations)

- Using event stream processing technology for filtering incoming measurement values

Validation of Sensor Data/Alerting

- Sensor Event Service (SES) → new OGC approach for alerting
- 52° North SES implementation supports event stream processing
- Event Patter Markup Language (EML) for expressing alerting rules

# Validation of Sensor Data/Alerting

- Rules to be supported
  - Above/under threshold
  - Value change over a time period
  - Value change over a number of measurements
  - No data
  - Combination of rules

Open Source SWE Clients

- Conceptual improvements have been integrated into new client developments

- SOS client → time series and map display

- SES client → definition of validation/alert criteria

- First versions available by the end of September

Sensor Observation Service Client

- Based on the Google Web Toolkit

- Diagram and map display

- Generalised sensor data used for overview diagrams

- Data export functionality

- Time series navigation (zoom, pan, first value, last value)
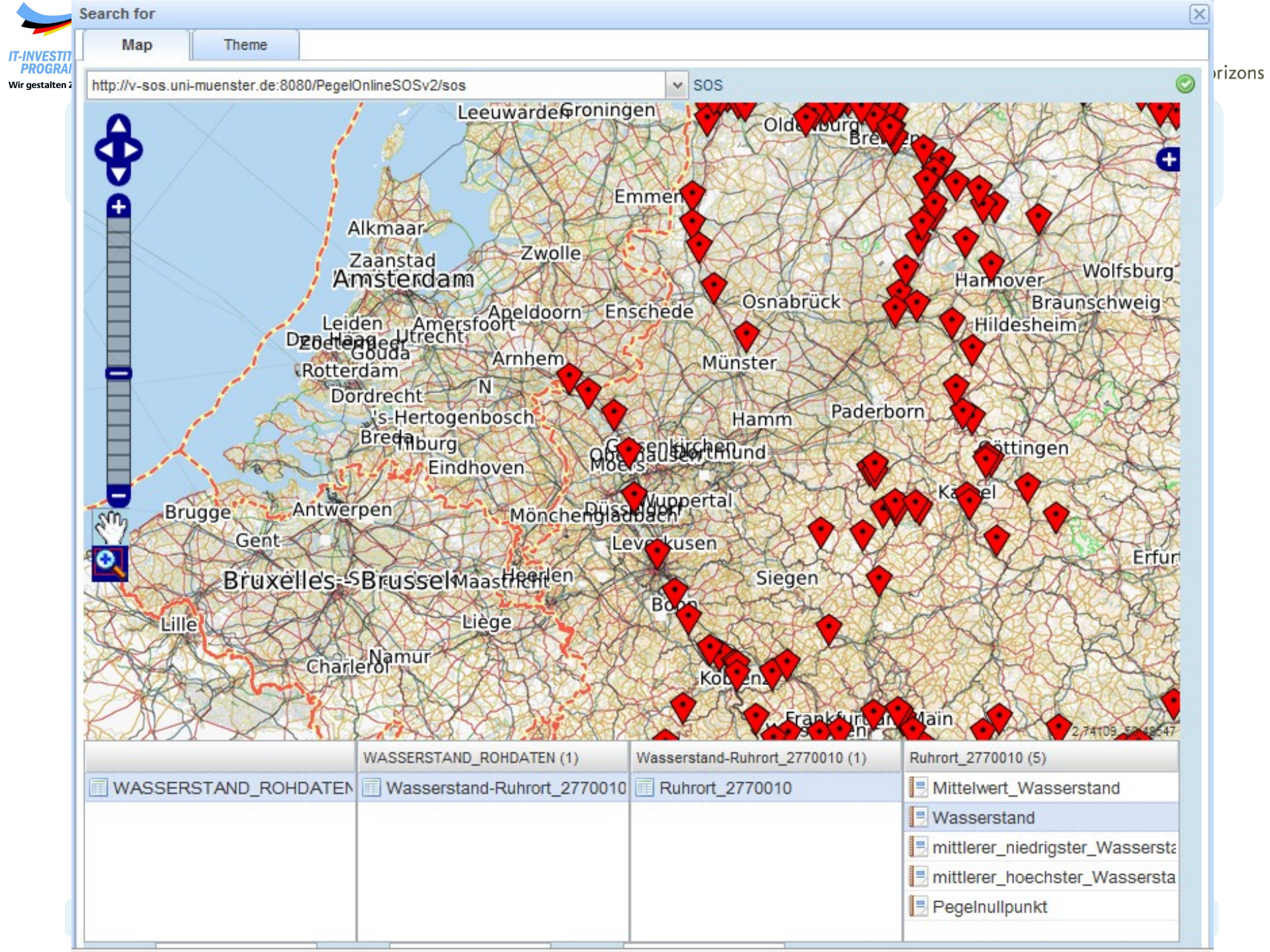
Sensor Event Service Client

- Definition of validation and alerting criteria → graphical approach → users do not need to deal with XML encodings

- Automatic translation of alerting rules into EML fragments

- Allows publication of alerting rules

- Subscription management

http://vpn.52north.org:8080/ThinSweClient2.0_Beta/Client.html

Google

Suchen · · · Freigeben· Sidewiki · Lesezeichen· Rechtschreibprüfung · »

· Anmelden ·

ThinSweClient2.0_Beta

Map | SES
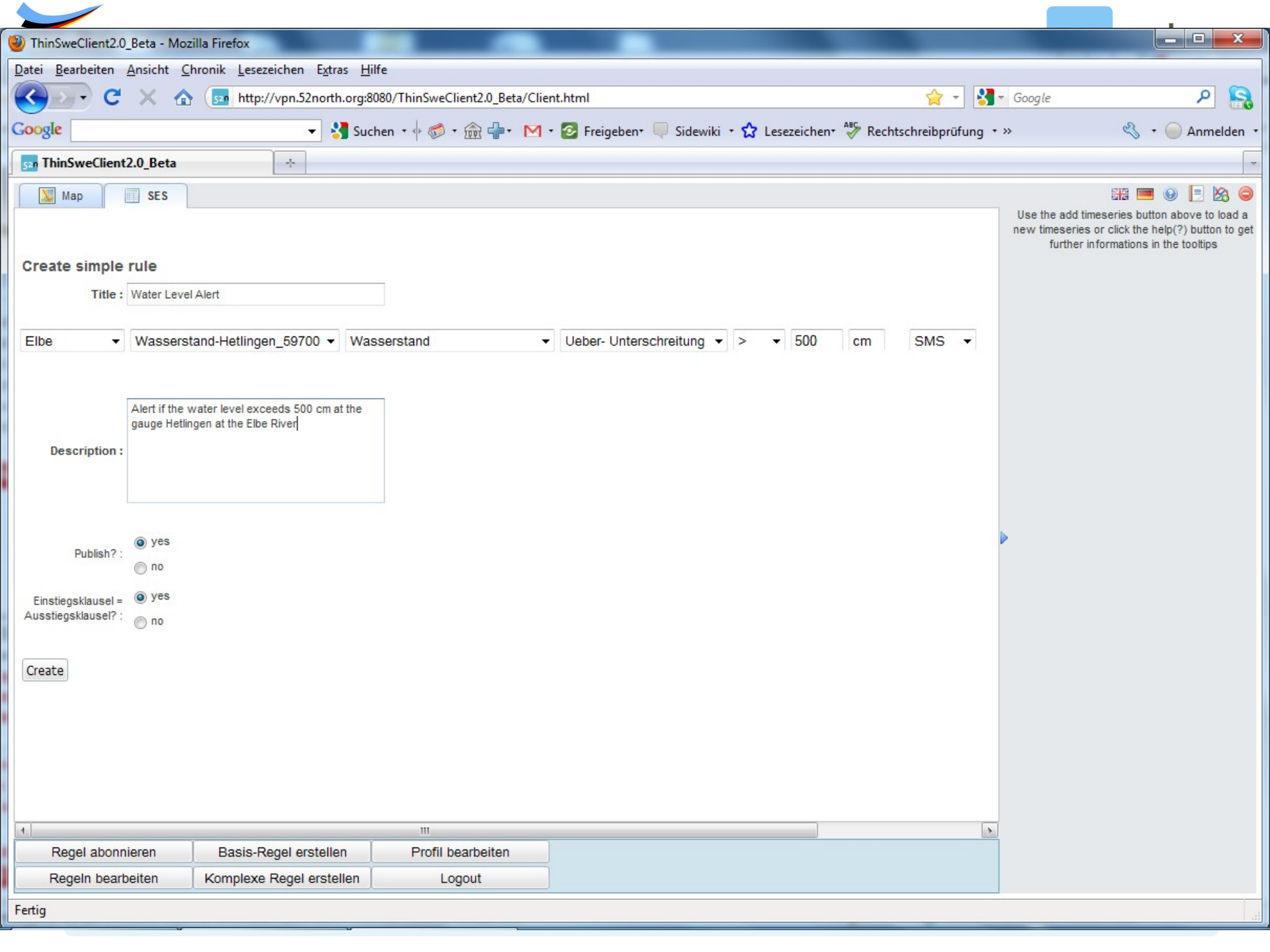
Use the add timeseries button above to load a new timeseries or click the help(?) button to get further informations in the tooltips

Create simple rule

Title : Water Level Alert

| Elbe | Wasserstand-Hetlingen_59700 | Wasserstand | Ueber- Unterschreitung | > | 500 | cm | SMS |

Description : Alert if the water level exceeds 500 cm at the gauge Hetlingen at the Elbe River

Publish? : ◉ yes ○ no

Einstiegsklausel = Ausstiegsklausel? : ◉ yes ○ no

Create

| Regel abonnieren | Basis-Regel erstellen | Profil bearbeiten |
| Regeln bearbeiten | Komplexe Regel erstellen | Logout |

Fertig

Summary and Outlook

- First versions will be available at the end of September

- Improved performance and functionality

- Can be customised to new application domains and contexts

- Open Source software allows the flexible extension and improvement

Thank you for your attention!

More information:

http://52north.org/swe

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