EU GREEN WEEK

Towards a Water Resilient Europe

Exploring the Pivotal Role of Open Access Data for Groundwater Quality and Quantity Assessments

EuroGeoSurveys European Geoscience for Society
The Geological Surveys of Europe

Water4All
Water security for the planet

GSEU
GEOLOGICAL SERVICE FOR EUROPE

WATER4ALL
PARTNERSHIP

Towards an integrated groundwater and surface water information platform developed by the European partnership: “Water4All – Water security for the planet”

S.Grellet - BRGM

August 27, 2024

Co-funded by
the European Union

WATER4ALL PARTNERSHIP

Sharing of groundwater data, identification of barriers and problems, way ahead and solutions

S.Grellet - BRGM

August 27, 2024

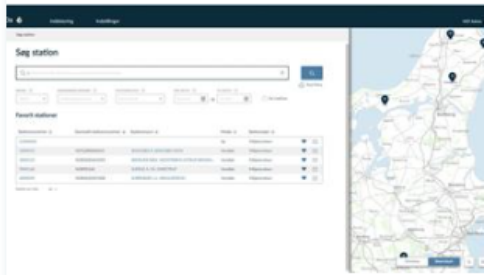
Data exchange context

Different countries / organisations / IT practices / …

Historical context in each of those is different

- Quick examples taken in couple minutes
- That list will grow in various countries, continents, organisations …

VanDa



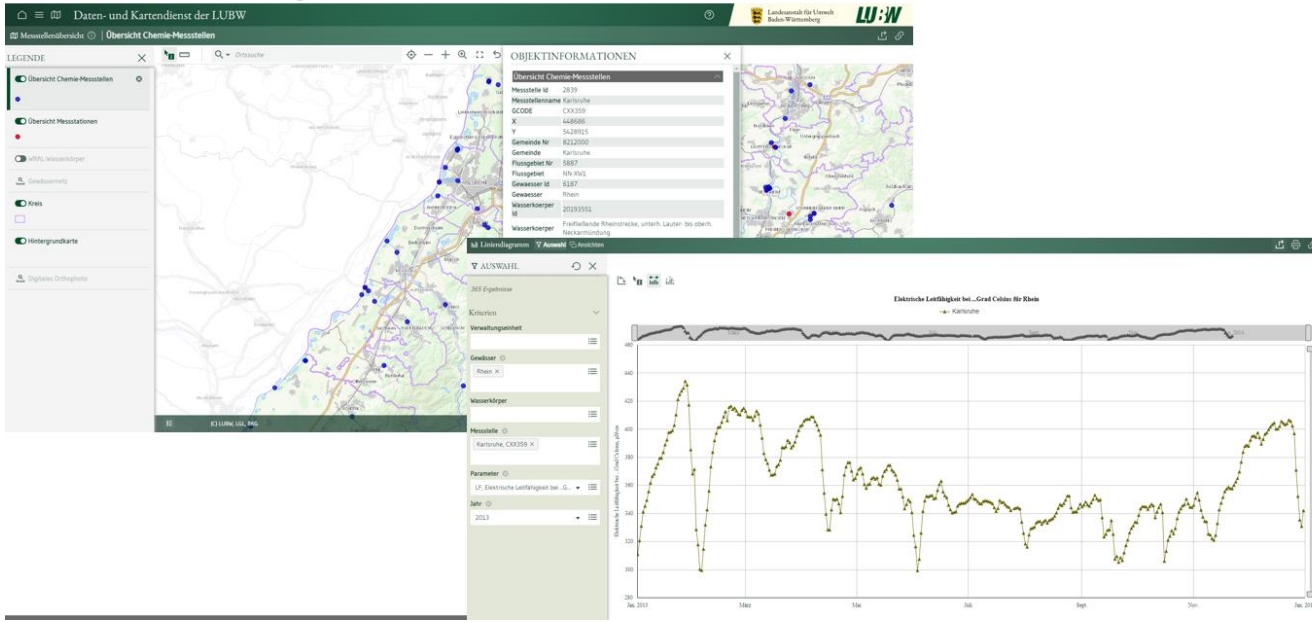
VanDa er Danmarks Miljøportals system for inddatering af data for det rene overfladevand. VanDa indeholder data for sø, vandløb og det marine område, når det drejer sig om kemi, flora og fauna. Har du brug for hjælp så gå til vores HelpCenter

Jupiter - GEUS

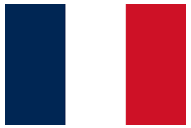
NATIONAL BORINGSDATABASE (JUPITER)

Indberetning i dette system er kun for myndigheder og kræver login.
Jupiter er en database under De Nationale Geologiske Undersøgelser for Danmark og Grønland (GEUS), der indeholder data om grundvand, drikkevand, råstof, miljø og geoteknik. Databasen indeholder information om mere end 280.000 boringer og kan blandt andet bruges til at tjekke vandkvalitet.
Få hjælp og vejledning i vores HelpCenter

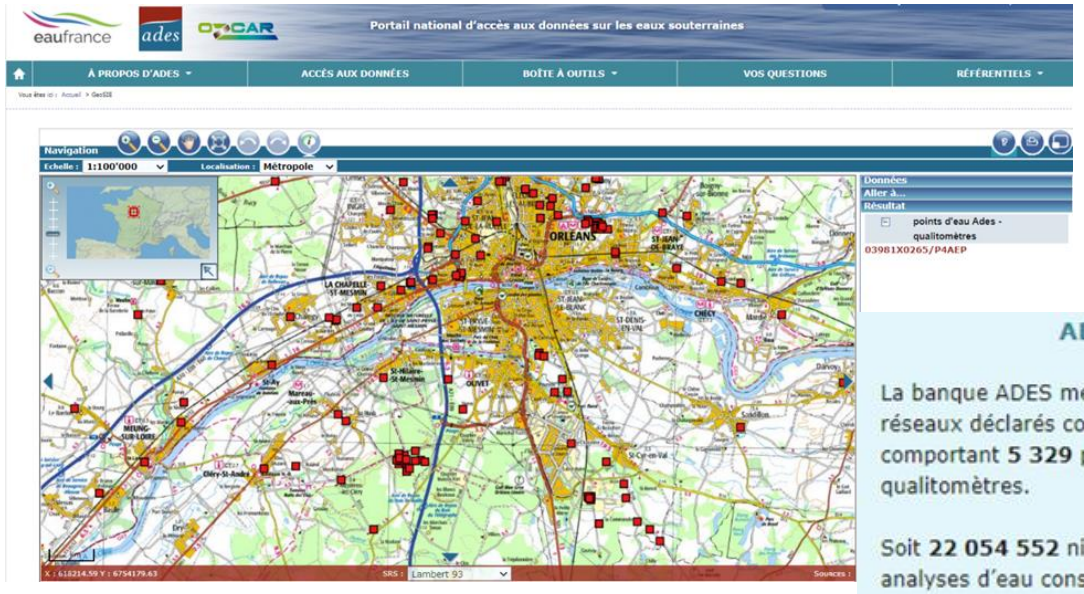
Land Baden-Württemberg



Different countries / organisations / IT practices / …



Ground Water



ADES en chiffres

La banque ADES met à disposition à ce jour **353** réseaux déclarés contenant **82 174** points d'eau comportant **5 329** piézomètres et **78 623** qualitomètres.

Soit **22 054 552** niveaux d'eau et **135 586 152** analyses d'eau consultables en ligne.

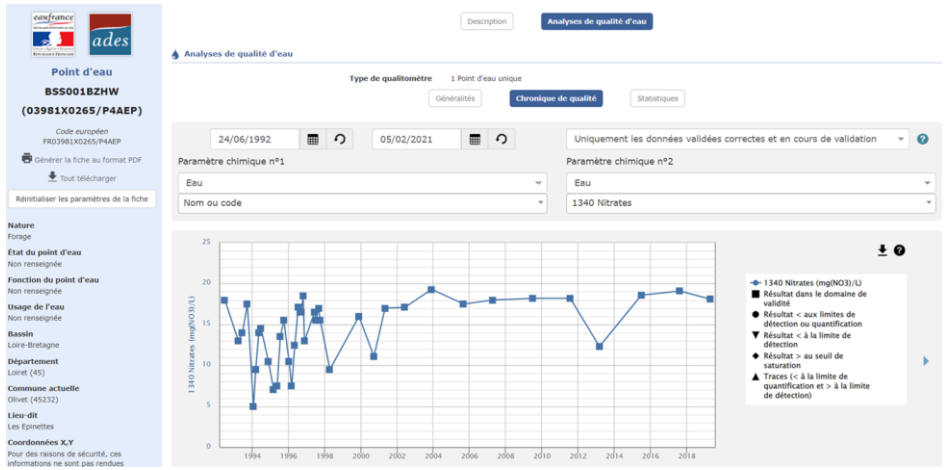
Water Agencies

French Geological Survey (BRGM)

Various ministries (Health, industry,..)

Partner networks (ex : local water councils, …)

National semantic & technical interoperability



Different countries / organisations / IT practices / …

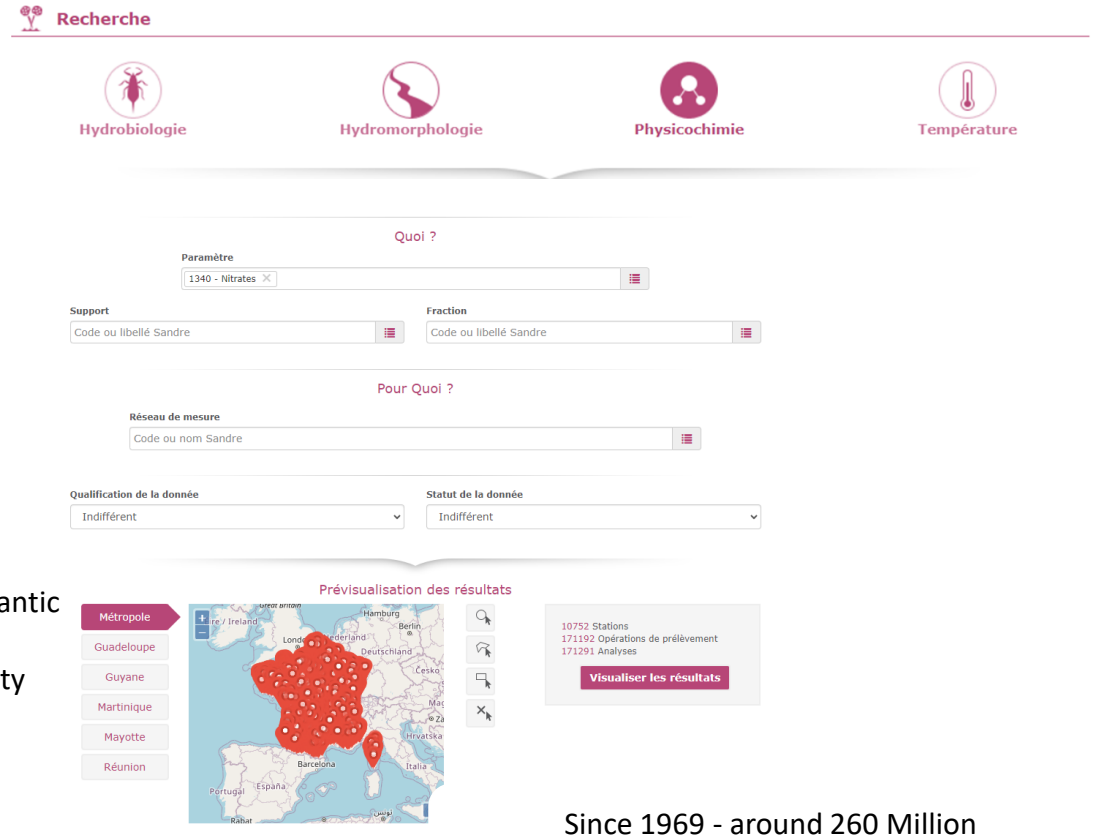
Surface Water

Water Agencies

French Biodiversity Office (OFB)

Partner networks (ex : DREAL, …)

National semantic & technical interoperability



Since 1969 - around 260 Million Observations on water physics & chemistry

Different countries / organisations / IT practices / …

EU country A

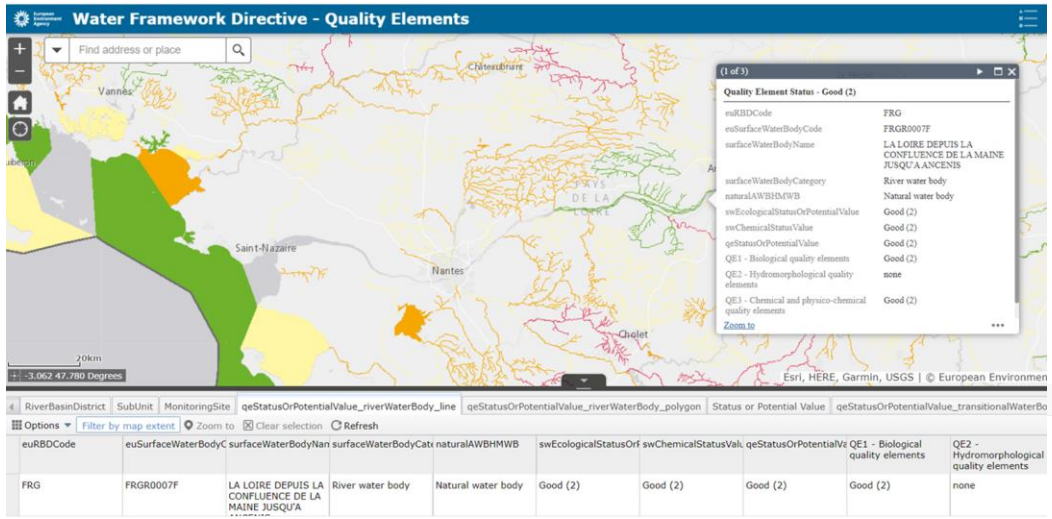
EU country B

EU country C

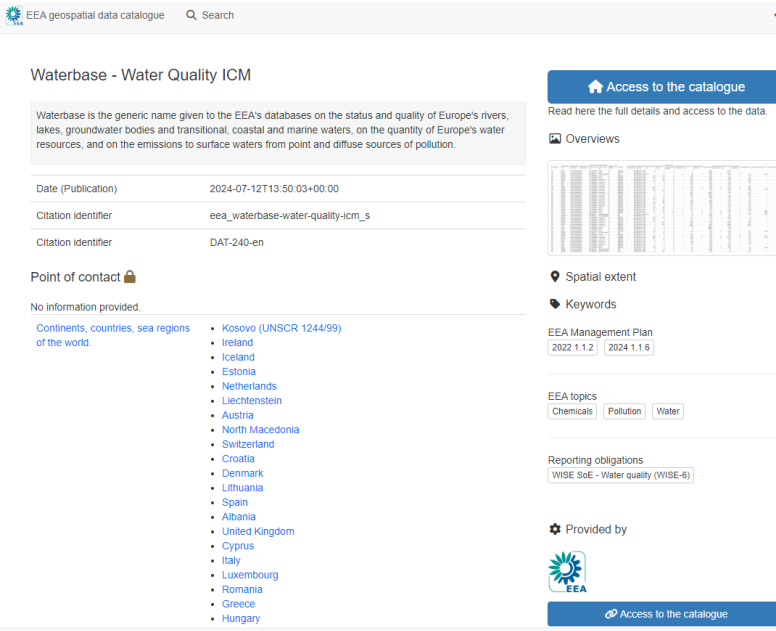
EU Reporting according to EU specifcations
https://dd.eionet.europa.eu/

Mostly file based

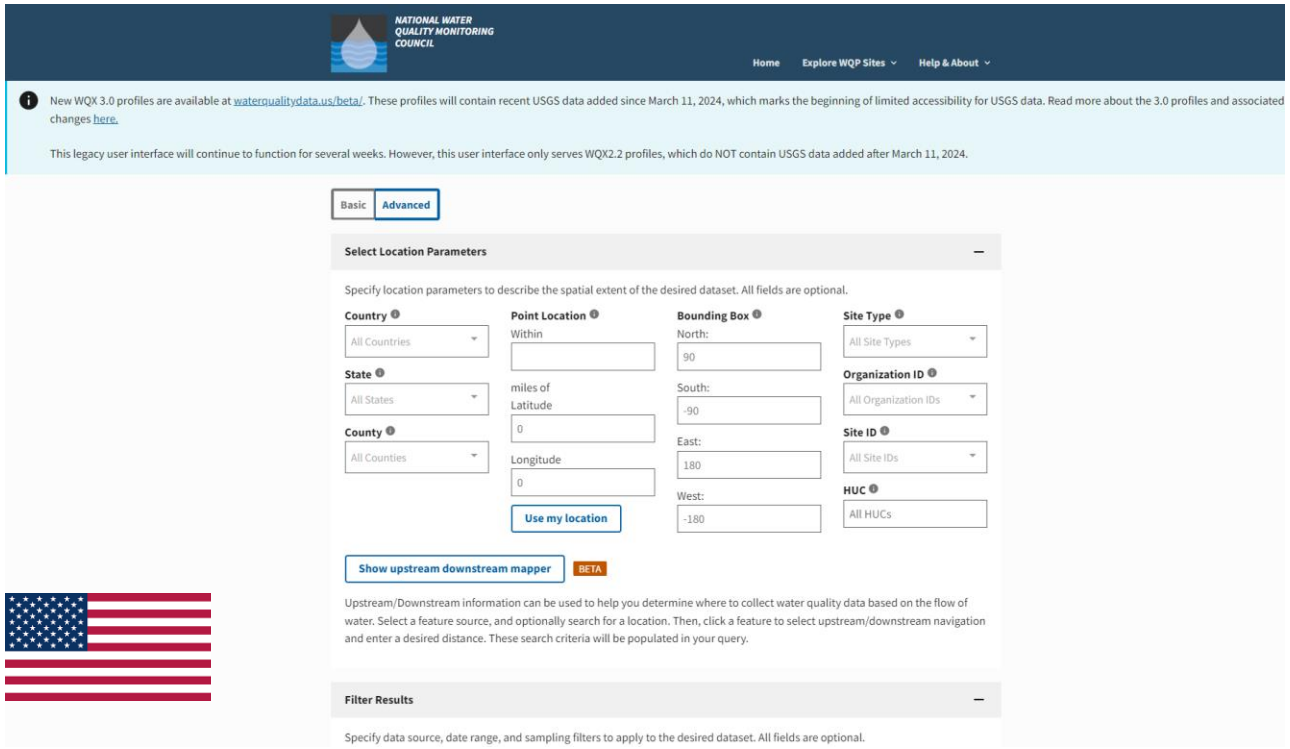
Mainly stations, network, indicators.
Only one with observations

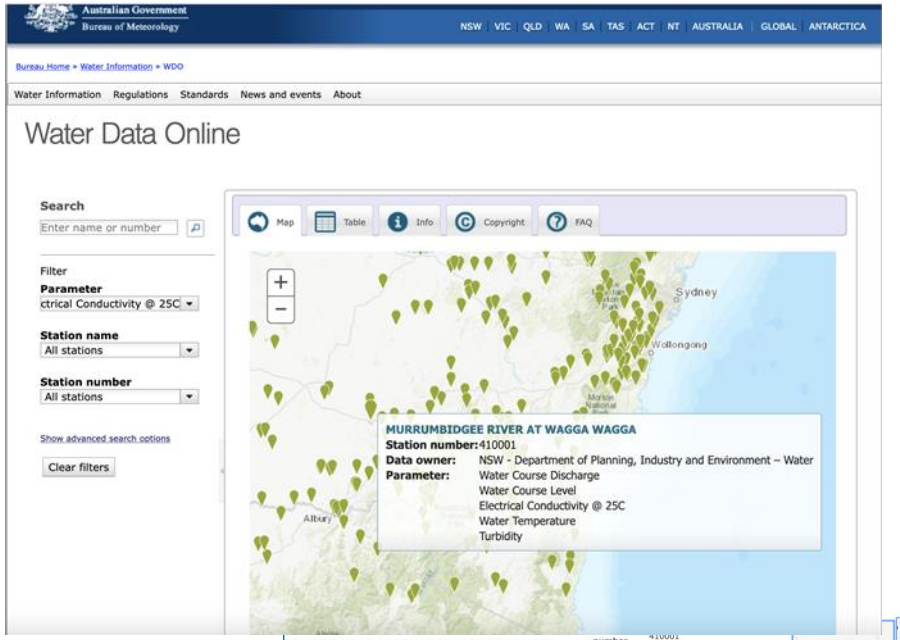


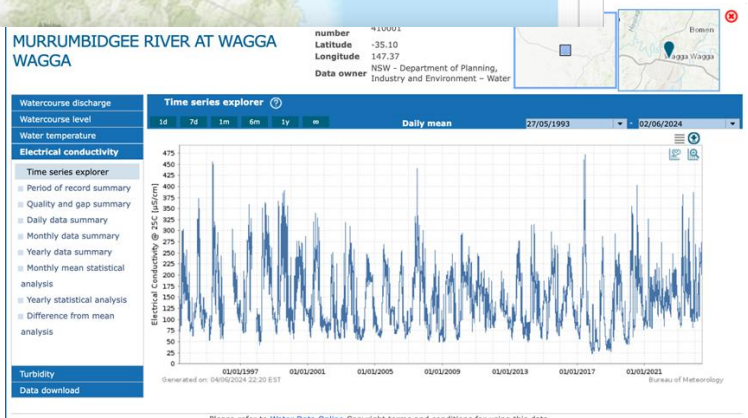
Reported Data from the EU WISE portal



Different countries / organisations / IT practices / …

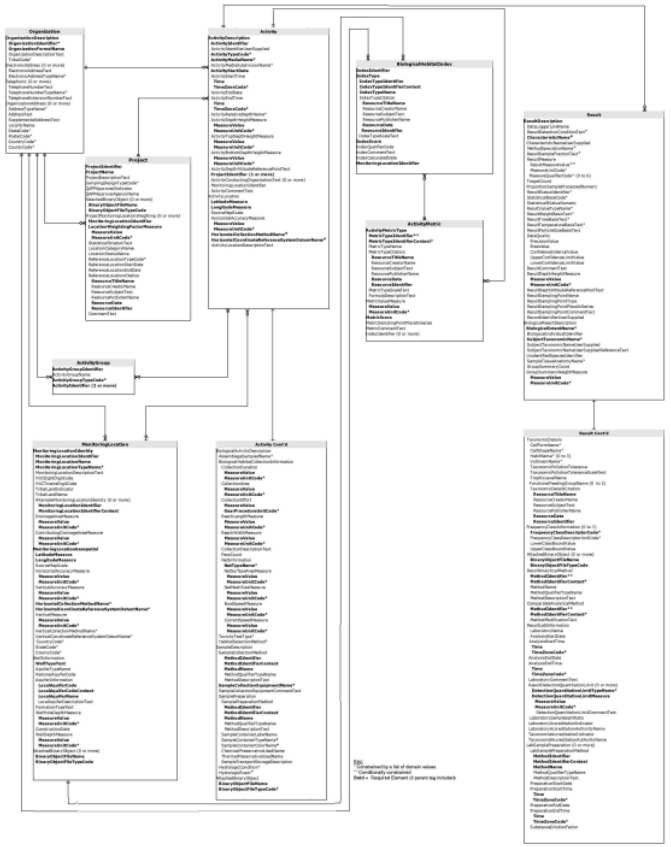




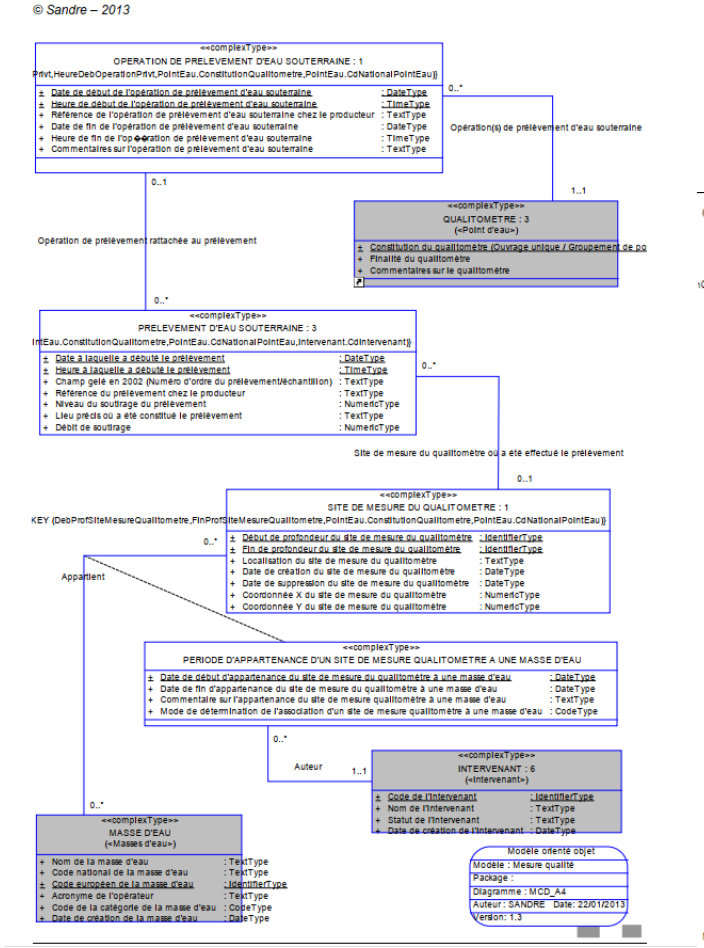


Barriers

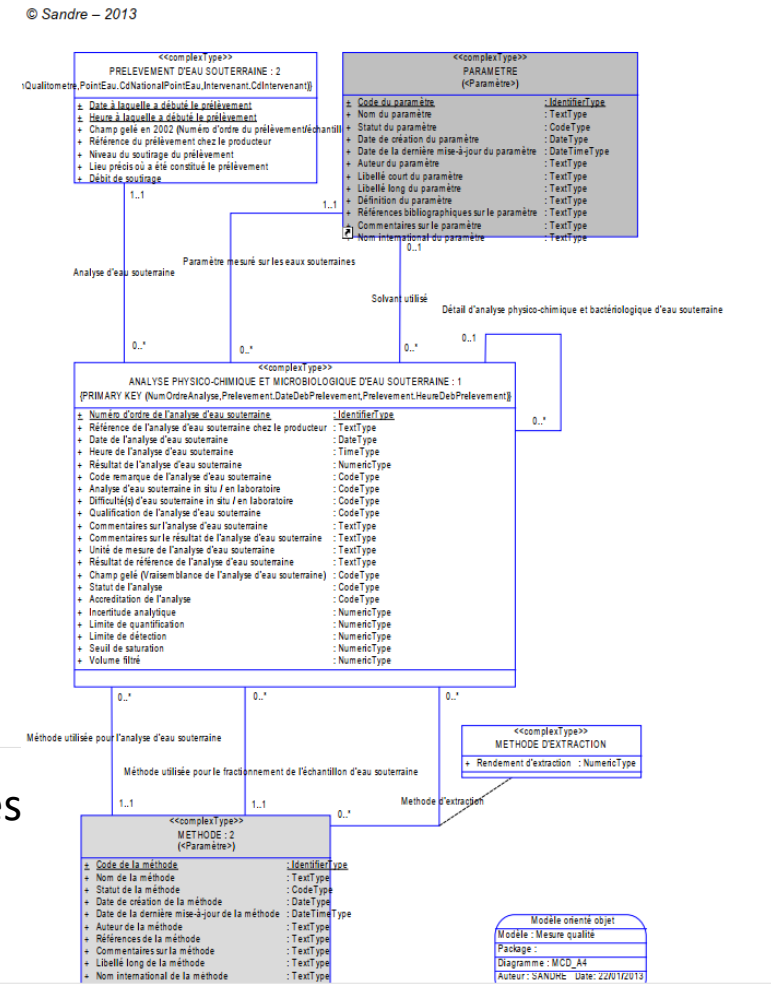
Different semantics – to structure data



WQX Schema v3.0
ElementRelationshipDiagram



Sandre «Mesure de la qualité des eaux souterraines » V 1.3



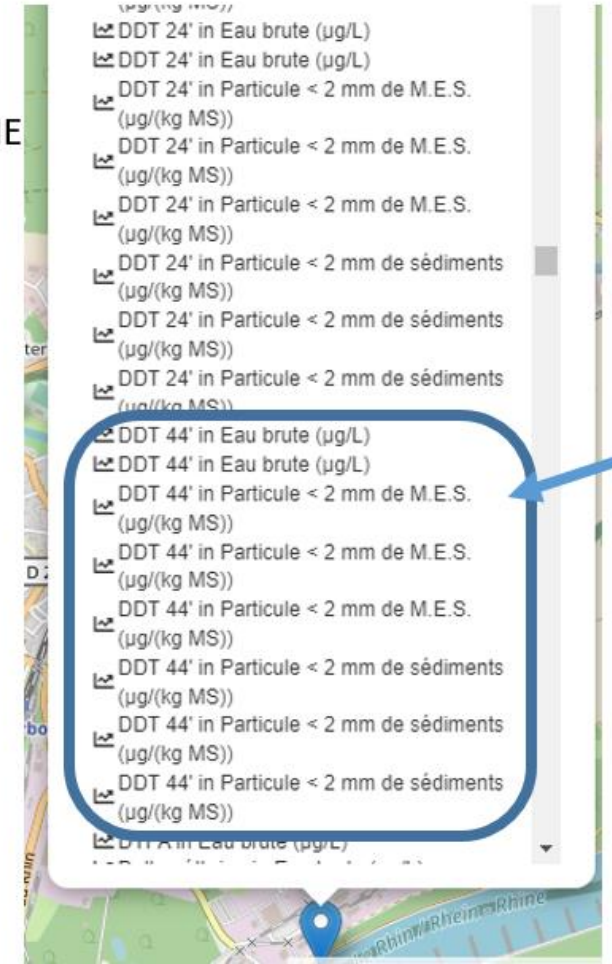
Barriers

Different semantics – to populate data

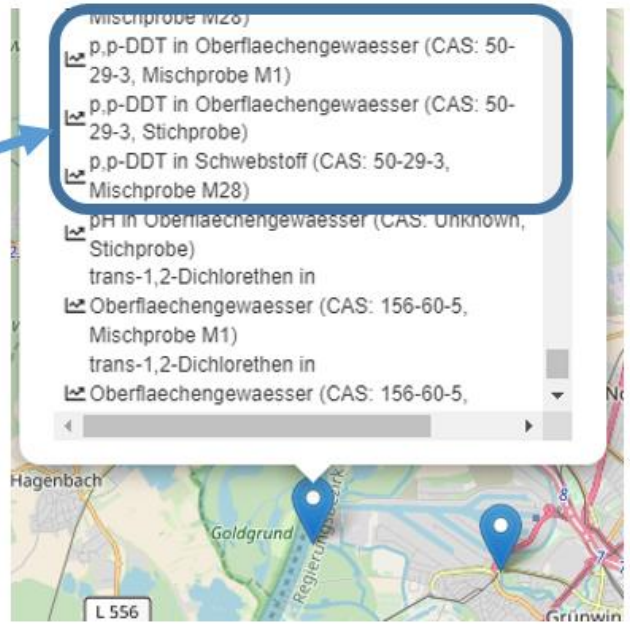
- E.g: not the same parameter/observed properties

Comparing data from 2 French – German stations on the Rhine close to each other

French-OFB:
LE RHIN À
LAUTERBOURG-KARLSRUHE
02047300

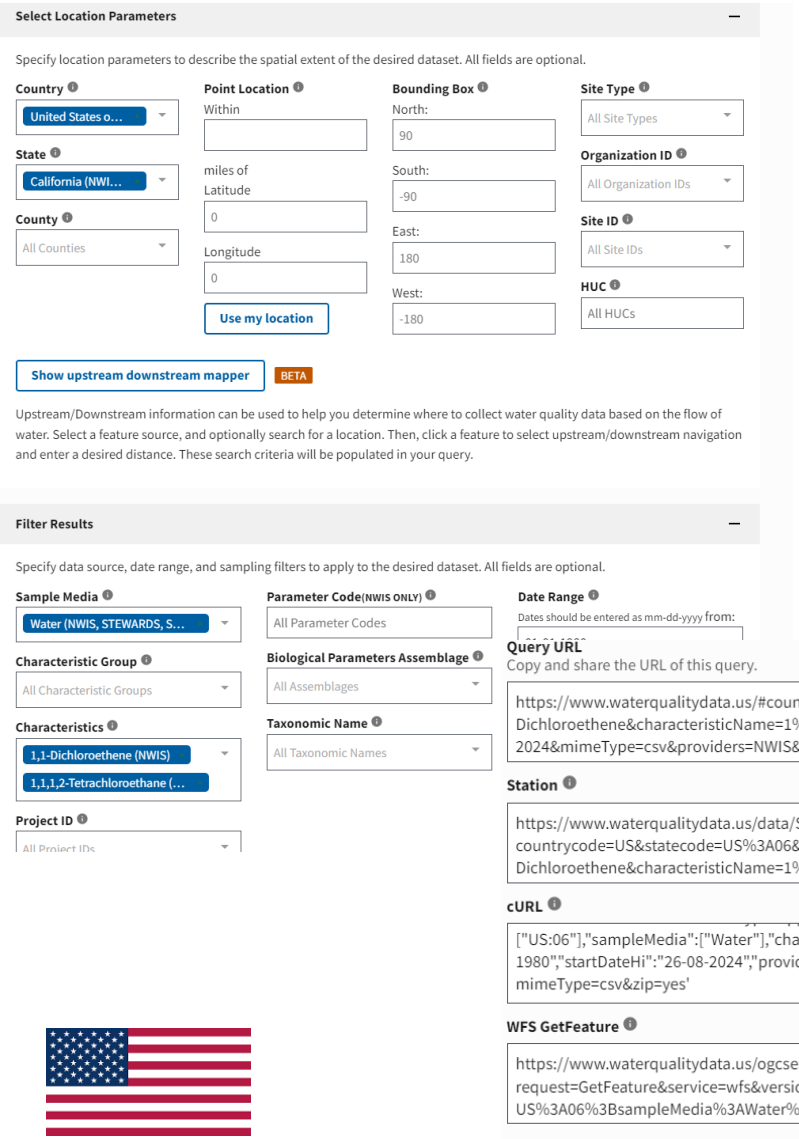


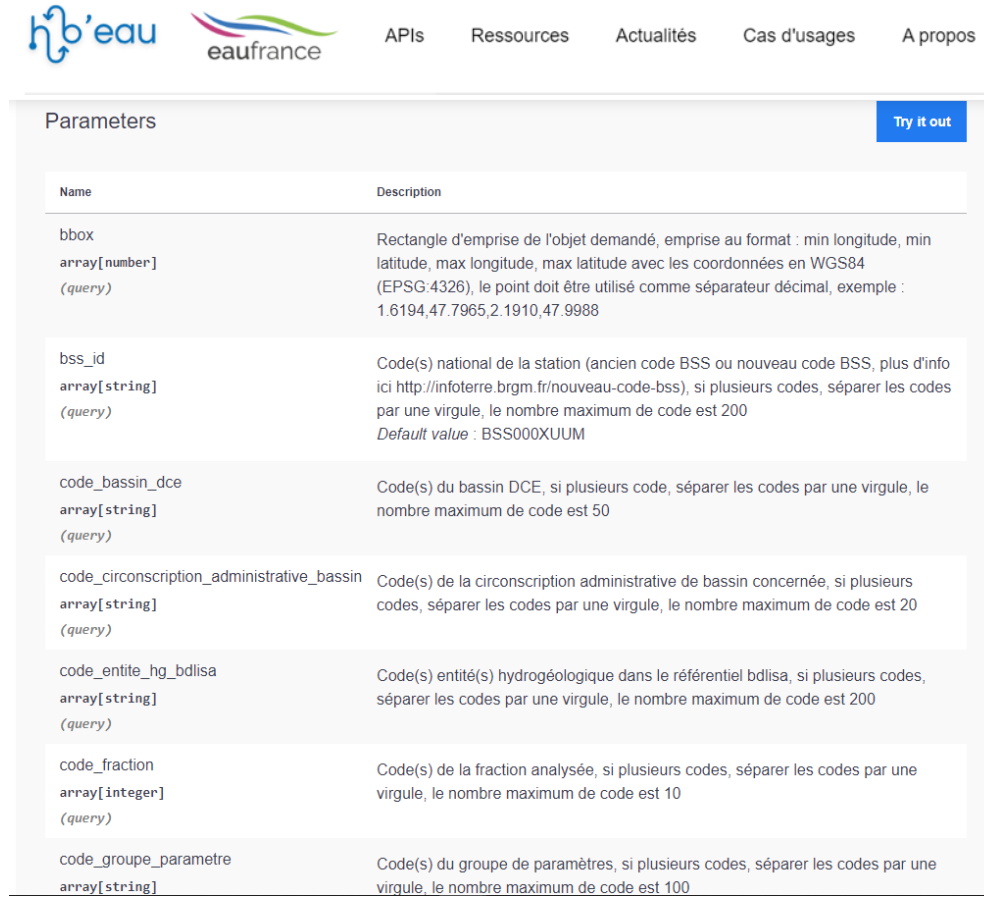
German-LUBW:
Karlsruhe (CXX359)



Barriers

Different webservices / APIs – to expose the same type of data





A way ahead

A way ahead

Barriers

- Different semantics – to structure data
- Different semantics – to populate data
- Different webservices/APIs – to expose data

As, often ad'hoc/local solutions in place

Proposal

- Using internationally agreed upon FAIR Water Data Practices

From where ?

- Dynamics are already in place in OGC, W3C, RDA, INSPIRE
- Just need a little more coordination and support

International standardisation dynamics in the water domain

Open Geospatial Consortium

- Standards not only to do web GIS !

- Highly driven through Domain Working Groups (Aviation, Earth Systems Science, Defense and Intelligence Emergency and Disaster Management, Geoscience, **Hydro**, Marine, Meteorology and Oceanography, …)

- Joint work with ISO

- Joint groups with W3C (standards for the web, data exchange on the web)

- Joint efforts with RDA RESEARCH DATA ALLIANCE

- Highly recommended and implemented
  - in the INSPIRE directive context
  - in many EU Research Infrastructures and projects eosc

International standardisation dynamics in the water domain

OGC - Hydro Domain Working Group

- Joint OGC – World Meteorological Organisation group
- Target: WaterML 2.0 suite of standards : https://www.ogc.org/standard/waterml/
- Organising Interoperability Experiments - (IEs) focused on the water sub-domains
- Entry point : https://external.ogc.org/twiki_public/HydrologyDWG/WebHome

- WaterML2.0
  - Implemented in WMO Information System
  - in those from many organizations : UNESCO, USGS, US EPA, NrCan, NIWA, BRGM, etc…
  - And in opensource tools : CUASHI Hydro-Server, Kisters, 52°N etc…
  - Updated with a regular contribution from projects involving Hydro DWG partners

Part 1 - Timeseries	Part 2 – Ratings, Gaugings and Sections	Part 3 – Surface water features	Part 4 – Groundwater	Part 5 – Water quality (best practice)

Soon to be updated by the Water Quality Interoperability Experiment

A long history of joint activities

- 2003 - Earth Systems Science Domain Working Group (DWG)
- 2009 - Hydrology DWG
- 2011 - Groundwater Interoperability Experiment (IE)
- 2011 - Water Information Services Concept Development Study
- 2011 - Surface Water Interoperability IE
- 2012 - Hydrology Forecasting IE
- 2013 - Climate-Hydrology Information Sharing Pilot
- 2013 - GroundWater IE2
- 2014 - Water ML 2.0 Standards Working Group (SWG)
- 2015 - Hydrographic Features SWG
- 2015 - Research Data Alliance Global Water Information IG (Hydro DWG sister group)
- 2016 - Groundwater SWG
- 2017 - Geoscience DWG
- 2018 - Environmental Linked Features IE (ELFIE)
- 2019 - Borehole IE
- 2021 - Second ELFIE (SELFIE)
- 2022 - Water Quality IE => on going

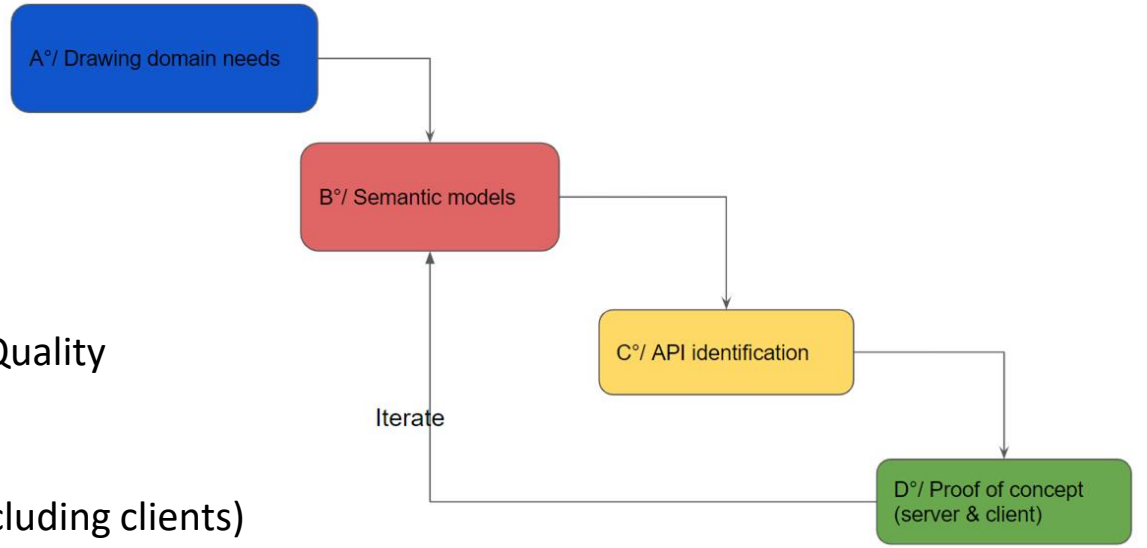
International test on Surface / Ground Water Quantity / Quality data exchange

OGC Water Quality Interoperability Experiment (WQ IE)

tl;dr;

- 1°/ WMO-UNEP-WHO-UNESCO Water Quality workshop in March 2022 (29-31) : Surface & Ground water

- 2°/ Kick-off 13/09/2022 … 77 (+ impromptu) meetings later



- A Best Practice on Observations, measurements and samples for Water Quality
- A tooling specification : OGC SensorThings API 1.1

+ WQ extension (reference open-source implementation in FROST)

- Running implementations in various national, organization endpoints (including clients)
- A steadily growing uptake through initial IE partners + 2 important EU projects and WMO members

- 3°/ Engineering Report being written will prepare next steps on

- a Best Practice for WQ Data Exchange : upgrading OGC WaterML2.0 - Part 5 (OGC 14-003)
- a review of OGC WaterML2.0 - Part 1 (OGC 10-126r3) : Timeseries

Both to be updated with regards update in the international standard for Observations, measurements and samples change + worldwide change of practices in API deployment

OGC Water Quality Interoperability Experiment (WQ IE)

Quick links

- Full demo – https://external.ogc.org/twiki_public/HydrologyDWG/HydroDWGOGCMemberMeetingJune2024
- Water Quality IE reference point : https://github.com/opengeospatial/WaterQualityIE

What -> shared international approach

- Semantics (data-model) : based on OGC/ISO “Observations, measurements & samples” standard -> Water quality profile
- Technical (API) : OGC SensorThings API (mostly)

Who

- EU Water4All
  - project partners -> Ex : BRGM, Danish DEP, ISPRA, Fraunhofer, VITO etc…
  - EU DataSets (ex : EEA)
- Water Quality IE members USGS, USEPA, DataStream (Canada), BRGM, BaFG (Unesco GEMS water), Fraunhofer
- EU GSEU project partners -> EU Geological surveys

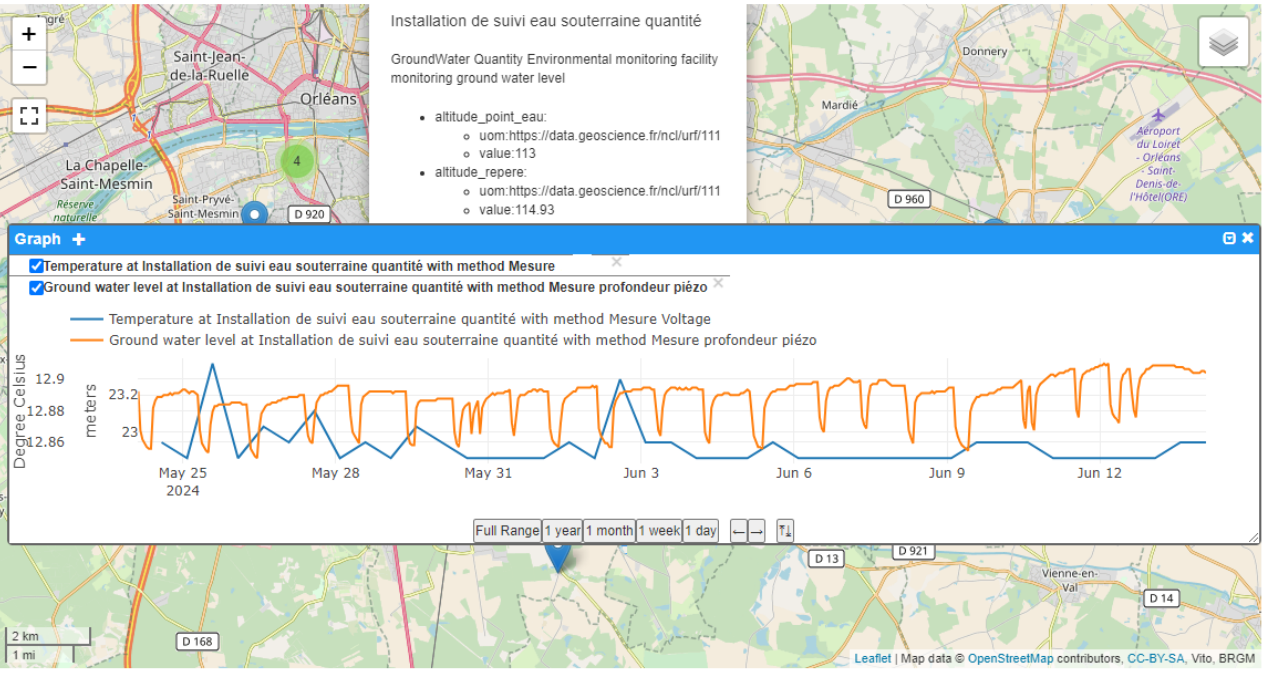
How

- Data Provider side : Deploying the solution according to the documentation provided
- Client side connected to the same APIs (proof of interoperability) : Generic WebMap client (https://api4inspire.k8s.ilt-dmz.iosb.fraunhofer.de/servlet/is/226/), QGIS SensorThings API Plugin, R

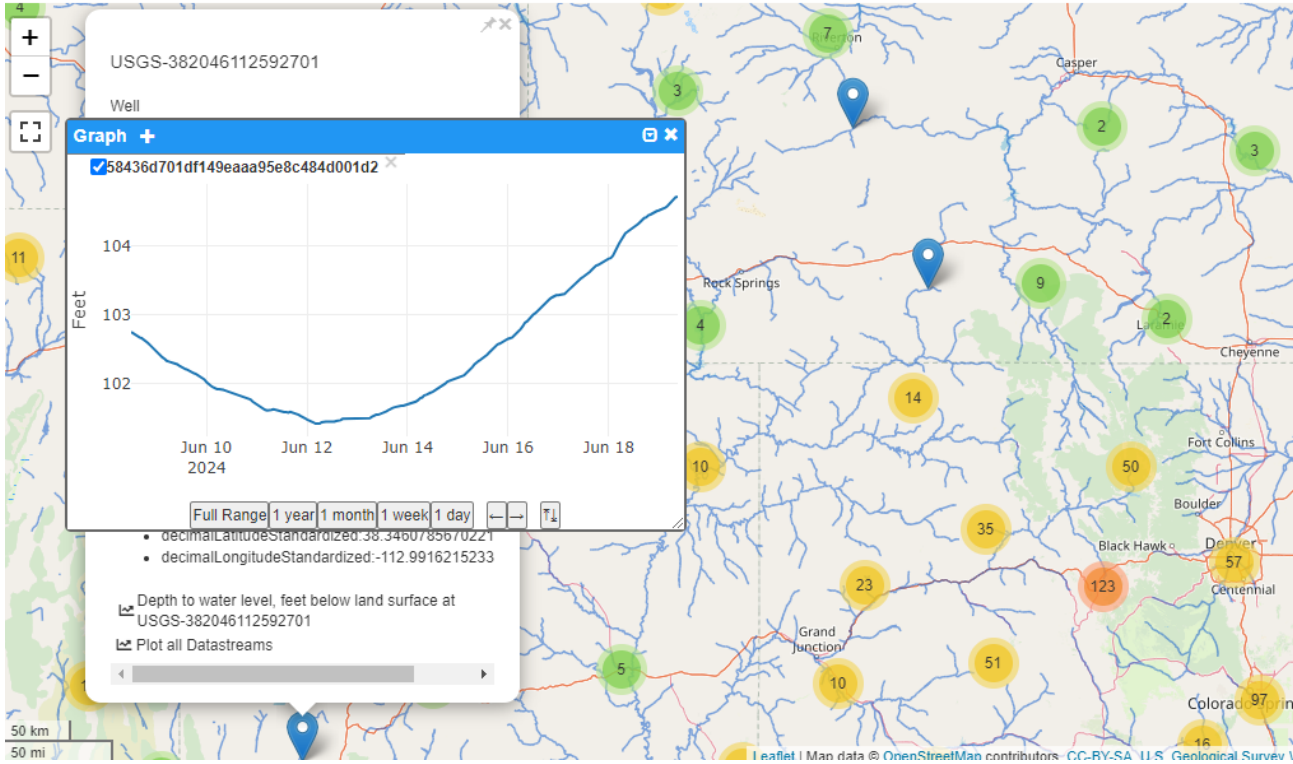
Water4All, Water Quality IE: FAIR Water Data Practices

It works

Water Quality IE / Water 4 All



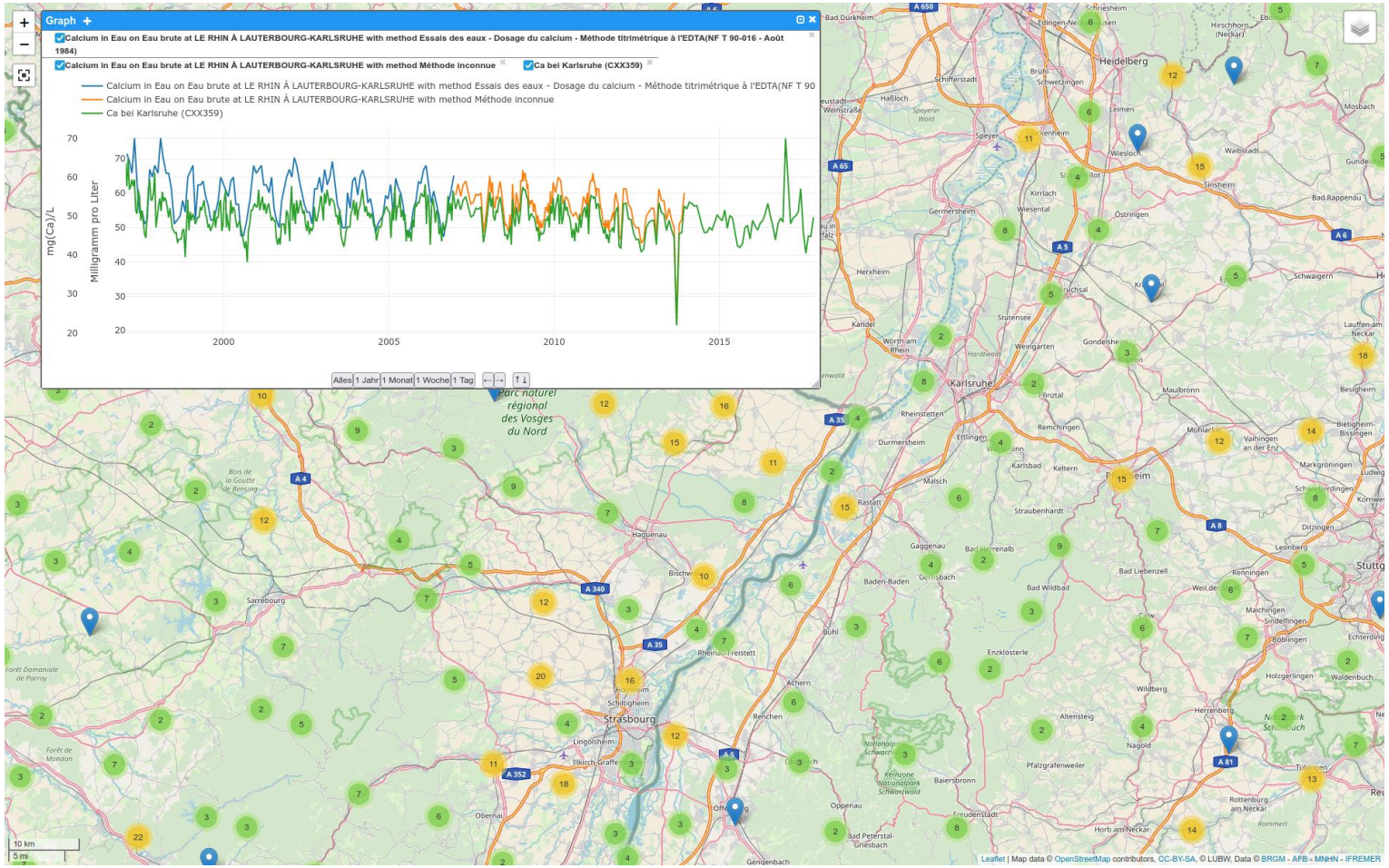
BRGM : raw *in-situ* groundwater quantity & quality



USGS : *in-situ*, groundwater quantity

Water4All, Water Quality IE: FAIR Water Data Practices

It works

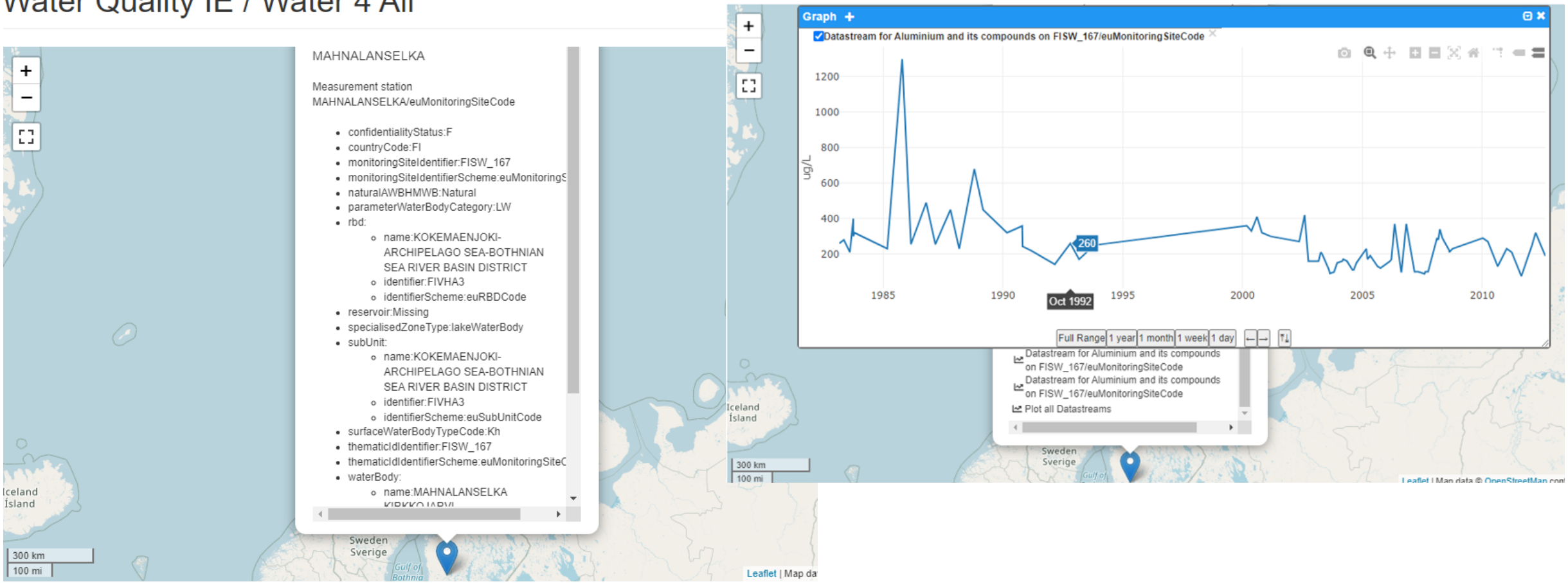


Surface water quality, *ex-situ*,
France - Germany

Water4All, Water Quality IE: FAIR Water Data Practices

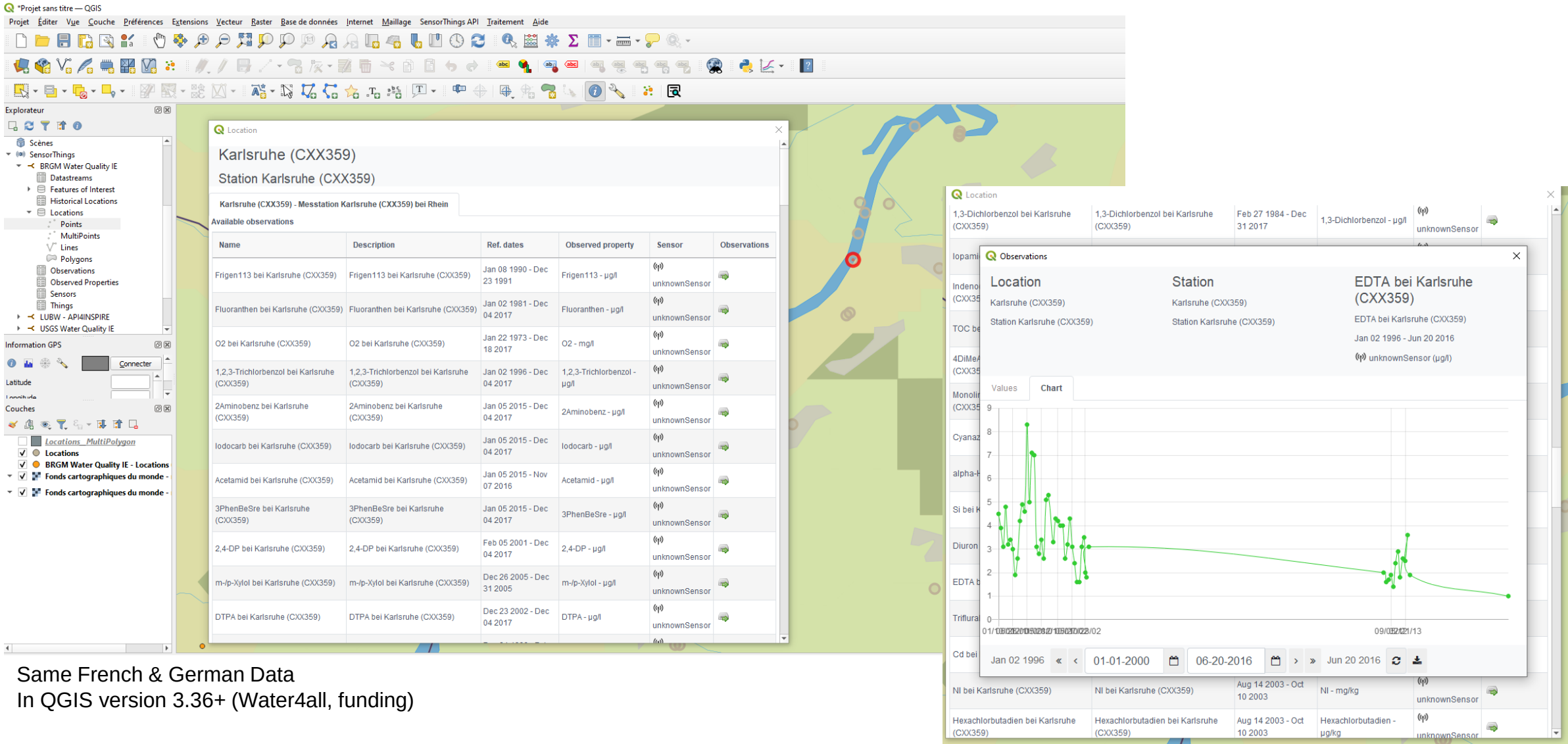
It works

Water Quality IE / Water 4 All



Water4All, Water Quality IE: FAIR Water Data Practices

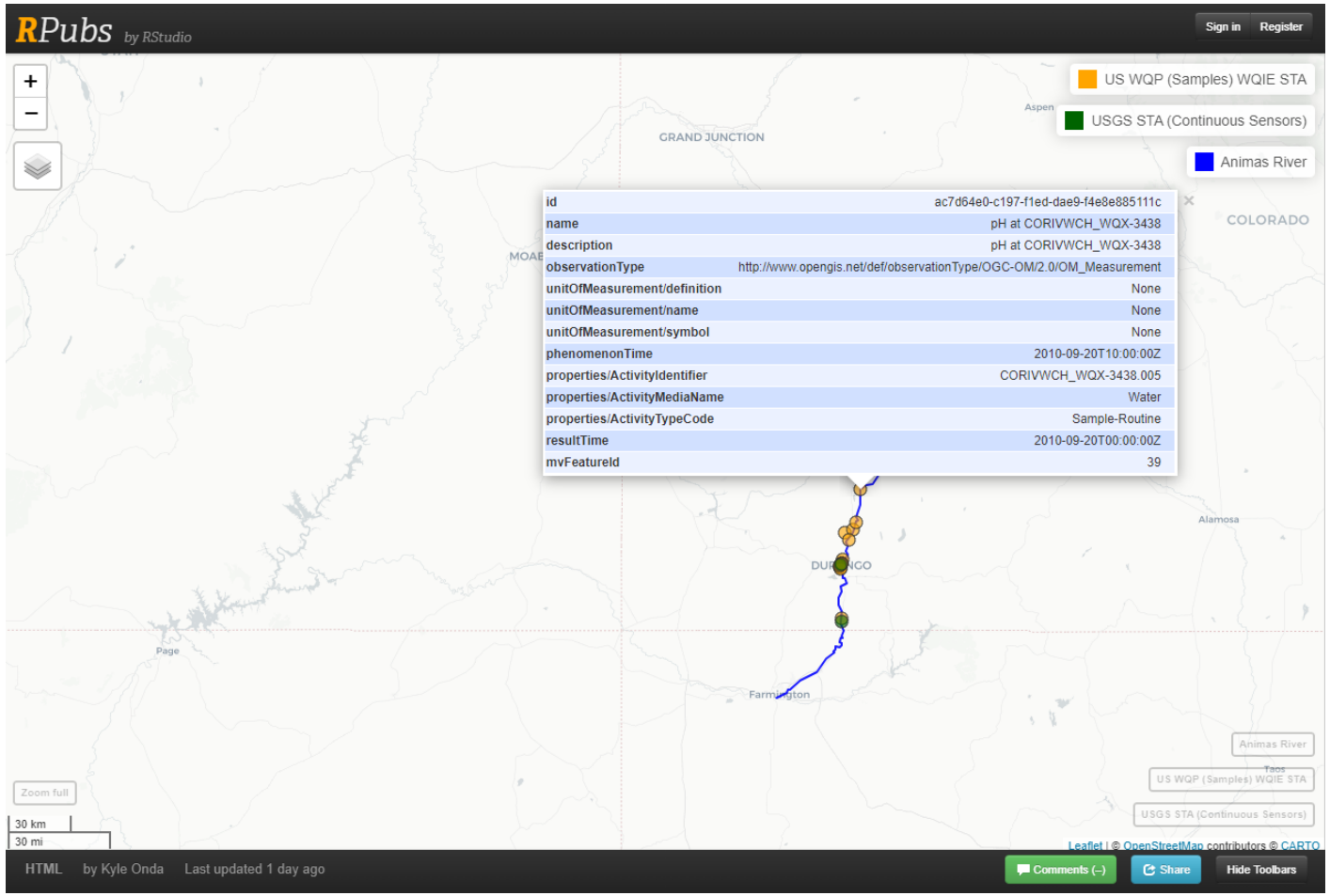
It works – also in desktop tools like QGIS



Same French & German Data
In QGIS version 3.36+ (Water4all, funding)

Water4All, Water Quality IE: FAIR Water Data Practices

It works – also ingesting this data in R



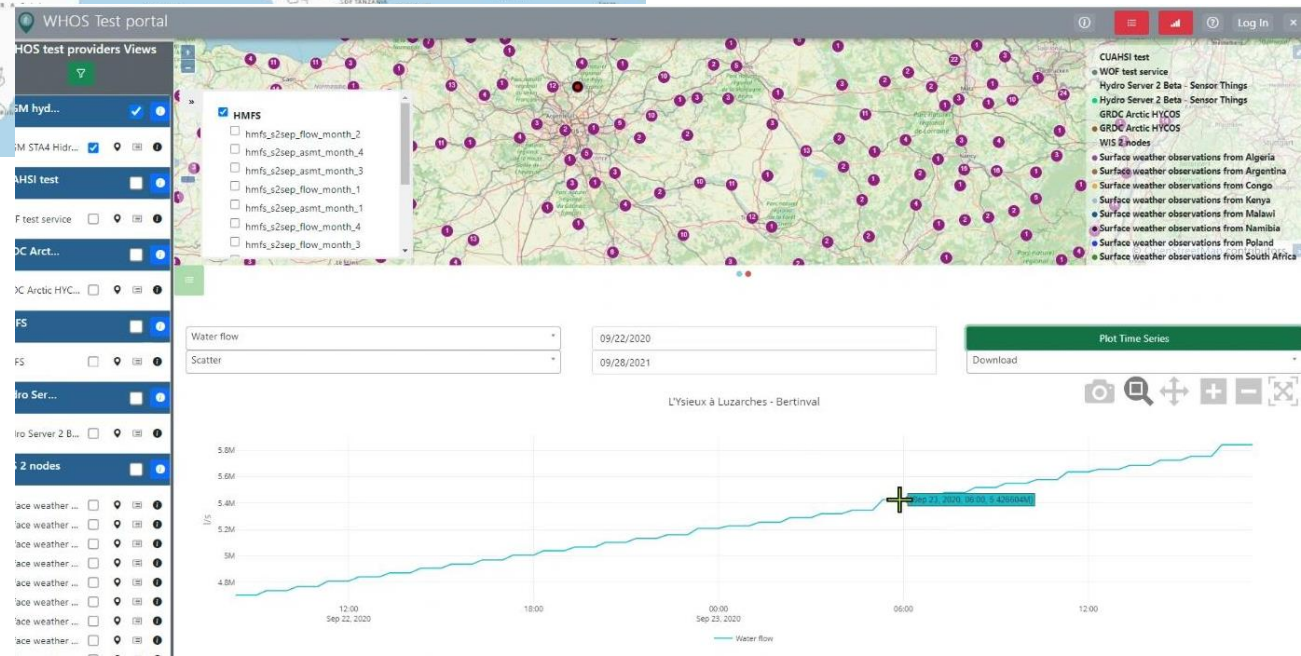
USGS Water Quality Portal data + continuous sensor (ex: pH)

Water4All, Water Quality IE: FAIR Water Data Practices

It works – also connecting with institution systems (ex : World Meteorological Organisation)

Being based on a **standard communication protocol**, it was very easy to test and integrate to WHOS in the way to the workshop!

Description of the service and some suggestions are reported after preliminary integration tests in the next slides, with the **aim of further improving the connection** to WHOS.

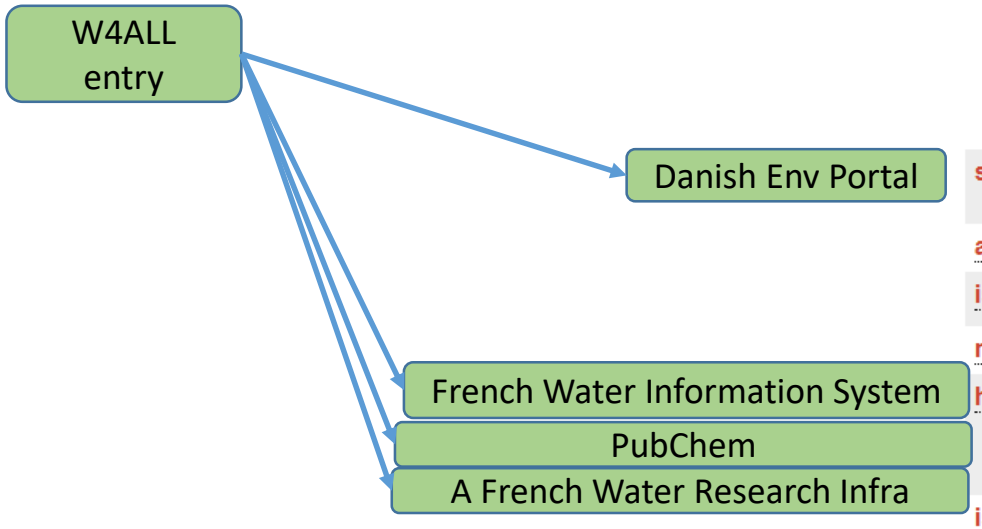


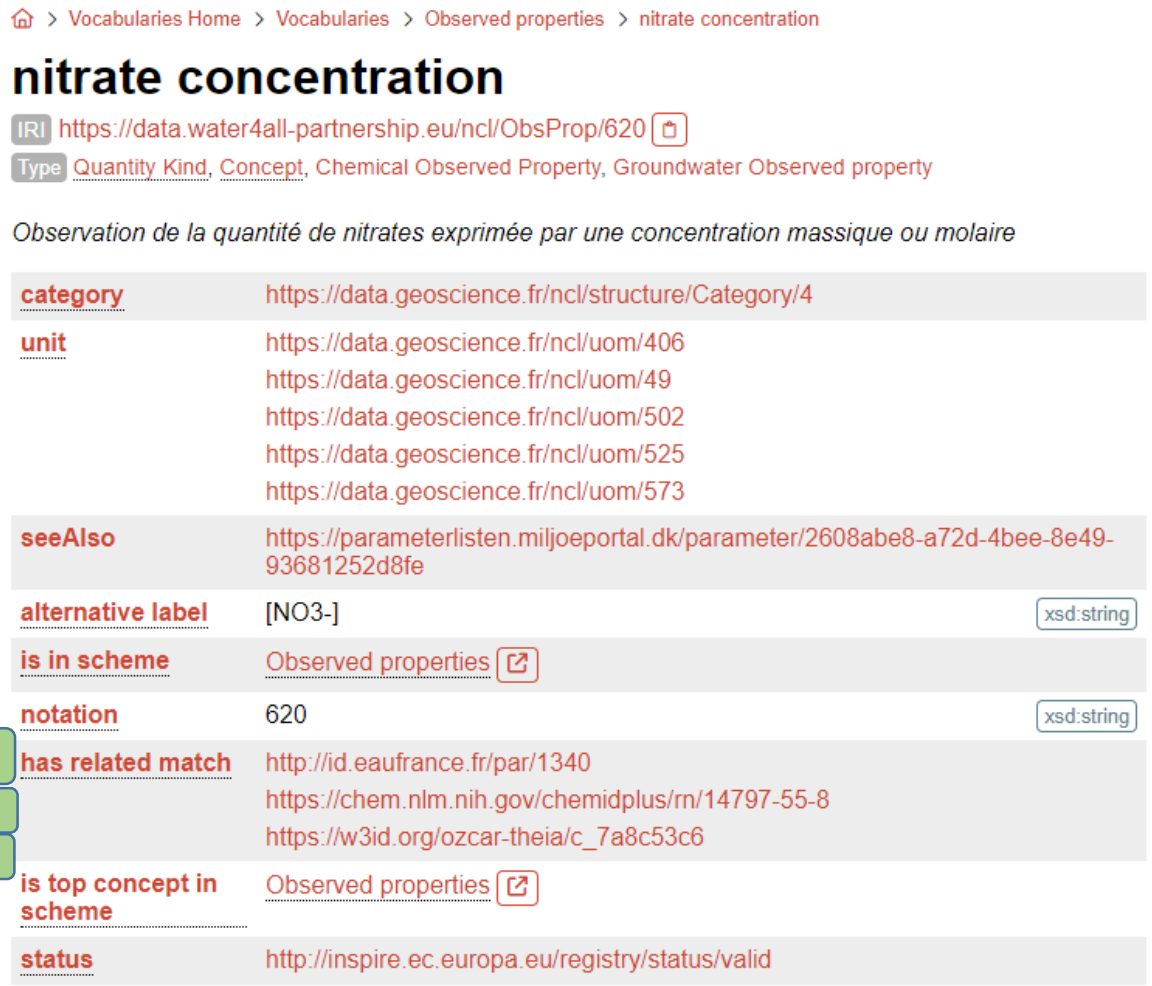
Surface water quantity – France data ingested in WMO Hydrological Observing System (WHOS)

Shaping an integrated groundwater and surface water information platform

Other Water4All components

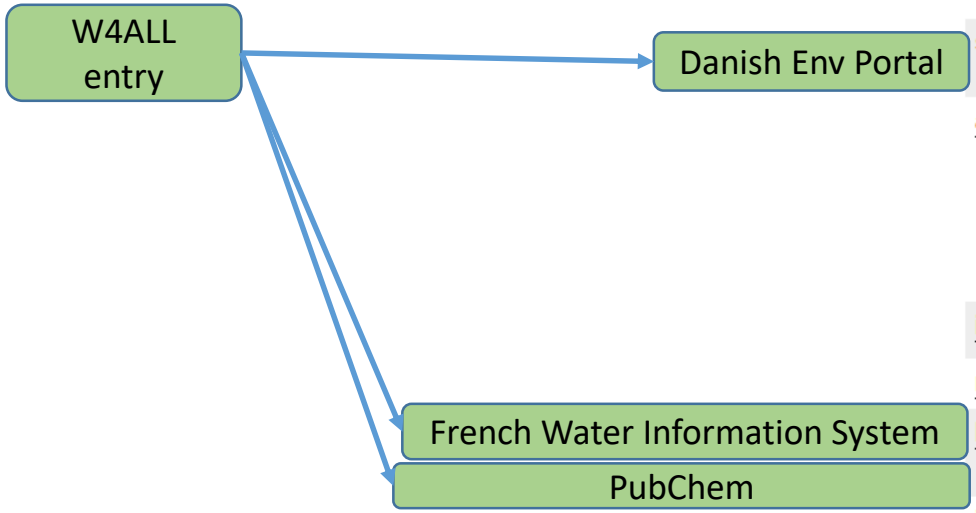
Shared vocabularies





Other Water4All components

Shared vocabularies



Vocabularies Home > Vocabularies > Observed properties > 4,4'-DDT concentration

4,4'-DDT concentration

IRI https://data.water4all-partnership.eu/ncl/ObsProp/621

Type Quantity Kind, Concept, Chemical Observed Property, Groundwater Observed property

Observation de la quantité de 4,4'-DDT exprimée par une concentration massique ou molaire

category	https://data.geoscience.fr/ncl/structure/Category/4	
unit	https://data.geoscience.fr/ncl/uom/502 https://data.geoscience.fr/ncl/uom/573	
seeAlso	https://parameterlisten.miljoeportal.dk/parameter/3283527d-830b-401b-8267-2e241e928150	
alternative label	[4,4'-DDT] Clofenotane concentration Dicophane concentration concentration en dichloro diphenyl trichloroétane pp' concentration en pp'DDT	xsd:string en en fr fr
is in scheme	Observed properties	
notation	621	xsd:string
has related match	http://id.eaufrance.fr/par/1148 https://chem.nlm.nih.gov/chemidplus/rn/50-29-3	
is top concept in scheme	Observed properties	
status	http://inspire.ec.europa.eu/registry/status/valid	

Alternate Profiles

View alternate views & formats

VocPub current

RDF/XML Turtle JSON-LD

Alternates Profile

text/anot+turtle RDF/XML Turtle

JSON-LD

Other Water4All information platform components

FAIR water data specification

To support FAIR Water Data Practices standardization work, share specification and guide providers/users
Next steps : stabilize Interoperability Experiments findings in standards, provide support to more new comers

Open-source tools for the community

To lower the entry ticket for both the data provision and client sides
Next steps :

- Data Provision : stabilize in standard the proposed version, continue joint effort with WMO
- Client : continue momentum, more mature & simple clients, add Virtual Research Environment component

Metadata catalogue & repository

To support discovery of datasets and corresponding services
Next steps : enrich as other partners join the effort

LinkedData Resolver

To foster data discovery and enable Linking data
Next steps : resolve to more resources

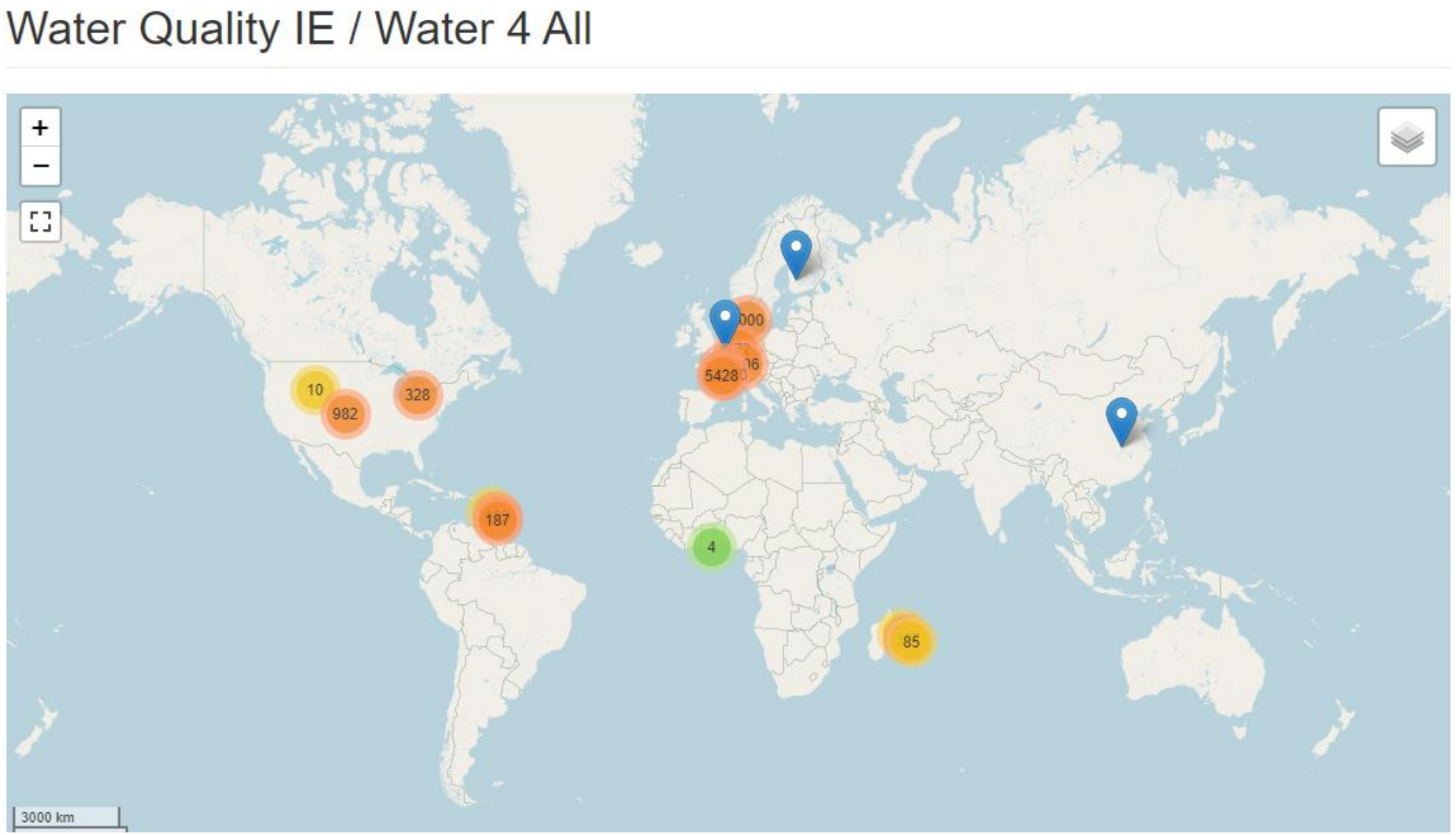
Water data FAIRifier

To help those not having the capacity/knowledge to share data directly according to FAIR Water Data Practices
Next steps : more testers for a more robust solution

Water4All information platform entry point

Information platform GUI

Graphical User Interface: visible tip of the iceberg (*most of the screenshots from this presentation come from here*)
Next steps : enhance prototype, test Virtual Research Infrastructure component



Water4All information platform – next Use Cases

1°/ Surface Water (SW) Quantity Observation

2°/ SW Quality Observation

- *2a Direct in-situ sensor (ex: Temp, conductivity)*
- *2b. Ex-situ observation (involving samples from Lab)*
- 2c Biodiversity observation

3°/ Ground Water (GW) Quantity Observation

4°/ GW Quality Observation

- *4a Direct in-situ sensor (ex: Temp, conductivity)*
- *4b. Ex-situ observation (involving samples from Lab)*

5°/ Sharing reference datasets (river, lakes, aquifers, …)

6°/ Water level forecast : Surface, Ground

7°/ Water abstraction

8°/ Industrial emission

9°/ Waster water discharge

10°/ …

We focused on those

Now

- moving to the others
- while making the other more mature (TRL)

Conclusion

Water4all approach

Setting up international FAIR water data practices

that fulfill community needs

Support open-source solutions

in implementing those practices

Deploy those solutions within the community

Water4all approach towards a virtuous cycle

Setting up international FAIR water data practices

that fulfill community needs

Support open-source solutions

in implementing those practices

Deploy those solutions within the community

Thank you

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