

TERENO data management

CT Data Management

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Outline

- Accessing and querying data from TEODOOR
 - Data visualization and access
 - New search application
- Current status
 - Processed and published data,
 - Data access through TEODOOR
- Quality assessment of sensor data
 - Modelling data quality
 - Quality assessment workflow
 - Quality flagging tool
- Conclusions and outlook



TEODOOR – access to data

- Central data portal accesses the individual services and allows information exchange, data search and data access
- All observatories are connected to TEODOOR
- Redesigned data query and access
 - Predefined views to individual observatories
 - Access to weather radar device data
 - Spatial and thematic search to data

PUBLIC TERENO DATA PORTAL

One task TERENO is to provide long-term statistical series of system variables for the analysis and prognosis of Global Change consequences using integrated model systems, which will be used to derive efficient prevention, mitigation and adaptation strategies. Within the distributed Spatial Data Infrastructure TEODOOR each institution responsible for an individual observatory sets up its own local data infrastructure. This portal application brings together the data collected and published via OGC Web-services from the individual observatories and provides access of the data to the public. Therefore, it serves as a database node to provide scientists and decision makers with reliable and well accessible data and data products.

To provide an easy access to the data collected within TERENO, several visualization and query tools are available:

You can get an overview of the stations and the collected data from all or individual observatories either by clicking into the map of Germany or into one of the observatories or by selecting one of:

- Eifel/Lower Rhine Valley Observatory
- Bavarian Alps / pre-Alps Observatory
- German Lowland Observatory
- Harz/Central German Lowland Observatory
- All four TERENO Observatories

Data from the weather radar devices currently available for the Eifel and the Bavarian Alps observatories can be found here:

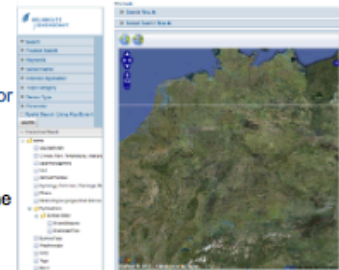
- Eifel/Lower Rhine Valley Observatory
 - Jülicher Weatherradar Sophienhöhe
 - Rainscanner Wüstebach
- Bavarian Alps / pre-Alps Observatory (coming soon)



Searching to specific data from all observatories, i.e.

- sensor data with respect e.g. to observed phenomena, sensor types, station names etc.
- filebased data according to its metadata

can be performed by clicking into the screen shot in the picture to the right





Data being processed at individual TERENO observatories

	Eifel/Lower Rhine	Harz/Central Lowland	Northeastern Lowland	Bavarian Alps and Prealps	
				HMGU	IMK/IFU
Climate, soil, water	589 stations 980000 obs/d	75 stations 125000 obs/d	179 stations 320000 obs/d	95 stations 848000 obs/d	8 stations 52128 obs/d
Eddy-Covariance	7 stations 133000000 obs/d	3 stations 57000000 obs/d	3 stations 57000000 obs/d	1 station 1900000 obs/d	4 stations 76000000 obs/d
Weather radar	2 devices 576 rasters/d	1 device 288 rasters/d			1 device 288 rasters/d
SoilCan	36 lysimeters 285000 obs/d	30 lysimeters 238000 obs/d	12 lysimeters 95000 obs/d	6 lysimeters 47500 obs/d	42 lysimeters 333000 obs/d



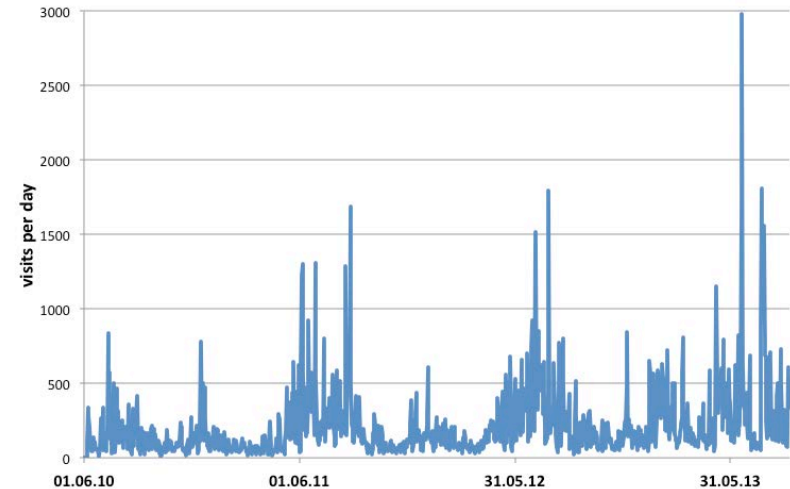
Data being published via TEODOOR

	Eifel/Lower Rhine	Harz/Central Lowland	Northeastern Lowland	Bavarian Alps and Prealps	
				HMGU	IMK/IFU
Climate, soil, water	589 stations	(75 stations)	20 stations	In preparation	-
Eddy-Covariance	7 stations (climate data)	-	-	In preparation	2 stations (climate data)
Weather radar	2 devices	-			In preparation
SoilCan	In preparation	-	-	-	-



TEODOOR access statistics 1.6.2012 – 31.8.2013

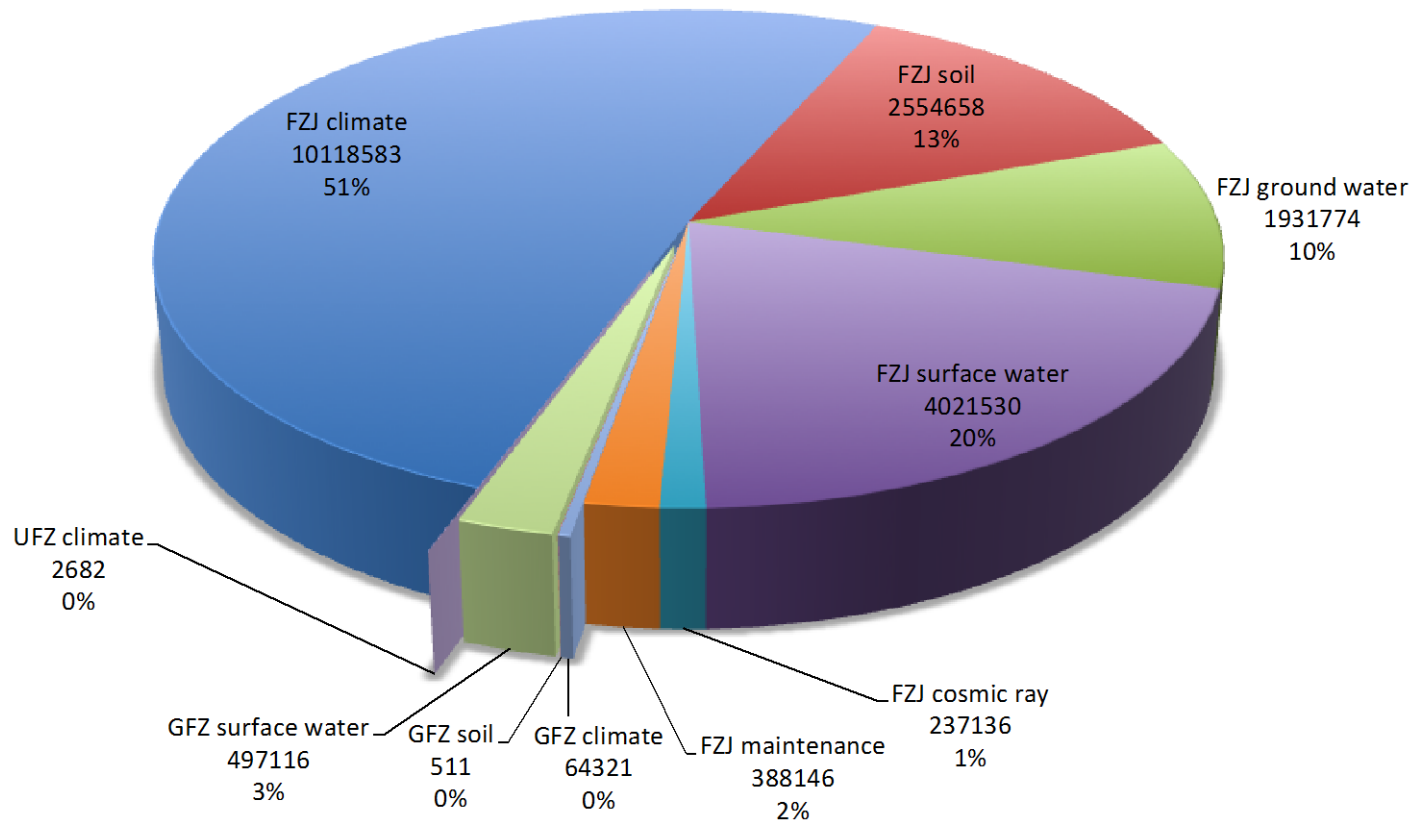
- Visitors: 92 800
- Visits: 241 369
 - 136 countries
 - Germany: 94 %
 - Belgium, Netherlands, USA: 1%
- Page calls: 486.985
 - Weather radar: 291 912
 - Observatories: 26 226
 - Data portal: 9 232
 - Other: 159 615
- Access:
 - Direct: 50.7 %
 - Google: 19.5 %
 - FZJ ref: 2.9 %
 - UFZ ref: 0.8 %
 - GFZ ref: 0.3 %
 - HMGU, IMK ref: < 0.01 %





Downloaded sensor data from TEODOOR

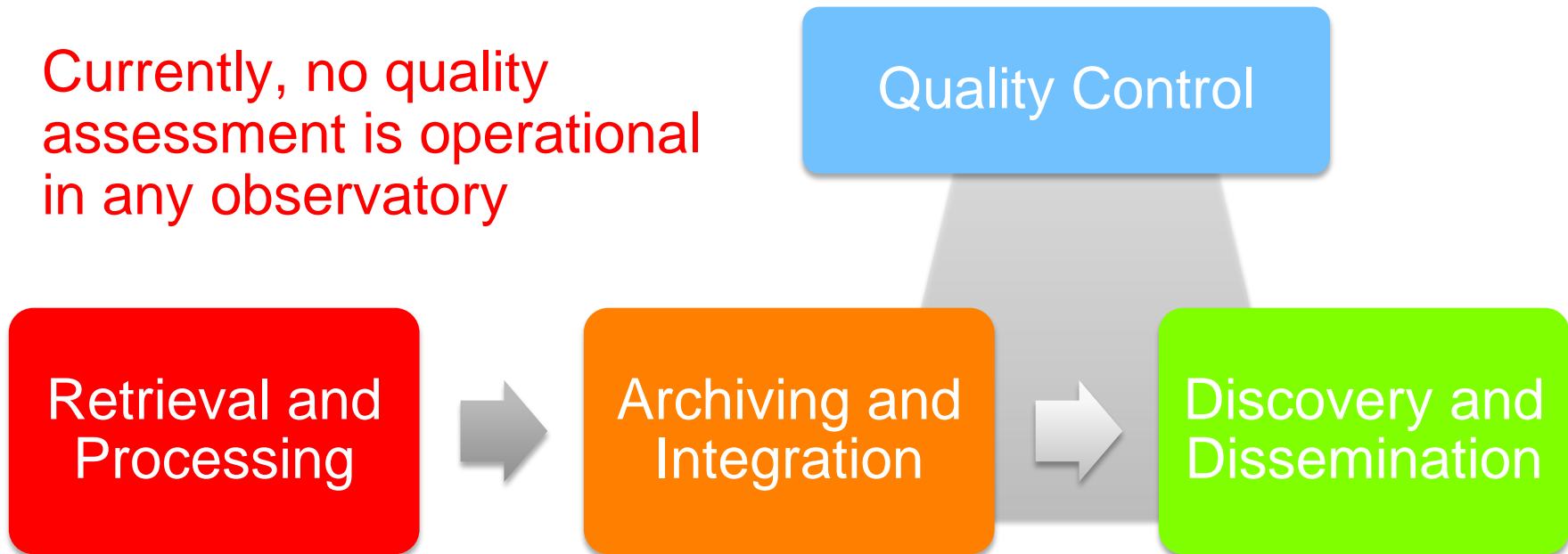
Time period: 12/2012-08/2013
Total downloads: 803
Downloaded data values: 19 800 000





Quality Control of sensor data

- In each observatory up to 2,000,000 data values are collected each day
- Data quality is a primary concern when building trust in shared data.
- **Currently, no quality assessment is operational in any observatory**





Implementing Quality Control into TERENO

- Modelling Quality Control (QC) information of TERENO observations
 - [Data types and quality control methods](#)
 - [Data processing status/level](#)
 - [Data quality flag convention](#)
 - [Quality control workflow](#)

- Incorporating QC information into the TERENO infrastructure
 - [Observational data model](#)
 - Observational service including request and response messages
 - [Quality flagging tool](#)
 - Administration of users and flagging classification



Digital Object Identifiers (DOI)

- Identification of content objects (e.g. data sets) in the digital environment sets by unique identifiers

Example: http://dx.doi.org/10.1594/TERENO/FZJ_1

- For a dataset to be assigned a DOI, it must be provided in good condition, with appropriate metadata and of a suitable level of technical quality.
- Within TERENO GFZ may act as a certification authority to assign unique identifiers to
 - Data and documents (DOI)
 - Samples (IGSN)
- **Unique identification allows the data to be cited**



Literature, data, samples

Google Scholar

Suche: ...

seciment.distrib.on.a

Evolution and biological effects of the 1997-98 El Niño ...

Agate-plateau associations of Peru and Chile: paleo-ecological evidence for a shift in the Andean climate ...

Peru Upwelling Region Sediments Near 12°S, 2. Dissolved ...

Peru Upwelling Region Sediments Near 12°S, 1. Accumulation of Organic Matter ...

doi:10...

Year	1997	1998	1999	2000
Mean	11.17	11.17	11.17	11.17
SD	1.00	1.00	1.00	1.00
Min	9.00	9.00	9.00	9.00
Max	13.00	13.00	13.00	13.00

Fig. 2. The scatter plot shows the relationship between mean annual precipitation (mm) and mean annual temperature (°C) for the period 1997-2000. The data points are: (1997, 11.17), (1998, 11.17), (1999, 11.17), (2000, 11.17). The correlation coefficient is 0.99.

Earth System Science
Data

Sref: ...

Volume 1, Number 1 + 2008

Copernicus Publications

doi:10...

Year	1997	1998	1999	2000
Mean	11.17	11.17	11.17	11.17
SD	1.00	1.00	1.00	1.00
Min	9.00	9.00	9.00	9.00
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Fig. 2. The scatter plot shows the relationship between mean annual precipitation (mm) and mean annual temperature (°C) for the period 1997-2000. The data points are: (1997, 11.17), (1998, 11.17), (1999, 11.17), (2000, 11.17). The correlation coefficient is 0.99.

doi:10.1594/...

doi:10.1594/...

doi:10.1594/...

Scientific Drilling Database

Abstract: ...

Activity: ...

IGSN hdl: ...



Conclusions and outlook

➤ Current status:

- Local data infrastructures operational and connected to TEODOOR (except HMGU)
- Data quality modelled, workflows for quality assessment developed and implemented in the data model.
- Quality flagging tool based on developed workflow implemented
- Common standards (parameters, Thesauri, Metadata profile ...) defined, implemented and published via TEODOOR

➤ Outlook:

- Draft Data Management Plan
- Operationalizing quality assessment for all observatories
- Inclusion of data sets with ecological content and spatial data (e.g. from remote sensing)
- Publication of primary data using persistent Digital Object Identifiers (DOI)



Presentations and Publications concerning TERENO data management (2012-2013)

➤ Publications:

- Bogena, H., Kunkel, R., Puetz, T., Vereecken, H., Krueger, E., Zacharias, S., Dietrich, P., Wollschlaeger, U., Kunstmann, H., Papen, H., Schmid, H.P., Munch, J.C., Priesack, E., Schwank, M., Bens, O., Brauer, A., Borg, E., Hajnsek, I. (2012): TERENO - Long-term monitoring network for terrestrial environmental research. **Hydrologie und Wasserbewirtschaftung** (3): 138-143
- Kolditz, O., Rink, K., Shao, H., Kalbacher, T., Kunkel, R., Zacharias, S., Dietrich, P. (2012): Data modelling platforms in environmental Earth sciences. **Environmental Earth Sciences** (4): 1279-1284, doi: 10.1007/s12665-012-1661-8.
- Kolditz, O., Rink, K., Shao, H., Kalbacher, T., Kunkel, R., Zacharias, S., Dietrich, P. (2012): International viewpoint and news: data and modelling platforms in environmental Earth sciences (vol 66, pg 1279, 2012). **Environmental Earth Sciences** (6): 1859-1859.
- Kunkel, R., Sorg, J., Eckardt, R., Kolditz, O., Rink, K., Vereecken, H. (2013): TEODOOR - a distributed geodata infrastructure for terrestrial observation data. **Environmental Earth Sciences** (Special Issue on Catchment Research, May 2013 issue 69/2.), doi: 10.1007/s12665-013-2370-7.
- Sorg J. (2012) Entwurf, Implementierung und Anwendung eines OGC-konformen Sensor-Observation Service für flächenbezogene Rasterzeitreihendaten. Master Thesis, Fernuniversität Hagen.
- Sorg, J., Kirschke, T., Kunkel, R. (2012): Entwicklung eines Sensor Observation Service für flächenbezogene Rasterzeitreihendaten, **GIS.Science**, June 2013

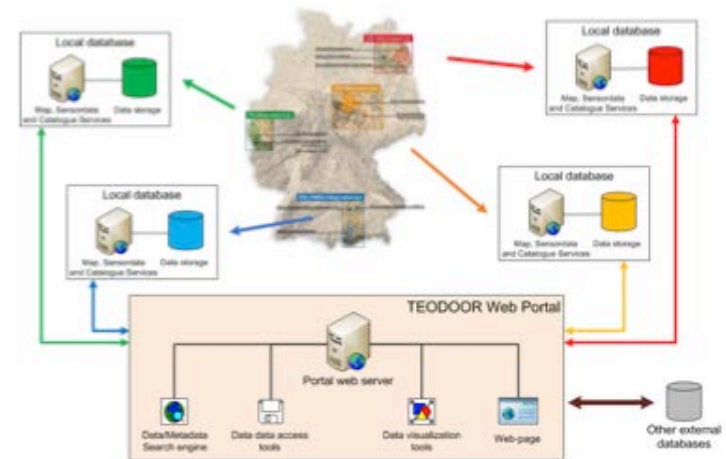
➤ Conference proceedings

- **TEODOOR: Geodateninfrastruktur zur Verwaltung und Veröffentlichung von terrestrischen Beobachtungsdaten der HGF Infrastrukturmaßnahme TERENO aus verteilten Quellen**, WissKom2012 - Vernetztes Wissen – Daten, Menschen, Systeme. Forschungszentrum Jülich GmbH, Jülich, Germany.
- **TEODOOR – a Spatial Data Infrastructure for terrestrial observation data**. Presentation at the IEEE International Conference on Networking, Sensing and Control (ICNSC13), Paris-Evry, France, 2013-04-10-12.
- **The Design of Monitoring and Data Infrastructures – Applying a forward-thinking Reference Architecture**. Presentation at the IEEE International Conference on Networking, Sensing and Control (ICNSC13), Paris-Evry, France, 2013-04-10-12.
- **Incorporating Quality Control Information in the SensorWeb**. Poster at European Geosciences Union General Assembly (EGU 2013), Vienna, Austria, 2013-04-07-12.
- **The architecture design of a monitoring infrastructure for the subobservatory Tereno North-East**. Poster at European Geosciences Union General Assembly (EGU 2013), Vienna, Austria, 2013-04-07-12.
- **User Guided Generation of Hydrological Models: Interface Design, Workflows and Concepts for an Extensible Software Framework**. 6th International Congress on Environmental Modelling and Software (iEMSs), Leipzig, Germany, 01.-05. July 2012.



TEODOOR - the TERENO data infrastructure

- Individual data infrastructures for each observatory
- OGC-compliant Web Services operated for each observatory provide access to data
- OGC-compliant metadata services provide descriptive information on monitoring stations and measured data
- Central data portal accesses the individual services and allows information exchange, data search and data access

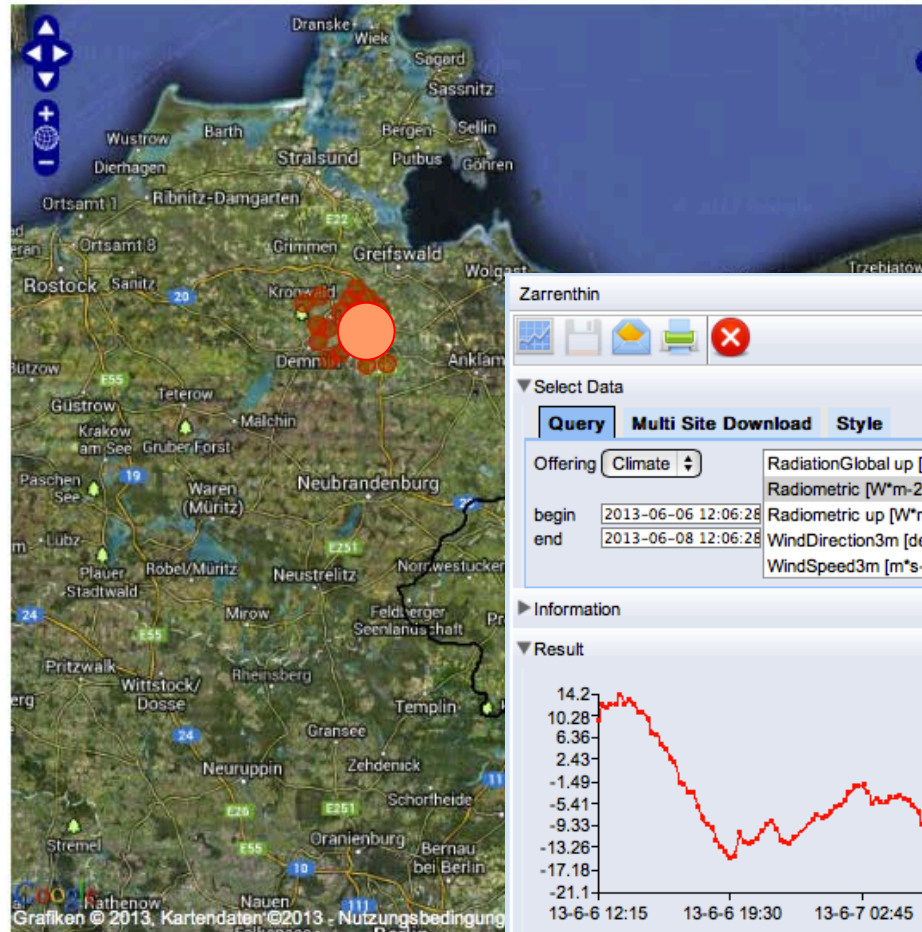




Data visualization in TEODOOR

HELMHOLTZ GEMEINSCHAFT

- BaseData
- AIDAGEoserver
- Search
 - Freertext Search
 - Keywords
 - Sensor Name
 - Intended Application
 - Topic Category
 - Sensor Type
 - Parameter
- Spatial Search (Using Map Extent)**
- Überblick
- Koordinationssteams
- Observatorien
- TERENO Forum
- TERENO Online Data Portal
- TERENO Newsletter
- Meetings



show

TerenoObservatories

show

Information

opaque:

GFZ

Zarrentin

Select Data

Query Multi Site Download Style

Offering: Climate

RadiationGlobal up [W*m-2]
Radiometric [W*m-2]
Radiometric up [W*m-2]
WindDirection3m [degN]
WindSpeed3m [m*s-1]

begin: 2013-06-06 12:06:28
end: 2013-06-08 12:06:28

Information

Result

time

— Radiometric [W*m-2]



Visualising and accessing time series data

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

Merzenhausen EC t

▼ Select Data

Query	Multi S
Offering	Climate
valid	2011-05-1 2013-01-0
begin	2013-0
end	2013-0

▶ Information

▶ Result

▼ Information

Short Name: Merzenhausen EC tower
Long Name: Merzenhausen EC tower
Term: ME_EC_001
Classification:
Sensor Type:
Intended Application:
Sensor Interface:
url: http://ibg3wradar.ibg.kfa-juelich.de:8080/eifelrur_intern/sos
id: ME_EC_001
type: SOS
valid time: 2011-05-10T11:20:00 - 2013-01-01T01:00:00
Contact Person:
surname: Schmidt
name: Marius
user ID:
affiliation:
phone number: ++49-2461-61-6469
email: ma.schmidt@fz-juelich.de
Responsible Party:
individualName: Marius Schmidt
organizationName: Research Centre Juelich GmbH, IBG-3
address: Juelich 52425
email: ma.schmidt@fz-juelich.de
delivery point:
ISM Classification (security level):
id:
Geographic Position:
Spatial Reference System: urn:ogc:def:crs:EPSG:4326
eastings: 6.2969924
northings: 50.9297879
elevation: 93.3
Sensor Output:
WindDirection2mAvg10min [degN]
RadiationGlobalAvg10min [W*m-2]
SoilHeatFlux0.01mAvg10min [W*m-2]
SoilWaterContent0.02mAvg10minSensor1 [%_Sat]
SoilHeatFlux0.08mAvg10min [W*m-2]
SoilTemperature0.01mAvg10min [degC]



Visualising and assessing time series data

- Connecting to OGC-SOS services
- Graphical selection of stations
- Display of:
 - Latest observations
 - Offerings
 - Available parameters
 - Station information (sensorML metadata)
- Visualisation of station data time series
- Data download (E-Mail, notification of responsible persons)
- Multisite downloads

lerzenhausen EC tower

Select Data

Query	Multi Site Download	Style
Offering: Climate		RadiationGlobalAvg10min [W*m-2] RadiationPhotosyntheticActiveAvg10min [umol*m-2*s-1]
valid: 2011-05-10 - 2011-05-10		
begin: 2012-11-01		
end: 2013-02-01		

Information

Result

```
# Time , feature , WindSpeed2mAvg10min in [m*s-1] , WindDirection2mAvg10min in [degN]
2012-11-01T14:10:00.000+01:00,ME_EC_001,5.165394,205.37129999999999
2012-11-01T14:20:00.000+01:00,ME_EC_001,4.6906129999999999,213.3254
2012-11-01T14:30:00.000+01:00,ME_EC_001,4.2068580000000004,247.32810000000001
2012-11-01T14:40:00.000+01:00,ME_EC_001,4.5687899999999999,229.65870000000001
2012-11-01T14:50:00.000+01:00,ME_EC_001,4.1253450000000003,236.13329999999999
2012-11-01T17:00:00.000+01:00,ME_EC_001,5.5916629999999996,219.62629999999999
2012-11-01T17:10:00.000+01:00,ME_EC_001,5.5811719999999996,215.16900000000001
2012-11-01T17:20:00.000+01:00,ME_EC_001,6.9080950000000003,220.07820000000001
2012-11-01T17:30:00.000+01:00,ME_EC_001,5.055879,224.0394
2012-11-01T17:40:00.000+01:00,ME_EC_001,4.5558779999999999,224.3717
2012-11-01T17:50:00.000+01:00,ME_EC_001,3.75224,226.0069
2012-11-01T18:00:00.000+01:00,ME_EC_001,3.682579,223.54949999999999
2012-11-01T18:10:00.000+01:00,ME_EC_001,3.6977000000000002,226.5421
2012-11-01T18:20:00.000+01:00,ME_EC_001,5.1096000000000004,233.45349999999999
2012-11-01T18:30:00.000+01:00,ME_EC_001,5.6473360000000001,239.60140000000001
2012-11-01T18:40:00.000+01:00,ME_EC_001,5.157883,240.11439999999999
2012-11-01T18:50:00.000+01:00,ME_EC_001,5.5900740000000004,236.26150000000001
2012-11-01T19:00:00.000+01:00,ME_EC_001,5.1872340000000001,236.4879
2012-11-01T19:10:00.000+01:00,ME_EC_001,5.266356,235.31540000000001
2012-11-01T19:20:00.000+01:00,ME_EC_001,5.1935219999999997,231.2295
2012-11-01T19:30:00.000+01:00,ME_EC_001,4.9423839999999997,236.92529999999999
2012-11-01T19:40:00.000+01:00,ME_EC_001,4.4572570000000002,239.0659
2012-11-01T19:50:00.000+01:00,ME_EC_001,5.4673790000000002,235.2775
2012-11-01T20:00:00.000+01:00,ME_EC_001,5.622147,236.768
2012-11-01T20:10:00.000+01:00,ME_EC_001,4.9633339999999997,239.00489999999999
2012-11-01T20:20:00.000+01:00,ME_EC_001,4.6880369999999996,240.71360000000001
2012-11-01T20:30:00.000+01:00,ME_EC_001,4.9703559999999998,237.2672
2012-11-01T20:40:00.000+01:00,ME_EC_001,5.2554210000000001,239.41730000000001
2012-11-01T20:50:00.000+01:00,ME_EC_001,5.0156109999999998,238.94749999999999
2012-11-01T21:00:00.000+01:00,ME_EC_001,4.2379340000000001,232.54820000000001
2012-11-01T21:10:00.000+01:00,ME_EC_001,4.4086860000000003,231.79660000000001
2012-11-01T21:20:00.000+01:00,ME_EC_001,4.6833210000000003,229.38730000000001
2012-11-01T21:30:00.000+01:00,ME_EC_001,4.5900109999999996,230.53469999999999
2012-11-01T21:40:00.000+01:00,ME_EC_001,4.6791159999999996,232.77420000000001
2012-11-01T21:50:00.000+01:00,ME_EC_001,4.838686,230.36840000000001
2012-11-01T22:00:00.000+01:00,ME_EC_001,4.5219930000000002,228.93799999999999
2012-11-01T22:10:00.000+01:00,ME_EC_001,4.9045509999999997,229.74600000000001
2012-11-01T22:20:00.000+01:00,ME_EC_001,4.0613549999999998,231.98570000000001
```



Data visualization in TEODOOR

TEODOOR ONLINE DATA PORTAL

Sonden_HAD_Pegel

Startseite >>TERENO Online Portal Folder >>TEODOOR Online Data Portal

Select Data

Query Multi Site Download Style

Offering: Offering_Bode-Selke

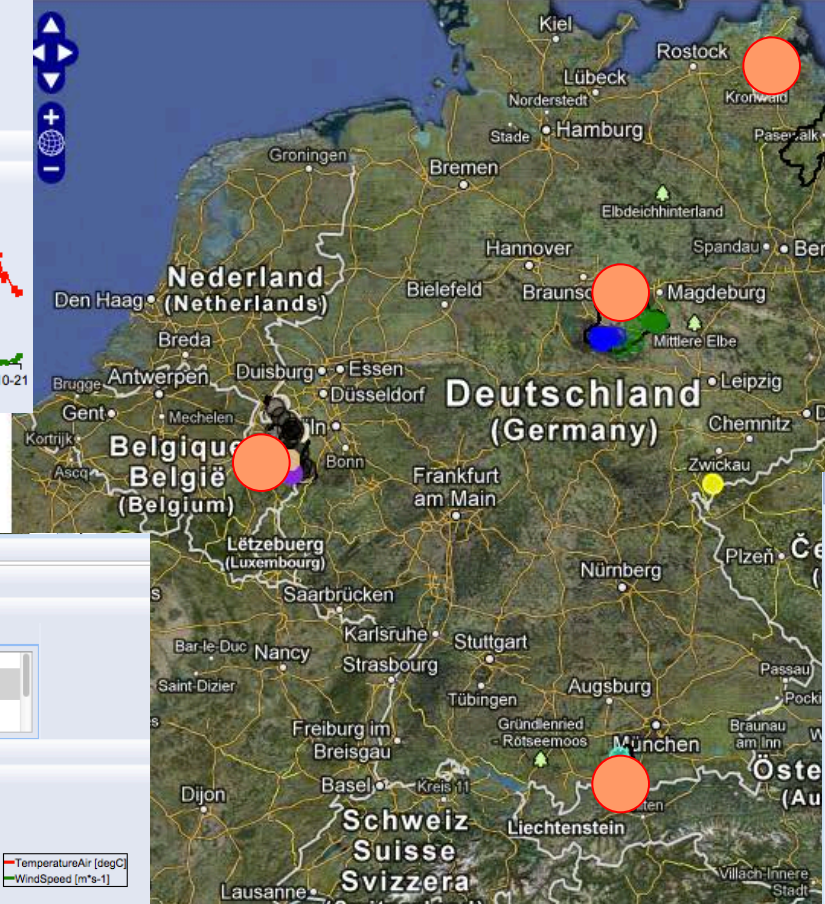
valid: 2012-05-20 23:51:53

begin: 2012-05-20 23:51:53

end: 2012-10-21 23:51:53

Information

Result



Klimastation_Sassen_cup-anemometer

download data

Select Data

Query Multi Site Download Style

Offering: WindSpeed

valid: 2013-01-01 - 2013-02-05

begin: 2013-01-01 10:37:40

end: 2013-04-09 10:37:40

Information

Result

Sensor Type

Parameter

Spatial Search (Using Map Extent)

Klimastation_Merzenhausen

Select Data

Query Multi Site Download Style

Offering: Climate

valid: 2011-12-16 - 2012-06-04

begin: 2012-10-20 23:56:32

end: 2012-10-21 23:56:32

Information

Result

- GFZ
- Garmisch
- Eifel-Rur
- Soilnet-Wuestebach
- Soilnet-Rollesbroich

Fendt

Select Data

Query Multi Site Download Style

Offering: ClimatePublic

valid: 2011-01-01 - 2011-11-02

begin: 2010-10-20 23:46:36

end: 2011-03-22 23:46:36

Information

Result

Search

- Freetext Search
- Keywords
- Sensor Name
- Intended Application
 - Atmosphere-Aerosols
 - Atmosphere-CloudParticles
 - Atmosphere-CloudTopTemp
 - Atmosphere-CloudType
 - Atmosphere-HumidityFields
- Topic Category
 - biota
 - boundaries
 - climatologyMeteorologyAtmosphere
 - economy
 - elevation
- Sensor Type
 - Aircraft
 - Anemometer**
 - Barometer
 - DetectorType
 - EOInstrumentType
- Parameter
 - AirPressure1mAvg1hr

delete item

Spatial Search (Using Map Extent)

search

Hierarchical Search

- theme
 - keyword1
 - datenmanagement
 - Weatheradar
 - atmosphere
 - Meteorological geographical fe
 - World

Free text or keyword :
in distributed Catalog
services

Search for station nar

Search for themes an
topics

Search for sensor types

Search for variables

Spatial search

Hierarchical keyword
search in distributed OGC-
catalogue services

Search Result

- Klima- un
- Climate s
- Klimastat
- Klimastat
- Climate s
- Klimastat
- Schoenes
- Abfluss- u
- Klimastat
- Merzenha
- Wetterun
- Waldstati

add

Merzenhausen EC tower

Access Through:
http://ibg3wradar.ibg.kfa-juelich.de:8080/eifelrur_intern/sos

Merzenhausen EC tower:
id: urn:org:fzj:ibg:senorml:ebrim:profil:ME_EC_001
description: permanent station since 2011-12-12
phenomenons (observed properties):
WindDirection2mAvg10min
RadiationGlobalAvg10min
SoilHeatFlux0.01mAvg10min
SoilWaterContent0.02mAvg10minSensor1
SoilHeatFlux0.08mAvg10min
SoilTemperature0.01mAvg10min
RadiationPhotosyntheticActiveBelowCanpoyAvg10min
PrecipitationAmountCum10min
SoilWaterContent0.1mAvg10min
SoilTemperature0.05mAvg10minSensor2
RadiationPhotosyntheticActiveAvg10min
SoilTemperature0.05mAvg10minSensor1
AirAbsoluteHumidity2mAvg10min
AirTemperature2mAvg10min
WindSpeed2mAvg10min
AirPressure1mAvg10min
SoilWaterContent0.02mAvg10minSensor2
LoggerDiagnosisWarningMessage
SoilWaterContent0.3mAvg10min
accessible through:
http://ibg3wradar.ibg.kfa-juelich.de:8080/eifelrur_intern/sos





Data Types and QC Methods

Type	Descriptions	QC method
D1	Automatically-uploaded data; not quality controlled when imported into TERENO database.	Automatic quality assurance procedures & visual inspection
D2	Manually-uploaded, and externally quality-controlled data	Only approval-by-upload needed
D3	User-inserted data; not quality controlled when inserted into TERENO database	Visual inspection



Type D1



Type D2



Type D3



Data Processing Status

Processing Status	Descriptions
Level 1	Raw data (unevaluated)
Level 2a	¹ Externally quality controlled data (without internal approval)
Level 2b	² Internally controlled data (with automatic quality assurance procedures (e.g., range check) and visual inspection)
Level 2c	Externally quality controlled data with internal approval
Level 3	Data derived from one or more Level 2(b,c) data series

¹External : Outside TERENO data infrastructure

²Internal : Within TERENO data infrastructure



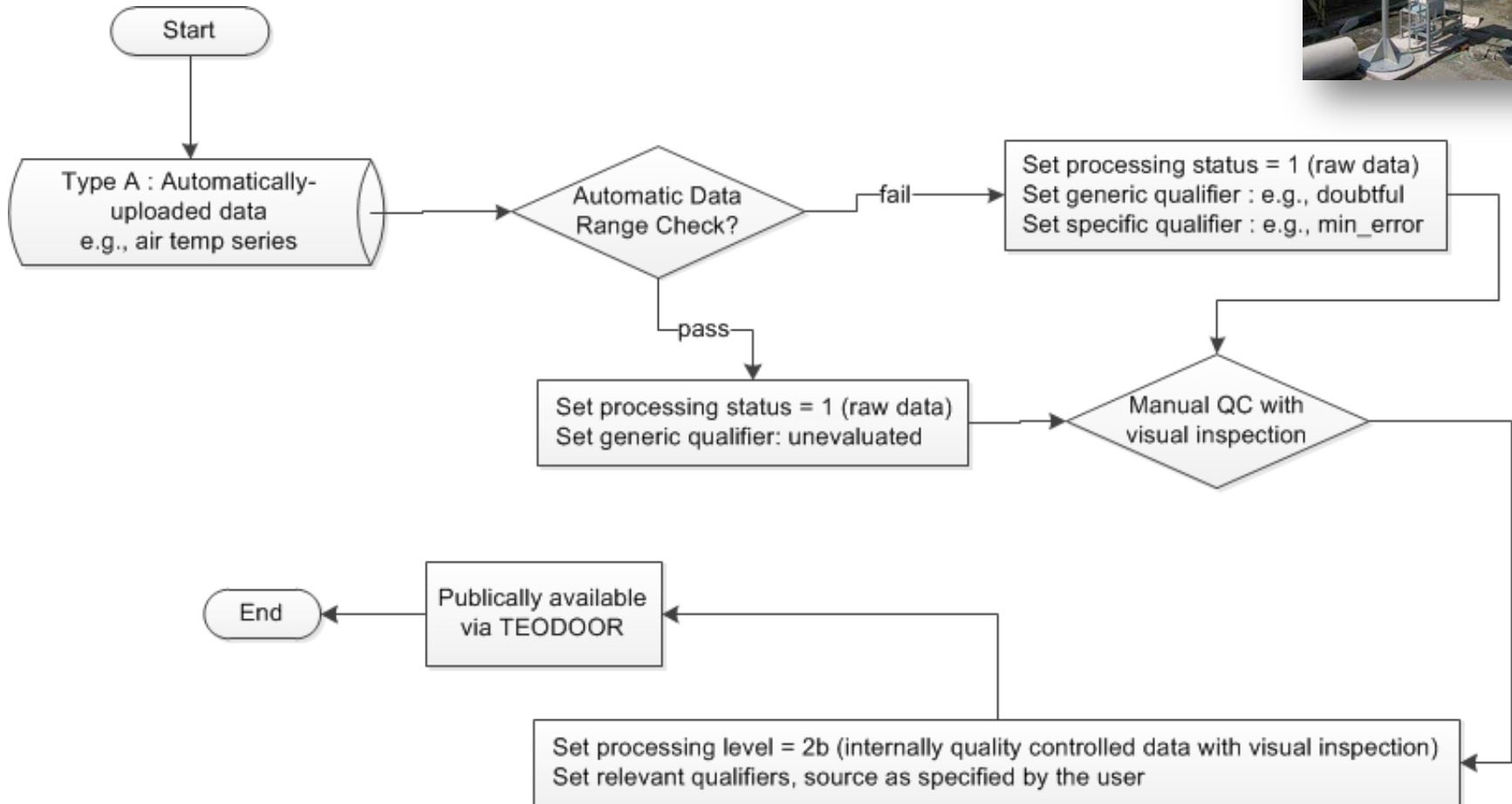
Qualify Flag (Qualifiers) Convention

- Generic qualifiers represents the common quality status of the data and they are fixed.
 - Examples: unevaluated, ok, bad, doubtful, gapfilled, missing

- Specific qualifiers extend generic qualifiers
 - they provide additional information about the causes and possible direction of bias, and/or the magnitude of data variability.
 - Specific qualifiers are varied according to observed properties and specified by the experts.
 - Examples: isospike, minerr, maxerr, interpolated, extrapolated

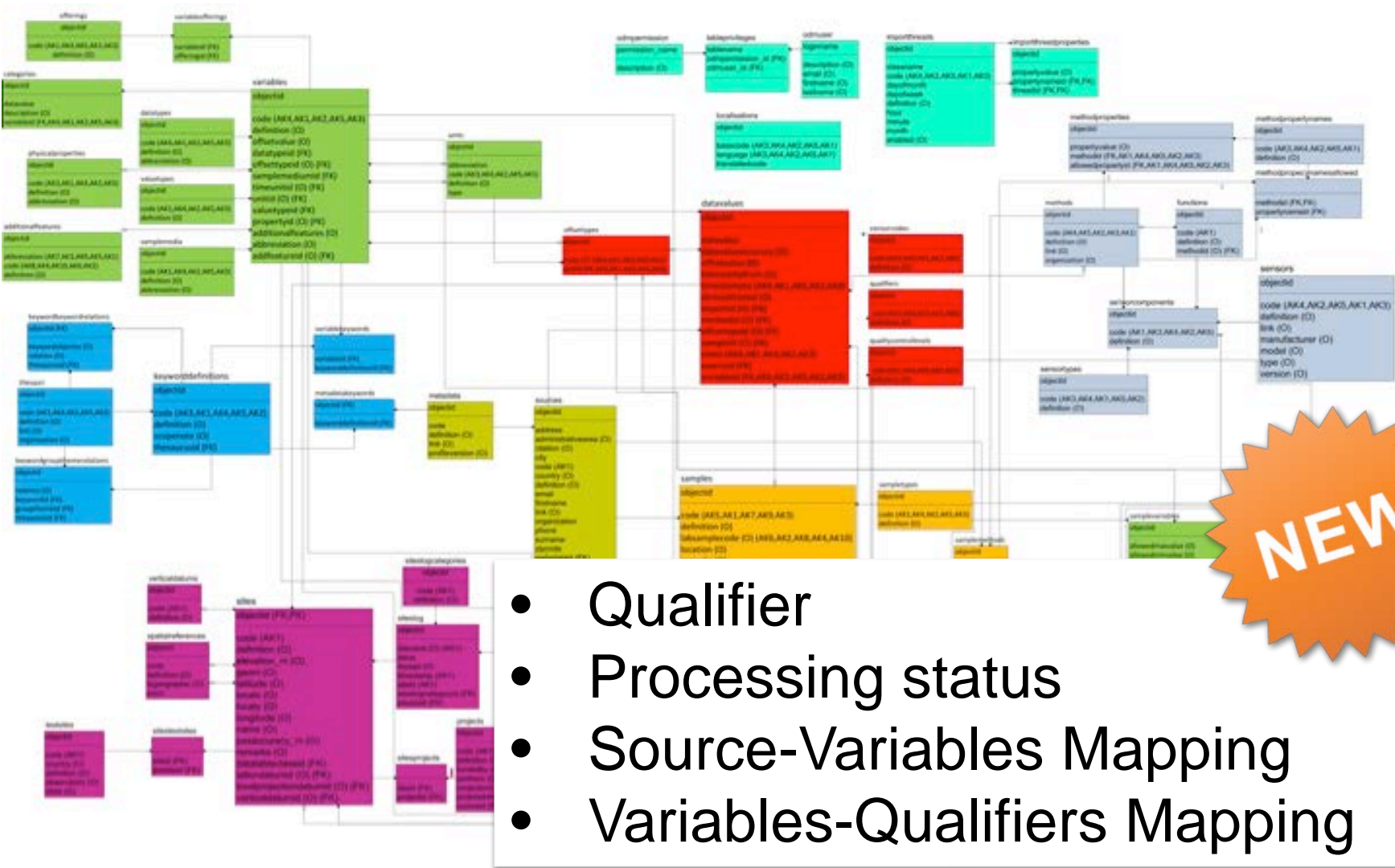


Workflow of D1: Automatically-uploaded data





Observational Data Model



- Qualifier
- Processing status
- Source-Variables Mapping
- Variables-Qualifiers Mapping



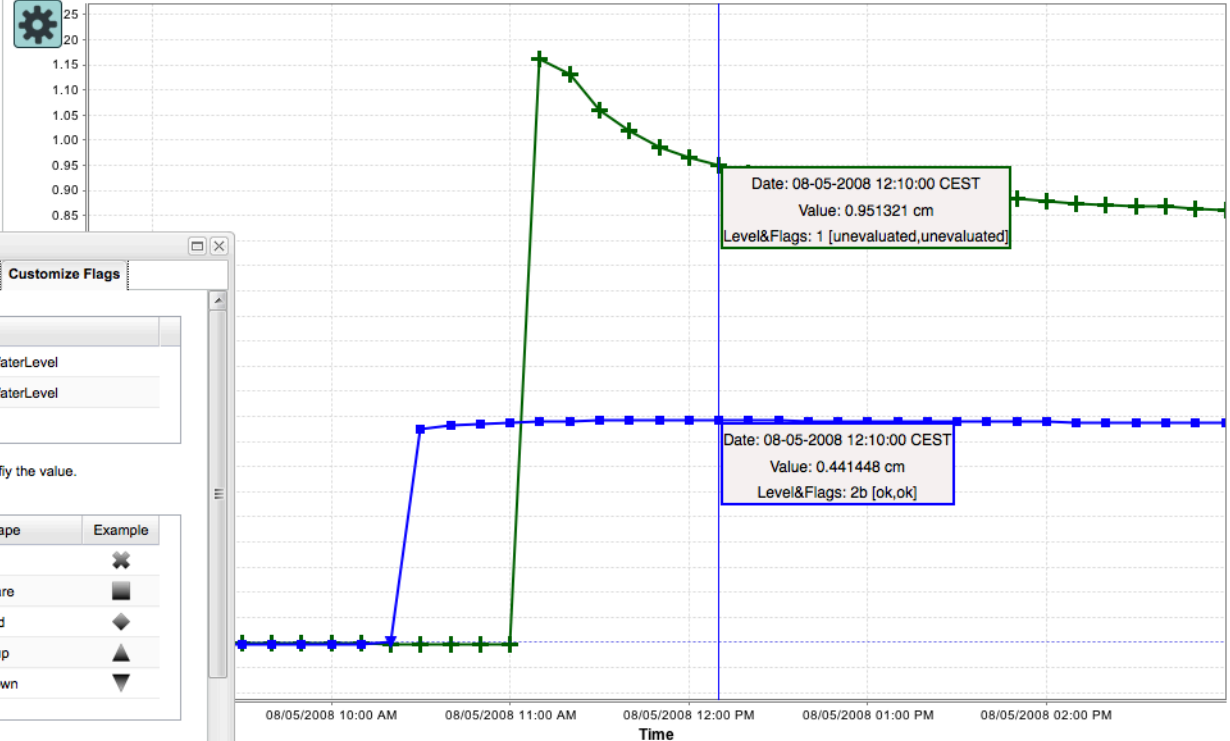
Quality flagging tool

Add Time Series | **Export Series** | **Data Quality Flagging**

GroundWaterLevel@WU GW 001

Parameter: GroundWaterLevel [cm]
 Station: WU GW 001
 07.05.2008 15:00 (NA cm) to 04.02.2013 18:30 (null cm)

GroundWaterLevel@WU GW 009



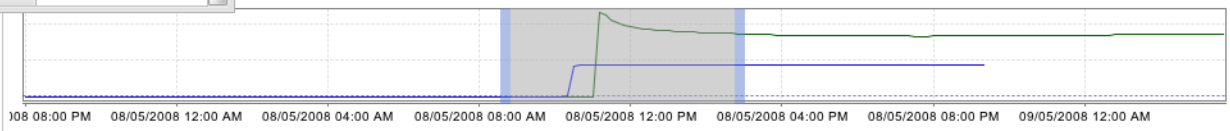
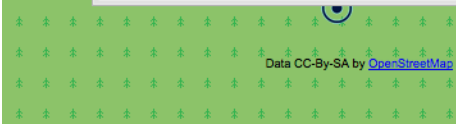
Search for time series

Point Flagging | Range Flagging | View-based Flagging | **Customize Flags**

Series	Sensor ^	Property
<input checked="" type="checkbox"/>	WU_GW_001	GroundWaterLevel
<input type="checkbox"/>	WU_GW_009	GroundWaterLevel

Click on a particular 'Series Shape' to modify the value.

Flag Type	Series Shape	Example
<input type="checkbox"/>	unevaluated	cross
<input type="checkbox"/>	ok	filledsquare
<input type="checkbox"/>	gapfilled	diamond
<input type="checkbox"/>	doubtful	triangleup
<input type="checkbox"/>	baddata	triangledown





Zusätzliche Dienste des GFZ

Das GFZ bietet eine Reihe von zusätzlichen Diensten für Forschungsdaten an:

- Datenveröffentlichung mit DOI
- Persistente Identifikatoren für Probenmaterial (IGSN)
- Datenmanagementsystem für dateibasierte Daten

- DOI und IGSN können miteinander verknüpft werden.
- Daten können aus dem Datenmanagementsystem heraus mit DOI veröffentlicht werden.