Management and publishing of TERENO data from distributed data bases

Tereno Coordination Team
Data Management

TERENO Advisory Board Meeting

25./26. October 2012, Scheyern

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Introduction

- Within TERENO each partner creates local data infrastructures for managing data and metadata
- TEODOOR is a standardized spatial data infrastructure (SDI) for acquisition, integration, management and exchange of heterogeneous data
- The main goal of TEODOOR is to provide scientists and stakeholder with reliable and well accessible data, metadata and data products
- All data is freely accessible to the public after a first quality check was performed

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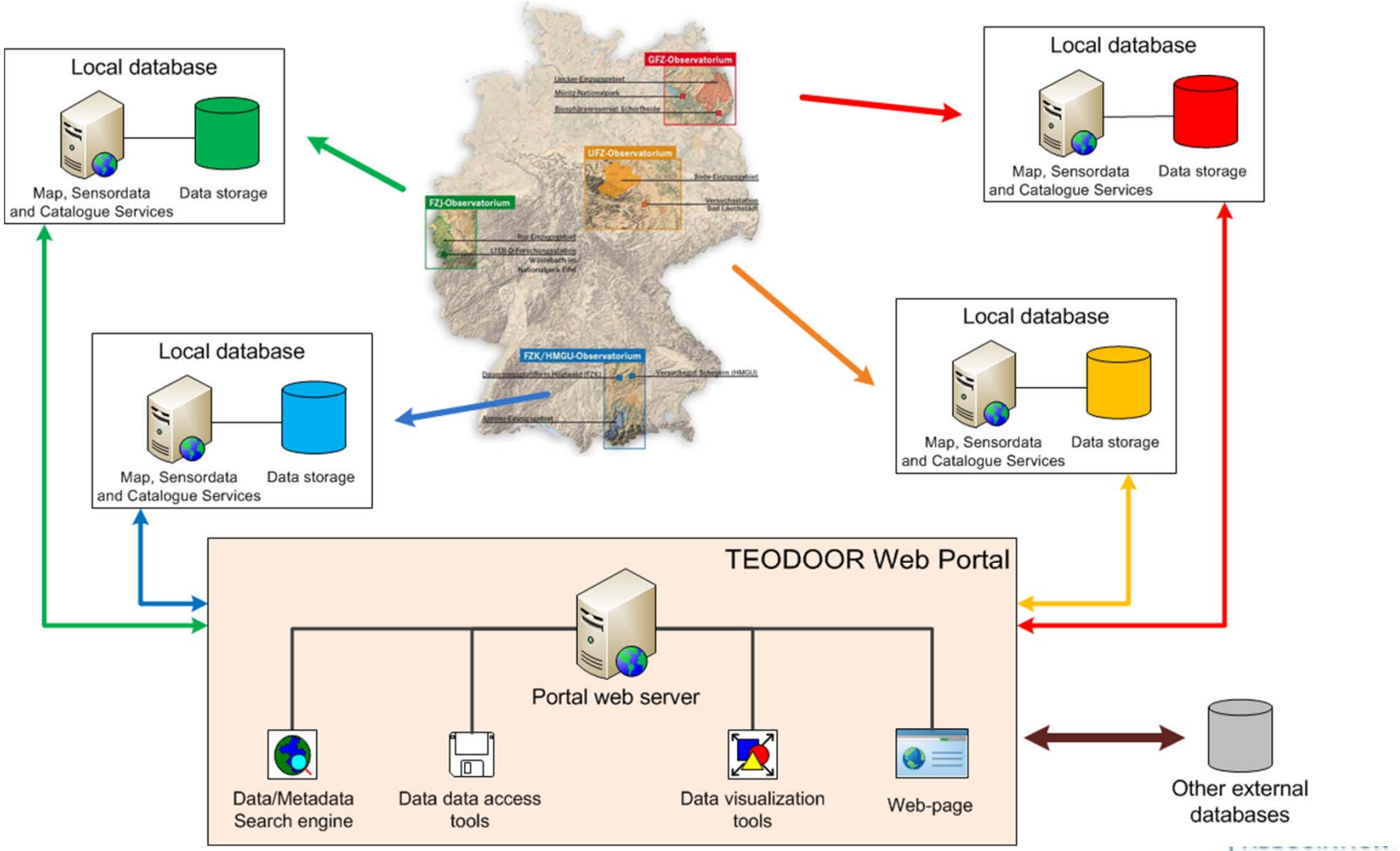
TERENO distributed data infrastructure design



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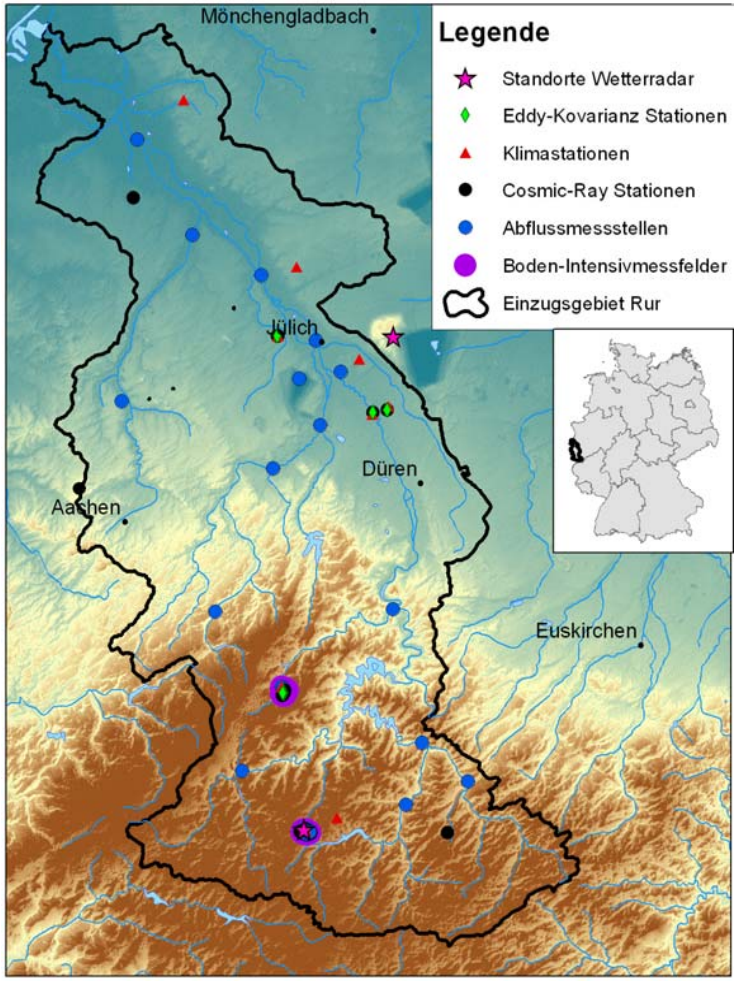
Data Infrastructure „Eifel/Lower Rhine Valley Observatory“

- **Standard stations: meteorological, hydrological and pedological data:**
  53 stations, >30.000 values per day
- **SoilNet: soil temperature and soil moisture, meteorological data**
  404 sensor nodes, >670.000 values per day
- **Eddy-Covariance stations: mikrometeorological and gas concentration data**
  7 stations, >133.000.000 values per day
- **Weather radar: Reflectivity and precipitation data**
  2 stations, 1728 grid data per day, >90 GB per day
- **External sources (LANUV, WVER)**:
  Hydrological and meteorological data



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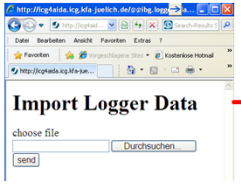
Data import and processing

Automatic sampling stations

E-Mail attachments

E-Mail parser



Manual upload

upload folder

Data import processing tool

Data overdue check

Technical warner

E-Mail notification

Data range check

Content warner

E-Mail notification

Data calculator

Raw data archive

Water samples

Local database

Data converter

PostGIS database

Raw data (Level 0)

Processed data (Level 1)

Quality checked data (Level 2)

Set quality checked data (Web-processing service)

Sensor Observation Service (SOS)

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Data model and data publishing

- Comprehensive data model based on the CUAHSI Observation Data Model (http://his.cuahsi.org/odmdatabases.html):
  - Sites
  - Sources and metadata
  - Sensors
  - Data classification, categories, data level, attributes
  - Data generation, lab methods, sample handling
- Extension of the model to
  - Specify individual sensors and data import by logger files
  - Store all relevant information in one relational data base
  - Implementation in JAVA using Hibernate3
  - Data base independent processing
  - Automated table generation and management
  - Versioning

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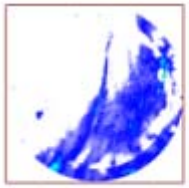
Managing and publishing weather radar data

Local data preprocessing

Data processing and reflectivity calculation

Raw data storage



Creation of precipitation images

Creation of metadata from templates

Teodoor (Tereno Data Portal)

Precipitation raster data download

Animated precipitation raster player/viewer

Metadata search engine

Metadata viewer and editor

Web-Map Service (geoserver)

Catalog Service (geonetwork)

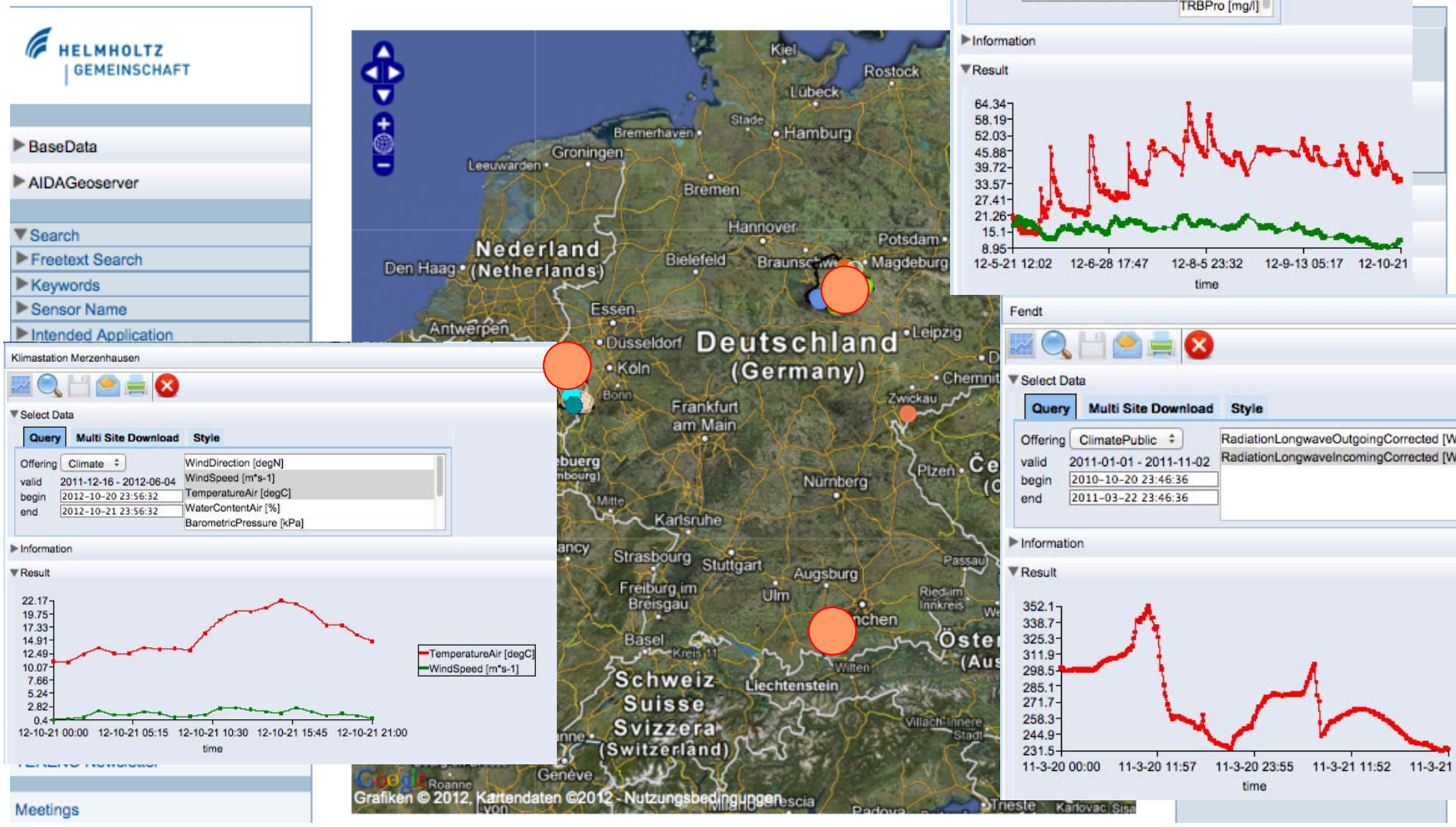
Internet

TEODOOR: The TERENO Data Portal

http.//www.tereno.net

- Implemented in Plone
- Contains practically no own data
- Communicates to local databases via OGC-compliant Web-services
- Internal and external live search to data
- Included Web-GIS functions

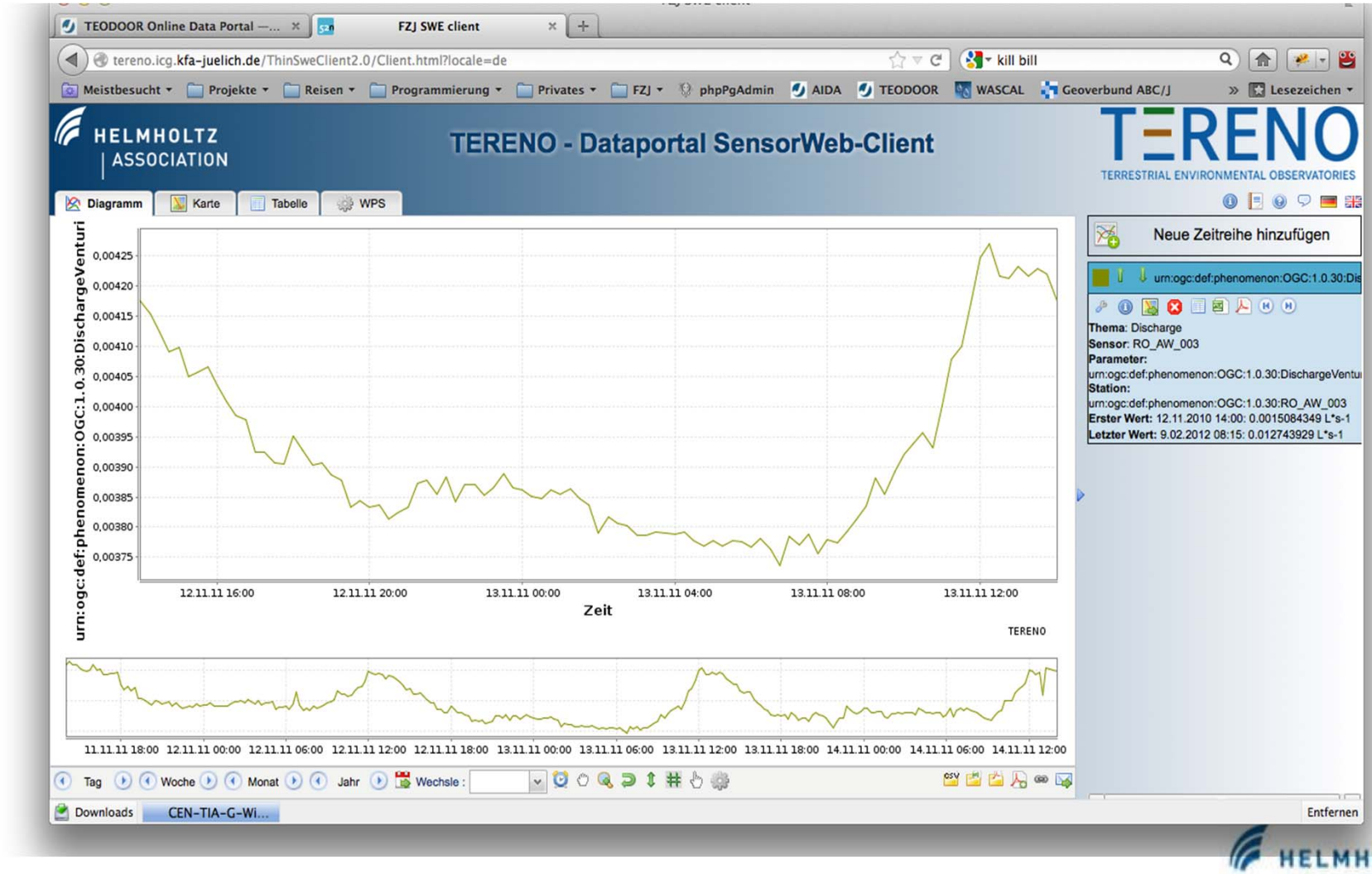
Status of data provision



New Features of TEODOOR

- Better visualization tool for data quality check (sensor web client)
- Data provision:
  - It is secured that data download is only possible with TEODOOR
  - E-mail messaging after each download
  - Multisite-download (e.g. sensor network data)
  - Visualization of remote sensors (e.g. weather radar)
- Data search options
  - Hierarchical search
  - Search for key words
  - Search for sensors, parameters, themes (eBRIM)
  - Web-GIS support (spatial search)

Sensor Web Client



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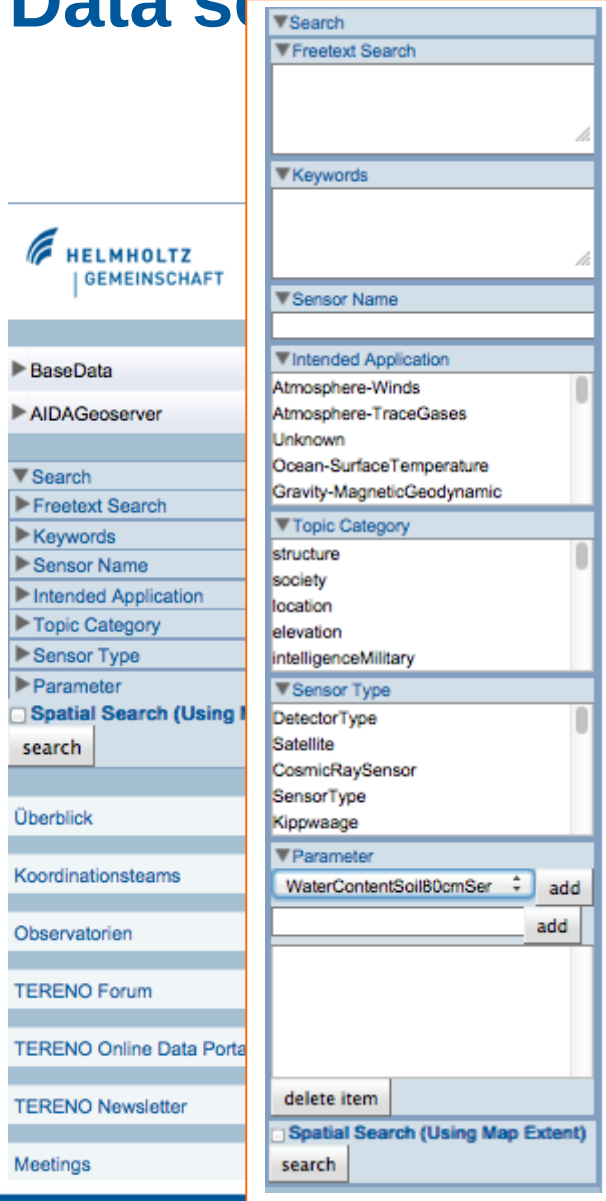
Data search



Freetext search OGC-catalogue services

Keyword seach

Search for station names and applications

Search for themes and sensor types

Search for parameters

Spatial search

Web-GIS functions in TEODOOR

- Implemented using OpenLayers
- Supports multiple WMS and SOS
- Customized
  - Default content
  - Default region
  - Visible WMS
  - Visible SOS

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Data visualisation in TEODOOR

- Connecting to OGC-SOS services
- Graphical selection of stations
- Display of:
  - Station information (sensorML metadata)
  - Latest observations
  - Available parameters

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Data visualisation in TEODOOR

- Connecting to OGC-SOS services
- Graphical selection of stations
- Display of:
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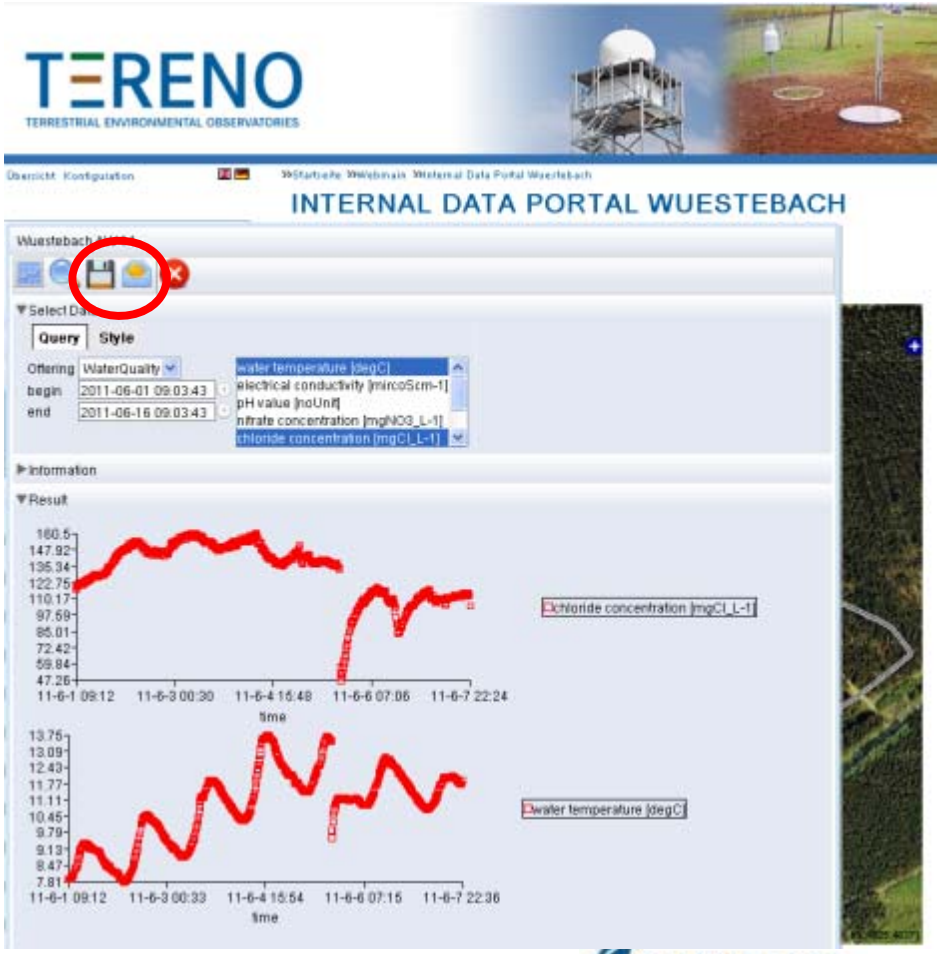
  - Latest observations
  - Available parameters
- Visualisation of station data time series
- Data download (direct or via E-Mail)



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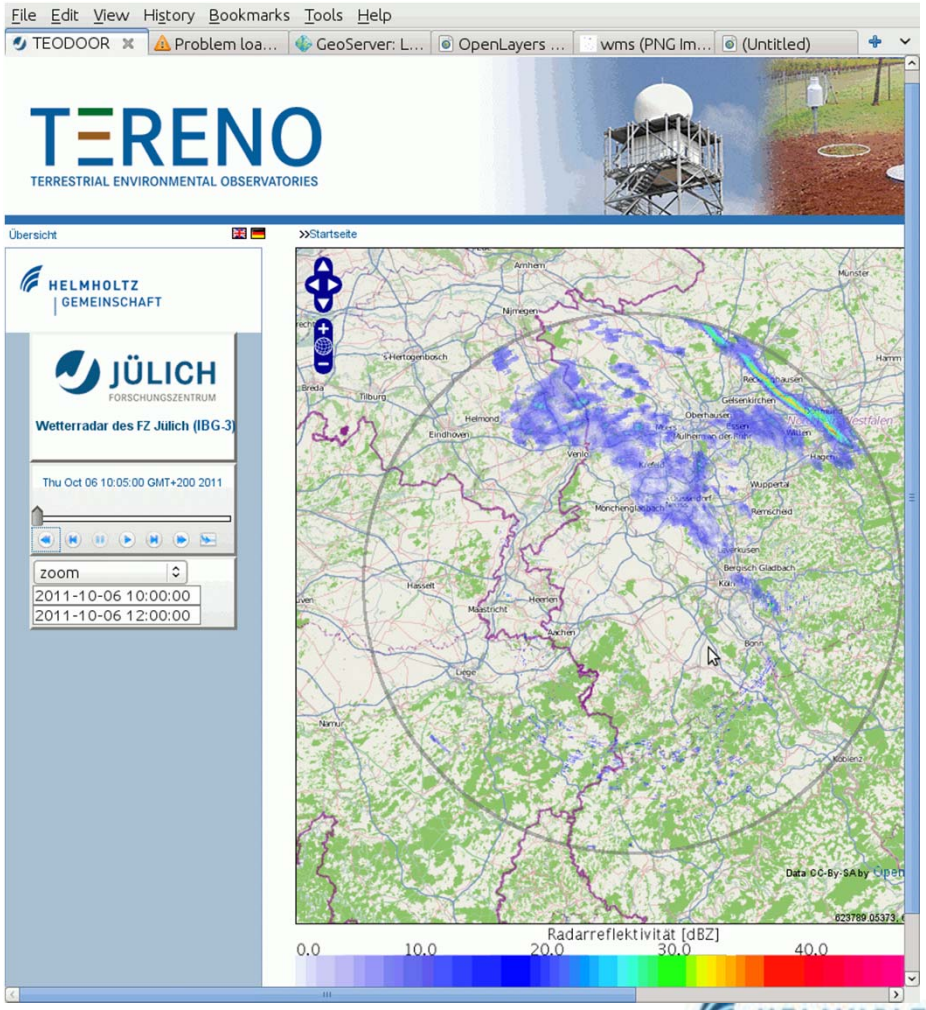
Weather radar data visualization

- Data visualization using distributed OGC-Raster SOS and WMS
- Raster data animation for custom
  - time periods
  - regions of interest
- Reflectivity/precipitation display for a given raster point
- Reflectivity/precipitation time series graphs for a given raster point



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Sensor Observation Service (SOS)

- Most important web-service to provide access to time series observations from sensors in a standardized way
- Widely used for point data
- Although mentioned in OGC-SOS specification, no existing SOS implementation is able to deliver raster data time series (only point data)
- SOS extension implementation (Master Thesis J. Sorg):
  - Data storage in PostgreSQL data base
  - Time series output of rasters or subrasters (spatial filters) as
    - WMS or WCS layer references
    - Discrete coverages (geometries and attributes)
  - Enables the output of time series of individual locations within a raster grid and
  - Zonal detection of specific events (e.g. rain storms)

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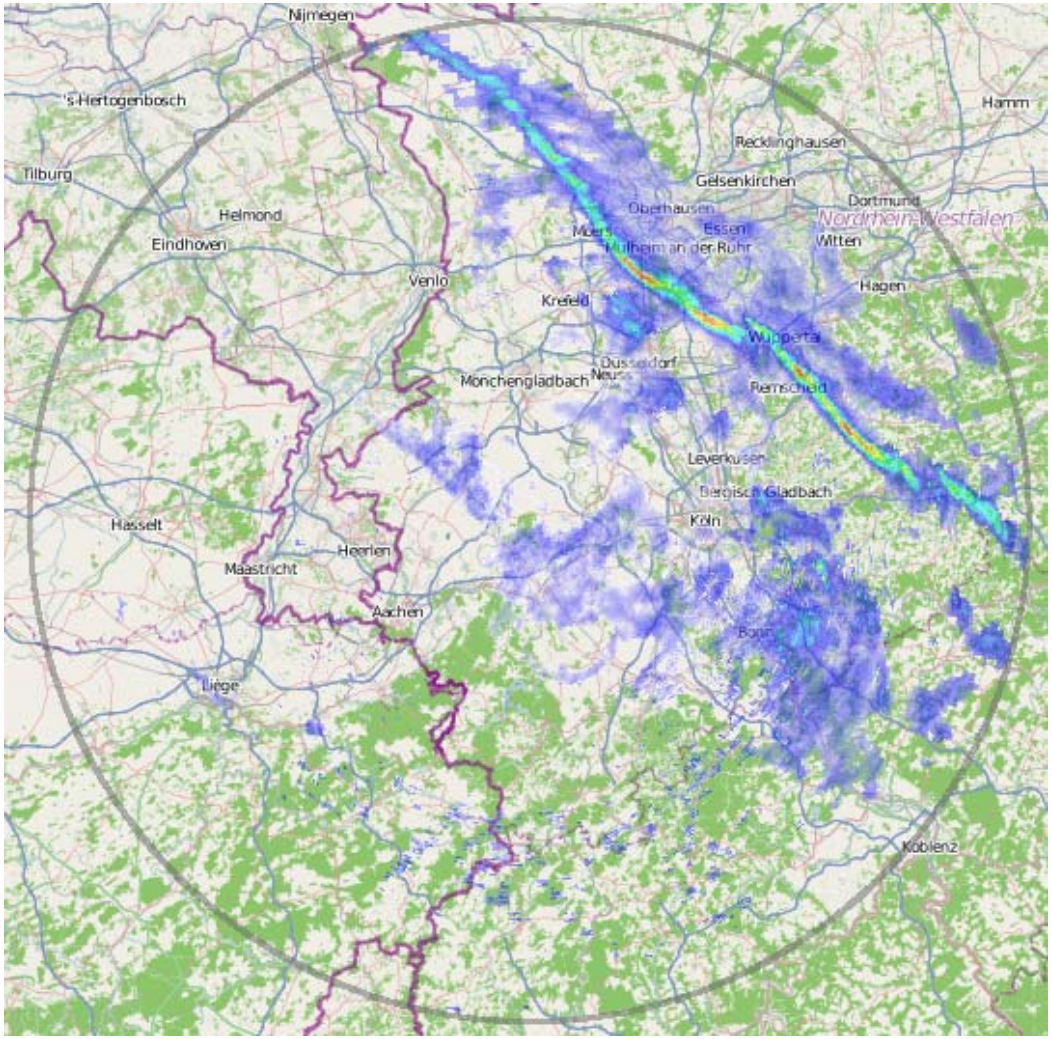
Automated detection of rainstorm events



- Red pixels are indicating rainstorm events

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Automated detection of rainstorm events

- Red pixels are indicating rainstorm events
- A GetObservation-request extracts all pixel with reflectivity >35 dBZ

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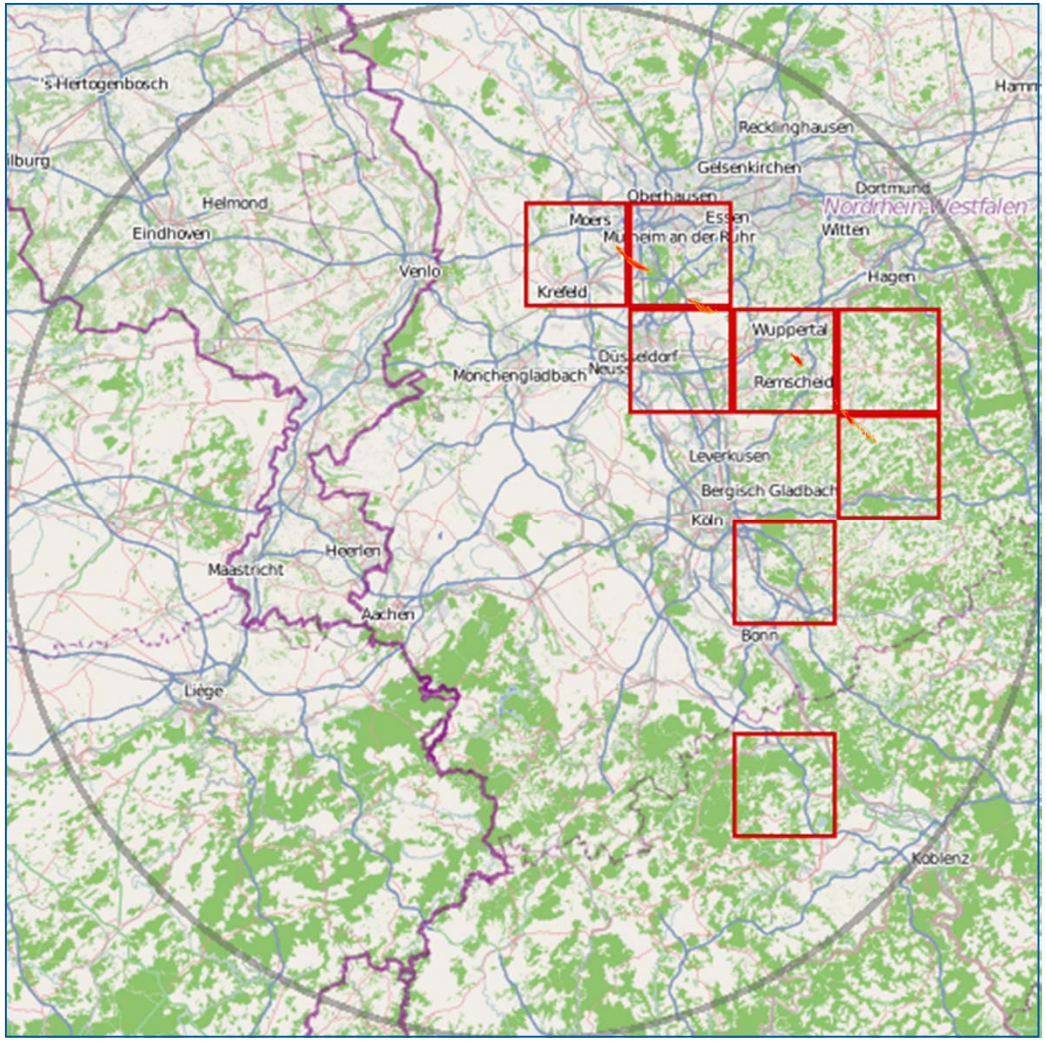
Automated detection of rainstorm events



- Red pixels are indicating rainstorm events
- A GetObservation-request extracts all pixel with reflectivity >35 dBZ
- Combination of selected pixel provides areas affected by rainstorm events
- These areas can be intersected with specific zones
- The rainfall amounts can be assigned to these zones

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Conclusions and outlook

- Current status:
  - Internal data import, storage, processing and visualization running for FZJ, KIT, UFZ, HMGU
  - Interfaces for data exchange in place for FZJ, KIT, UFZ
  - Catalogue services online for FZJ, UFZ
  - TEODOOR data portal is able to assess remote data infrastructures
- Outlook:
  - Publish TERENO data products using persistent Digital Object Identifiers (DOI)
  - Further improvement of quality control of the primary data and the descriptive metadata
  - Inclusion of further spatial data sets (e.g. from remote sensing)