Architettura federata di dati osservati e simulati in idrologia

Silvano Pecora

Servizio Idrologico

ARPAE Emilia-Romagna

Tavolo Nazionale di Idrologia Operativa

Ispra | Roma| 21 Febbraio 2019

ISPRA
Istituto Superiore per la Protezione e la Ricerca Ambientale

WHOS
WMO Hydrological Observing System

WMO

Home | Services | Tools | About

ISPRA HIS Sistema informativo idrologico servizio registri Web

Il monitoraggio idrologico italiano viene effettuato mediante una rete federata composta da 19 regioni amministrative e 2 province autonome, insieme con ISPRA, che è l'organo tecnico governativo istituito dal Ministero dell'Ambiente italiano.

Il portale fornisce l'accesso alle osservazioni idrologiche in Italia, comunemente pubblicate come Annali idrologici. In particolare, per le osservazioni in situ, fornisce ulteriori capacità operative, quali un registro nazionale di servizio dati, catalogati utilizzando le norme e le procedure della Geospatial Consortium e l'Organizzazione meteorologica mondiale.

Le interfacce pubblicate sul portale permettono di recuperare i dati idrologici regionali direttamente dai fornitori tramite abilitazione e download.

WEB SERVICE CATALOG SYSTEM

- Brokered services: 19
- Brokered sites: 6088
- Brokered variables: 6
- Brokered values: 73491569
- Geographic extent: [6.704337, 18.48, 35.5017, 47.03659]

http://www.hiscentral.isprambiente.gov.it

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Brokered services

Data Service Title	Observation Network Name	WSDL	CreatedDate	Organization	Status	Earliest Start Date	Latest End Date
Provincia Autonoma di Bolzano	Provincia di Bolzano	WSDL	2013.09.04	Provincia Autonoma di Bolzano - Ripartizione Protezione anticendi e civile - Ufficio Idrografico		1920.01.01	1999.01.01
Regione Abruzzo	Regione Abruzzo	WSDL	2013.09.04	Dipartimento Opere Pubbliche, Governo del Territorio e Politiche Ambientali, Servizio Emergenza di Protezione Civile, Ufficio Idrografico Mareografico (PE), Gestione Colonna Mobile		1921.01.01	2014.11.30
Regione Basilicata	Regione Basilicata	WSDL	2013.09.04	Protezione Civile Regione Basilicata		2001.01.01	2014.11.29
Regione Calabria	Regione Calabria	WSDL	2013.09.04	ARPACAL - Centro Funzionale Multirischi		1900.01.01	2014.10.31
Regione Campania	Regione Campania	WSDL	2013.09.04	Centro Funzionale Regione Campania - CEMPID		1995.01.01	2014.12.31
Regione Emilia Romagna	Regione Emilia Romagna	WSDL	2013.02.28	ARPA Emilia Romagna		1918.01.01	2014.12.31
Regione Friuli Venezia Giulia	Regione Friuli Venezia Giulia	WSDL	2013.09.04	Regione Autonoma Friuli Venezia Giulia		1912.01.01	2012.12.31
Regione Lazio	Regione Lazio	WSDL	2013.09.04	Regione Lazio - Centro Funzionale Regionale		1921.01.01	2004.12.31
Regione Liguria	Regione Liguria	WSDL	2013.09.04	ARPA Liguria - Centro Funzionale Meteo Idrologico di Protezione Civile		1913.01.01	2009.12.31
Regione Lombardia	Regione Lombardia	WSDL	2013.09.04	U.O. Servizio Meteorologico e Rete Idro-Meteo regionale		1763.01.01	2014.11.25
Regione Marche	Regione Marche	WSDL	2013.09.04	Dipartimento per le politiche integrate di sicurezza e per la protezione civile della Regione Marche - Centro Funzionale		1928.01.30	2013.12.31
Regione Molise	Regione Molise	WSDL	2013.09.04	Agenzia Regionale di Protezione Civile - Centro Funzionale del Molise		2007.01.01	2014.12.31
Regione Piemonte	Regione Piemonte	WSDL	2013.09.04	Arpa Piemonte - Agenzia Regionale per la Protezione Ambientale del Piemonte - Dipartimento Sistemi Previsionali		1987.09.25	2013.12.31
Regione Puglia	Regione Puglia	WSDL	2013.09.04	Centro Funzionale - Servizio Protezione Civile		2004.01.01	2004.12.31
Regione Sardegna	Regione Sardegna	WSDL	2013.09.04	ARDIS - Servizio Tutela e Gestione delle Risorse Idriche, vigilanza sui servizi idrici e gestione delle siccità		1920.01.01	2008.12.31
Regione Sicilia	Regione Sicilia	WSDL	2013.09.04	Regione Siciliana - Osservatorio delle Acque		1916.01.01	2008.12.31
Regione Toscana	Regione Toscana	WSDL	2013.09.04	Servizio Idrologico - Centro Funzionale		1916.01.01	2015.03.31
Regione Valle d'Aosta	Regione Valle d'Aosta	WSDL	2013.09.04	Assessorato opere pubbliche, difesa del suolo e edilizia residenziale pubblica - Centro funzionale regionale		1994.12.31	2013.12.31
Regione Veneto	Regione Veneto	WSDL	2013.09.04	Agenzia Regionale per la Prevenzione e Protezione Ambientale del Veneto		1992.01.01	2013.12.31

Regione Emilia Romagna

ARPA Emilia Romagna

Regione Emilia Romagna
WaterML Service
WFS Service
Silvano Pecora
Contact: specora@arpa.emr.it

Service Statistics:

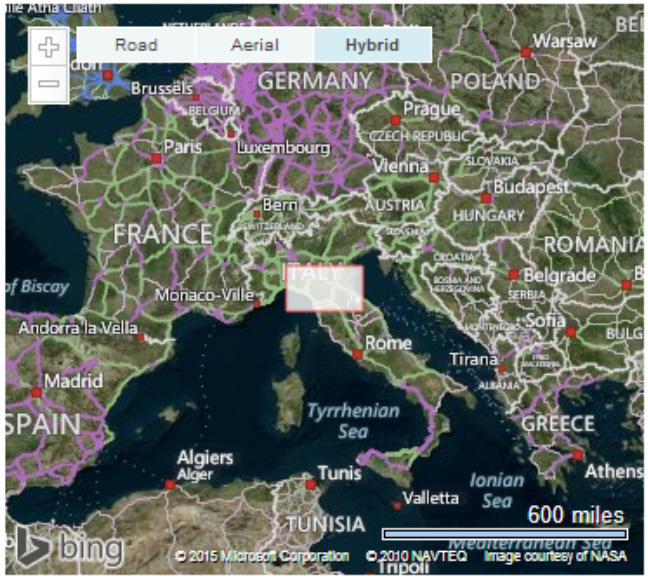
Sites: 717
Variables: 6
Values: 6618109

Geographic Extent:
45.1443
8.8493 12.73278
43.51029

Last Harvested on 7/1/2015 12:50:49 PM
(updated weekly, assumed static)

Abstract

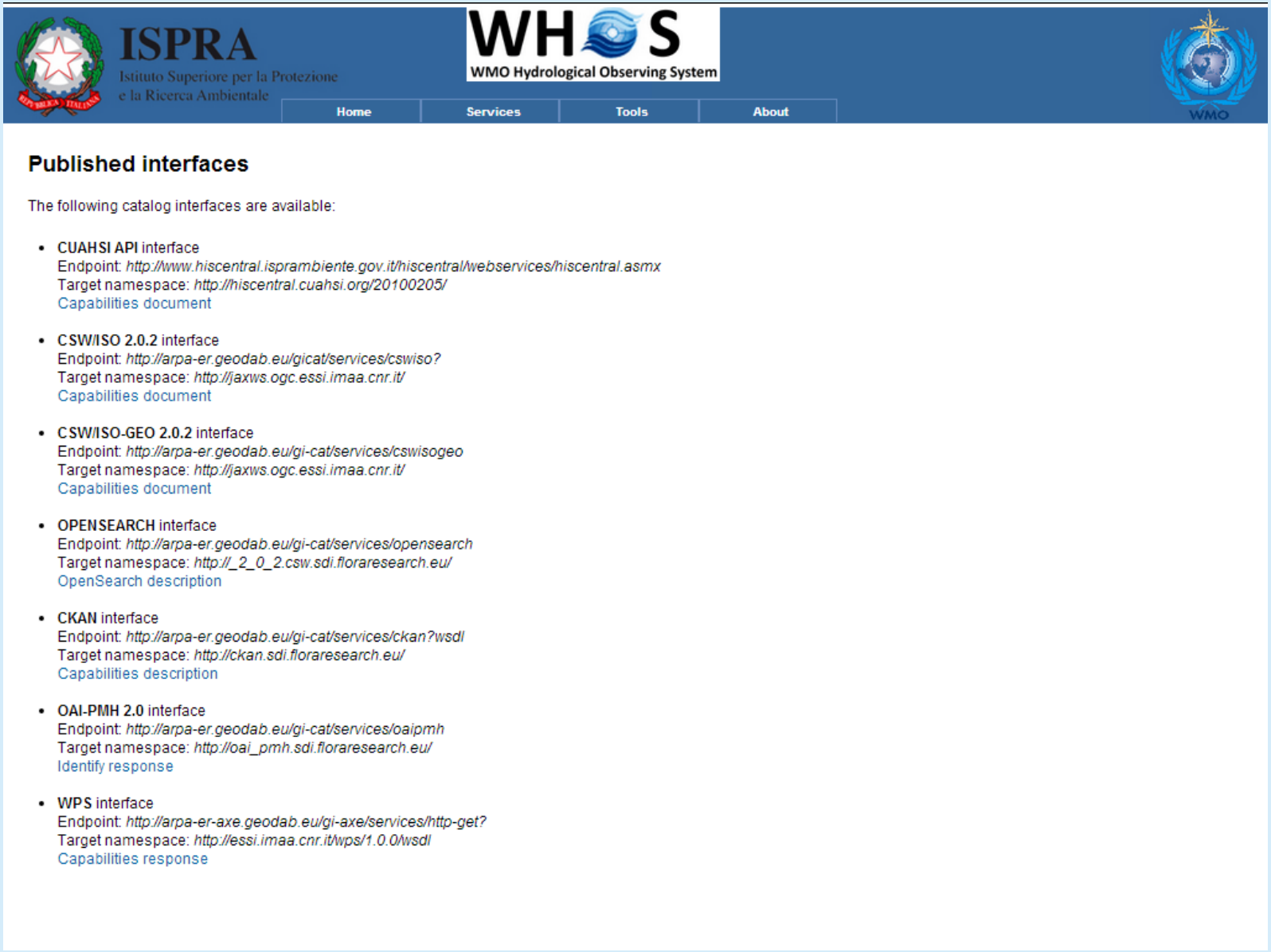
ARPA SIMC, Servizio Idro-Meteo-Clima dell''Agenzia Regionale Prevenzione e Ambiente Emilia-Romagna, svolge attività osservative e previsionali operative e di ricerca e sviluppo, in meteorologia, climatologia, idrologia, agrometeorologia, radarmeteorologia e meteorologia ambientale.



Citation

I dati si riferiscono alle stazioni di monitoraggio selezionate per la pubblicazione degli Annali Idrologici.

I servizi web di catalogo



Published interfaces

The following catalog interfaces are available:

- **CUAHSI API** interface
  Endpoint: *http://www.hiscentral.isprambiente.gov.it/hiscentral/webservices/hiscentral.asmx*
  Target namespace: *http://hiscentral.cuahsi.org/20100205/*
  Capabilities document

- **CSW/ISO 2.0.2** interface
  Endpoint: *http://arpa-er.geodab.eu/gicat/services/cswiso?*
  Target namespace: *http://jaxws.ogc.essi.imaa.cnr.it/*
  Capabilities document

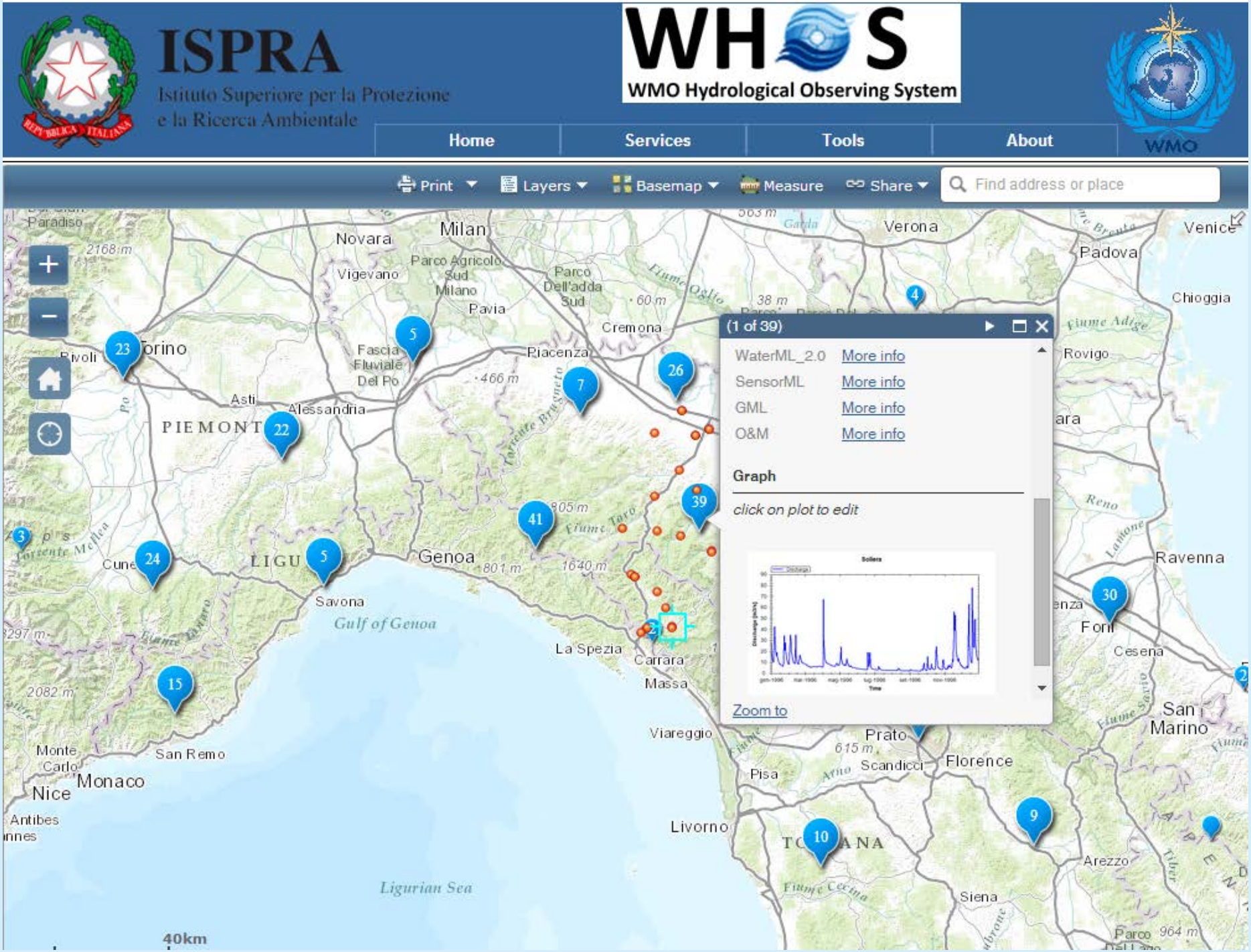
- **CSW/ISO-GEO 2.0.2** interface
  Endpoint: *http://arpa-er.geodab.eu/gi-cat/services/cswisogeo*
  Target namespace: *http://jaxws.ogc.essi.imaa.cnr.it/*
  Capabilities document

- **OPENSEARCH** interface
  Endpoint: *http://arpa-er.geodab.eu/gi-cat/services/opensearch*
  Target namespace: *http://_2_0_2.csw.sdi.floraresearch.eu/*
  OpenSearch description

- **CKAN** interface
  Endpoint: *http://arpa-er.geodab.eu/gi-cat/services/ckan?wsdl*
  Target namespace: *http://ckan.sdi.floraresearch.eu/*
  Capabilities description

- **OAI-PMH 2.0** interface
  Endpoint: *http://arpa-er.geodab.eu/gi-cat/services/oaipmh*
  Target namespace: *http://oai_pmh.sdi.floraresearch.eu/*
  Identify response

- **WPS** interface
  Endpoint: *http://arpa-er-axe.geodab.eu/gi-axe/services/http-get?*
  Target namespace: *http://essi.imaa.cnr.it/wps/1.0.0/wsdl*
  Capabilities response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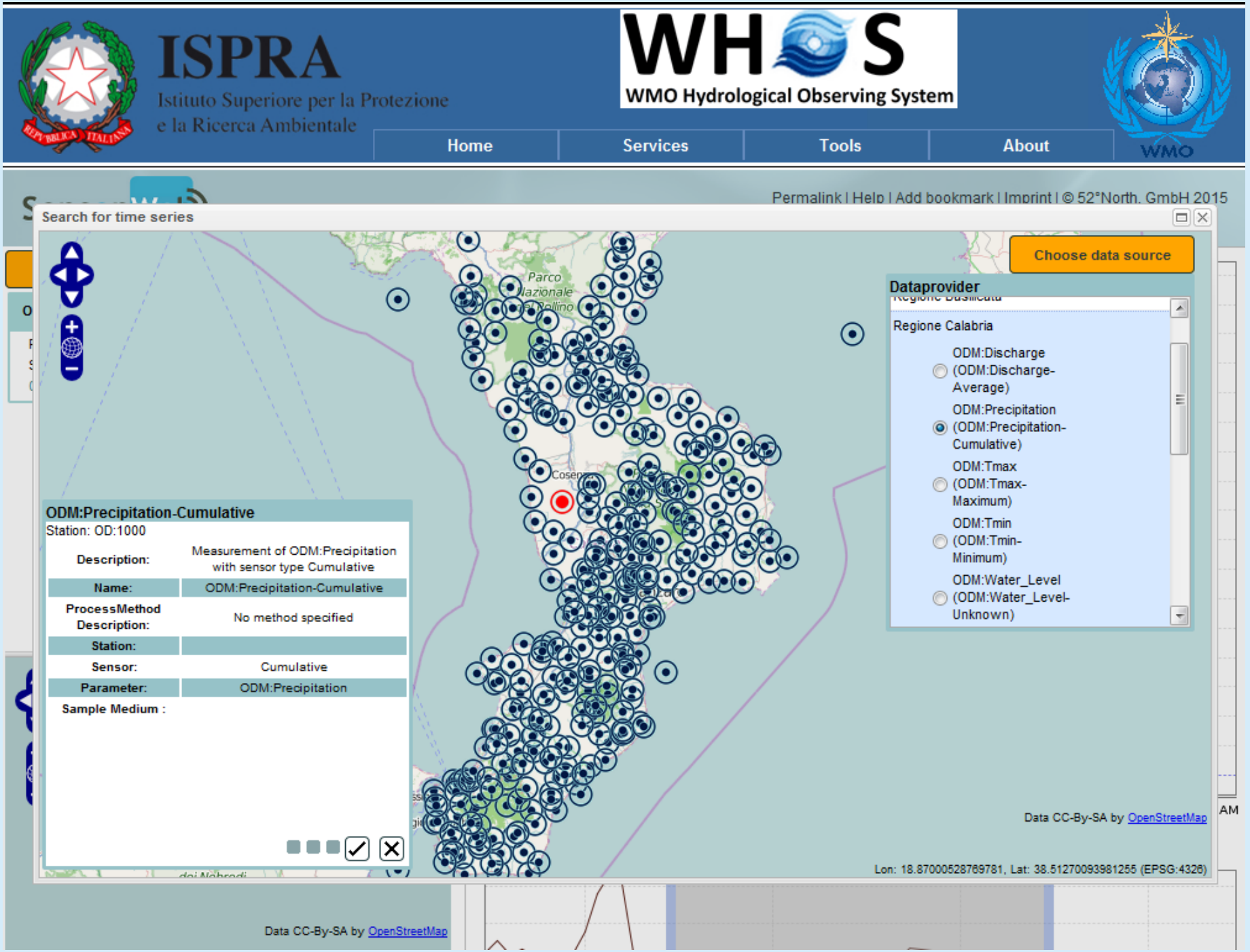
WHOS
WMO Hydrological Observing System
WMO
Home
Services
Tools
About
Print
Layers
Basemap
Measure
Share
Find address or place
(1 of 39)
WaterML_2.0 More info
SensorML More info
GML More info
O&M More info
Graph
click on plot to edit
Zoom to
Milan
Novara
Verona
Venice
Padova
Chioggia
Torino
Cremona
Piacenza
Asti
Alessandria
PIEMONTE
LIGURIA
Genoa
Savona
Gulf of Genoa
La Spezia
Carrara
Massa
Viareggio
Prato
Florence
Pisa
Livorno
Ravenna
Forlì
Cesena
San Marino
Arezzo
Siena
San Remo
Monaco
Nice
Ligurian Sea
40km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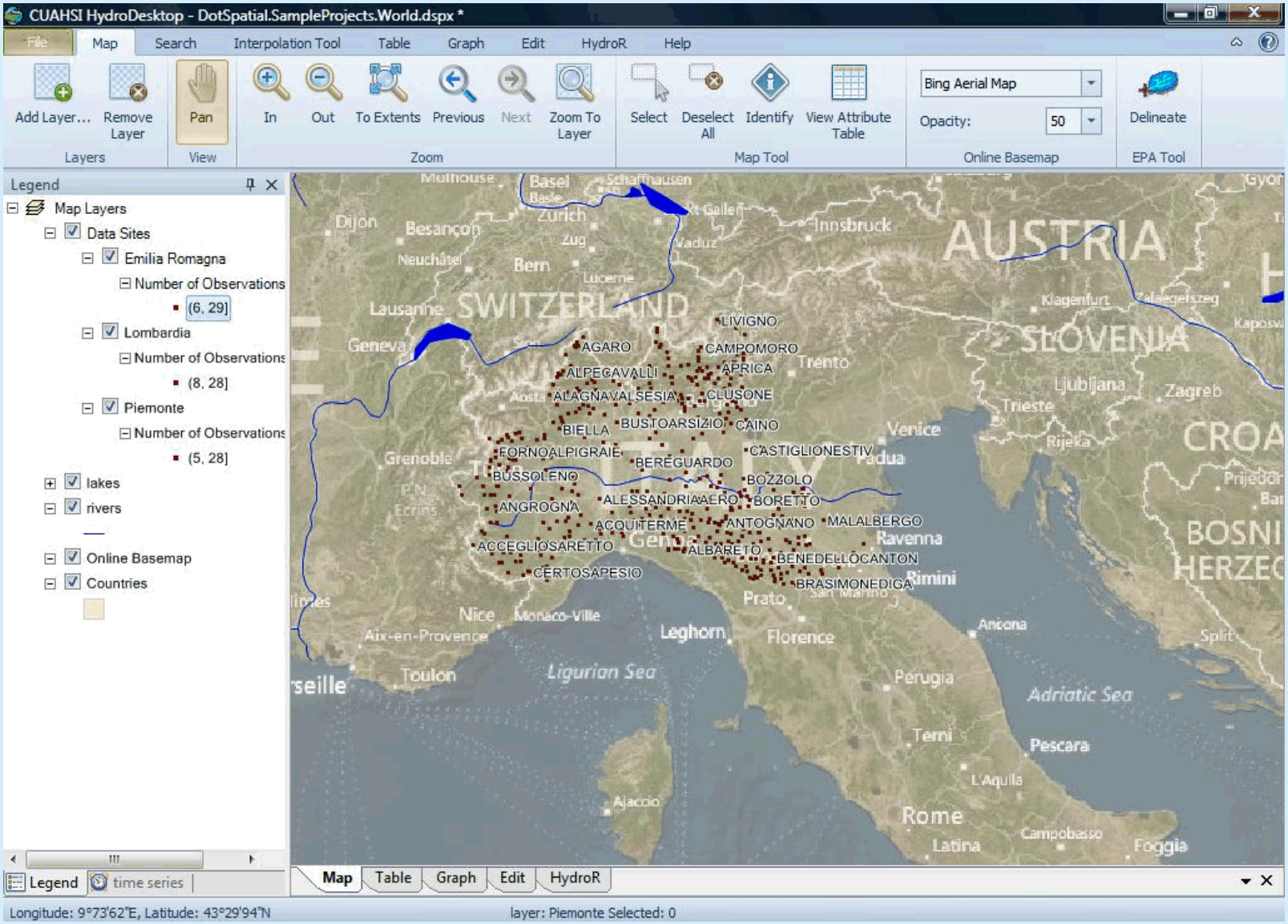
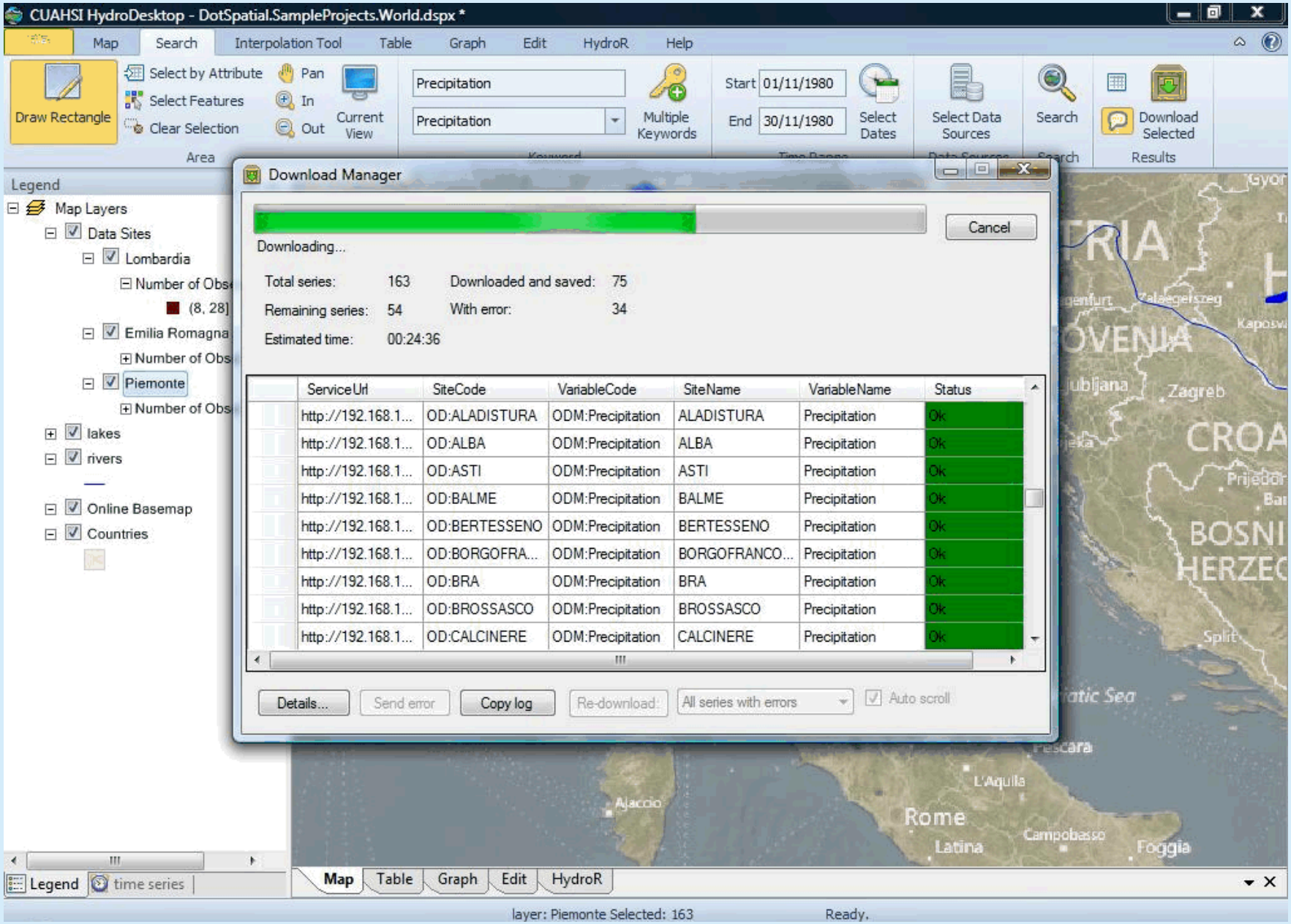
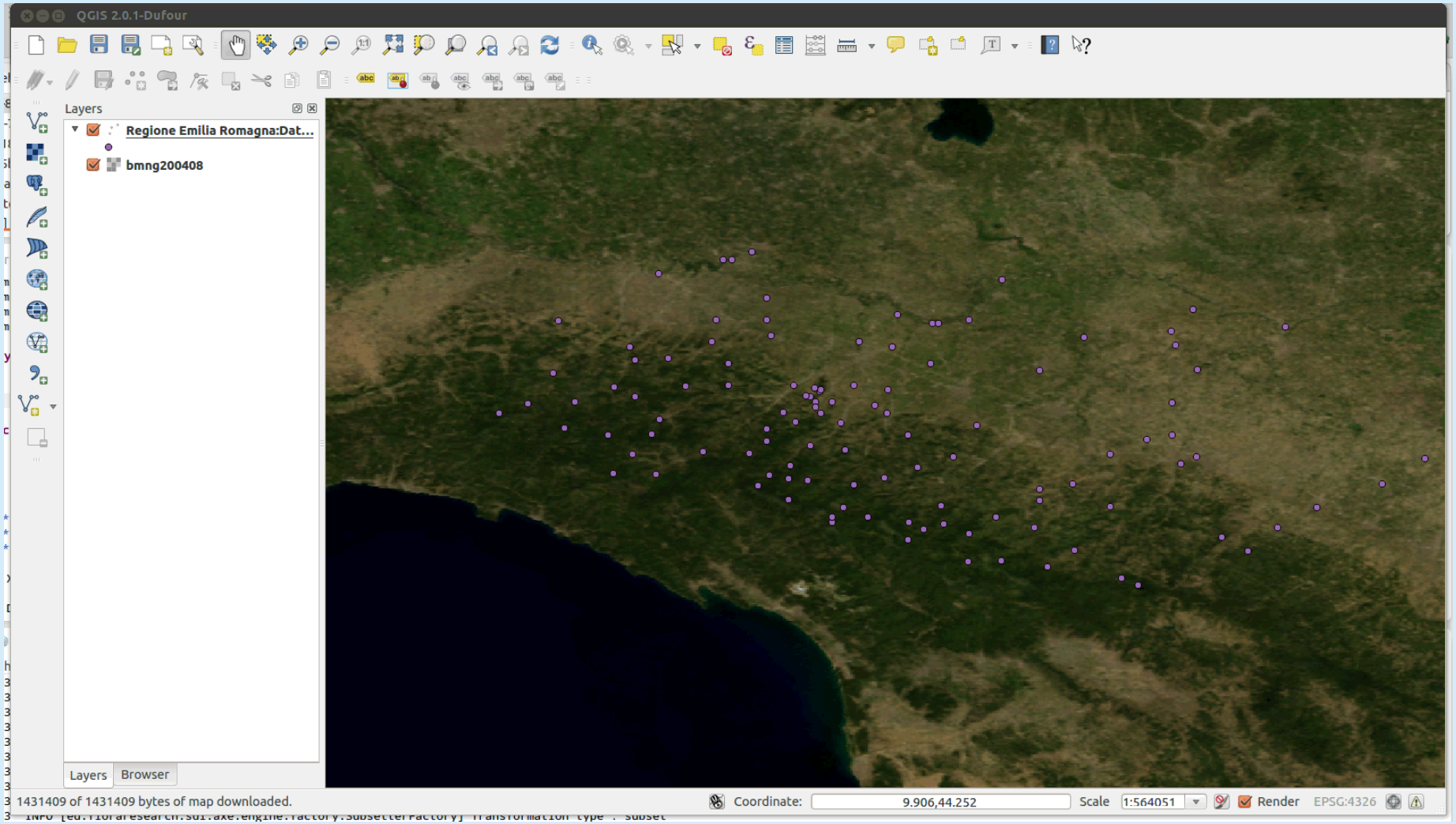
e la Ricerca Ambientale
WHOS
WMO Hydrological Observing System
WMO
Home
Services
Tools
About
Permalink | Help | Add bookmark | Imprint | © 52°North, GmbH 2015
Search for time series
Choose data source
Dataprovider
Regione Calabria
ODM:Discharge (ODM:Discharge-Average)
ODM:Precipitation (ODM:Precipitation-Cumulative)
ODM:Tmax (ODM:Tmax-Maximum)
ODM:Tmin (ODM:Tmin-Minimum)
ODM:Water_Level (ODM:Water_Level-Unknown)
ODM:Precipitation-Cumulative
Station: OD:1000
Description: Measurement of ODM:Precipitation with sensor type Cumulative
Name: ODM:Precipitation-Cumulative
ProcessMethod Description: No method specified
Station:
Sensor: Cumulative
Parameter: ODM:Precipitation
Sample Medium :
Data CC-By-SA by OpenStreetMap
Lon: 18.87000528769781, Lat: 38.51270093981255 (EPSG:4326)
Data CC-By-SA by OpenStreetMap

HYDRODESKTOP e HIS tramite CUAHSI API

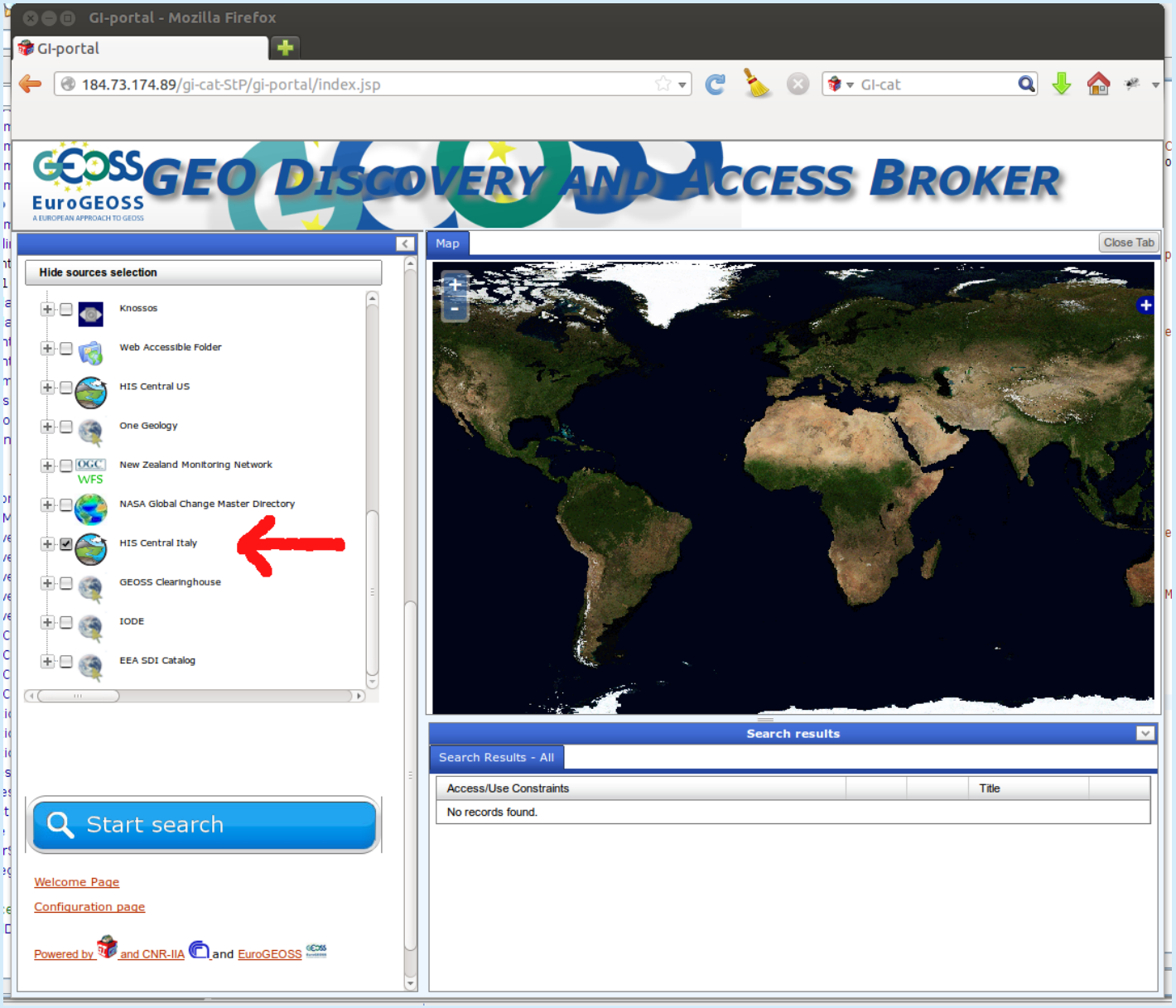



CUAHSI HydroDesktop - DotSpatial.SampleProjects.World.dspx *
Map
Search
Interpolation Tool
Table
Graph
Edit
HydroR
Help
Draw Rectangle
Select by Attribute
Select Features
Clear Selection
Pan
In
Out
Current View
Area
Precipitation
Precipitation
Multiple Keywords
Start 01/11/1980
End 30/11/1980
Select Dates
Select Data Sources
Search
Download Selected
Results
Legend
Map Layers
Data Sites
Lombardia
Number of Obs
(8, 28]
Emilia Romagna
Number of Obs
Piemonte
Number of Obs
lakes
rivers
Online Basemap
Countries
Download Manager
Downloading...
Cancel
Total series: 163
Downloaded and saved: 75
Remaining series: 54
With error: 34
Estimated time: 00:24:36
ServiceUrl
SiteCode
VariableCode
SiteName
VariableName
Status
http://192.168.1... OD:ALADISTURA ODM:Precipitation ALADISTURA Precipitation Ok
http://192.168.1... OD:ALBA ODM:Precipitation ALBA Precipitation Ok
http://192.168.1... OD:ASTI ODM:Precipitation ASTI Precipitation Ok
http://192.168.1... OD:BALME ODM:Precipitation BALME Precipitation Ok
http://192.168.1... OD:BERTESSENO ODM:Precipitation BERTESSENO Precipitation Ok
http://192.168.1... OD:BORGOFRA... ODM:Precipitation BORGOFRANCO... Precipitation Ok
http://192.168.1... OD:BRA ODM:Precipitation BRA Precipitation Ok
http://192.168.1... OD:BROSSASCO ODM:Precipitation BROSSASCO Precipitation Ok
http://192.168.1... OD:CALCINERE ODM:Precipitation CALCINERE Precipitation Ok
Details...
Send error
Copy log
Re-download:
All series with errors
Auto scroll
Ljubljana
Zagreb
Split
Pescara
L'Aquila
Rome
Latina
Campobasso
Foggia
Ajaccio
Legend
time series
Map
Table
Graph
Edit
HydroR
layer: Piemonte Selected: 163
Ready.

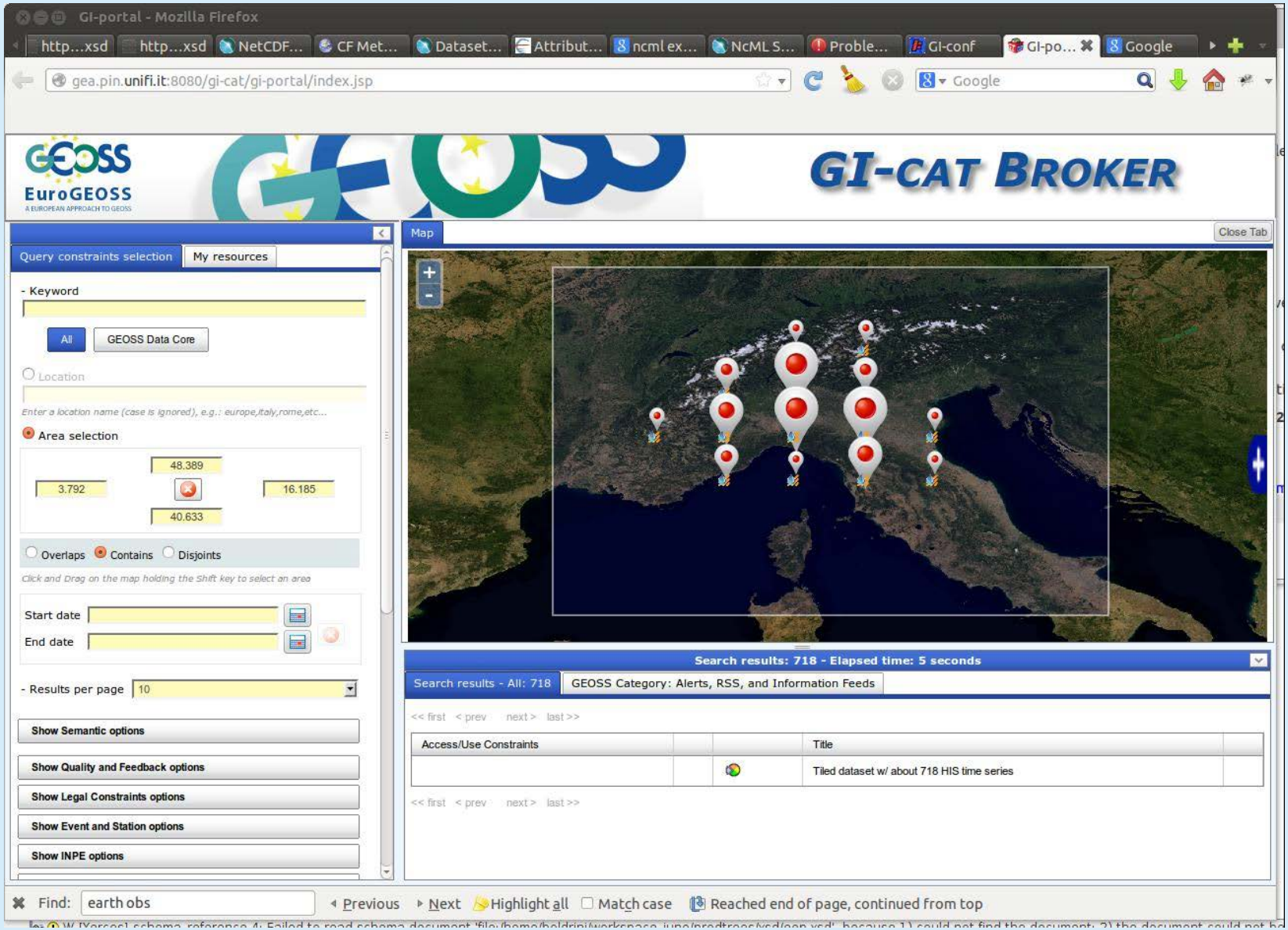
QGIS e HIS tramite WFS



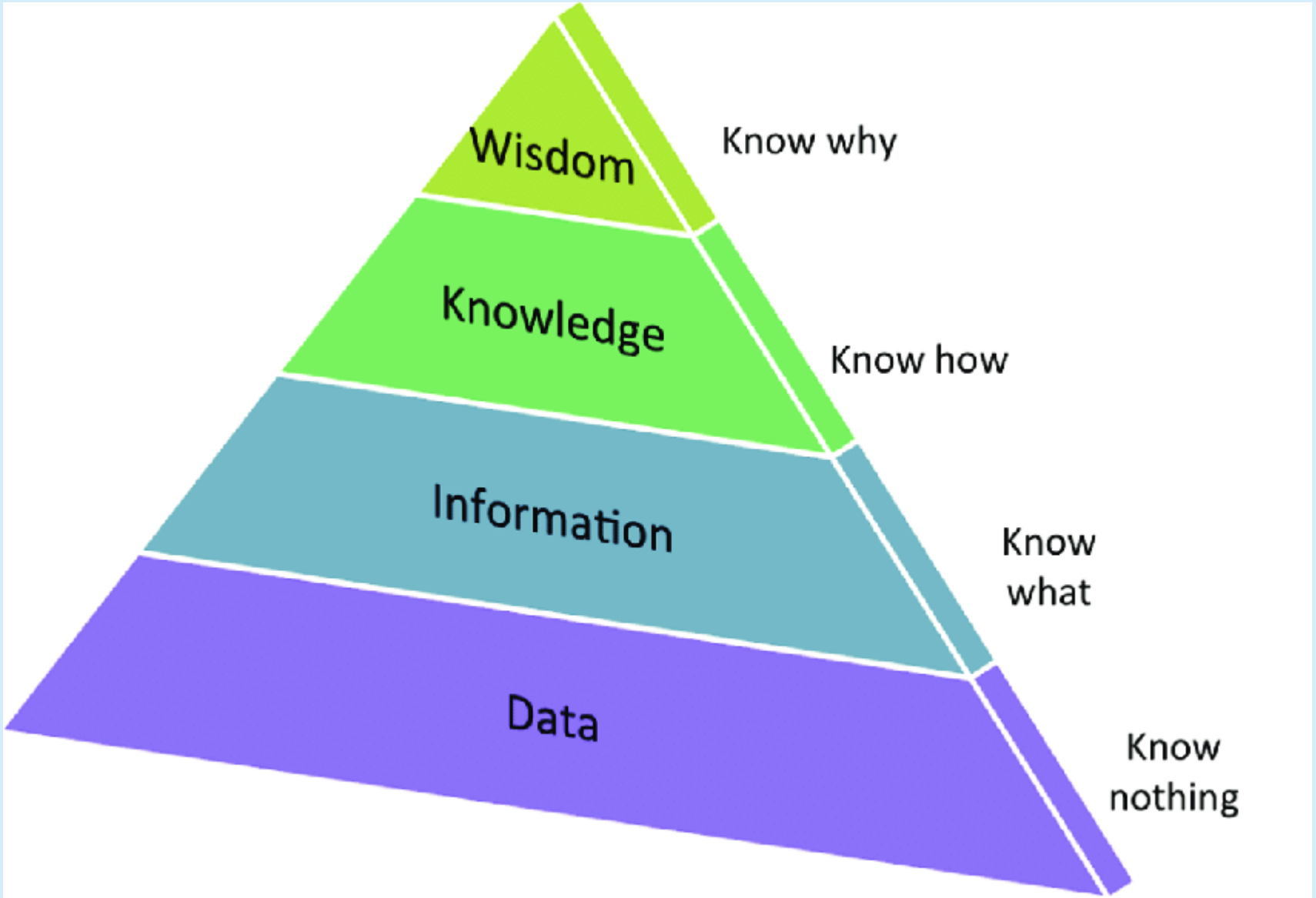
GEOSS e HIS


GI-portal - Mozilla Firefox
GI-portal
184.73.174.89/gi-cat-StP/gi-portal/index.jsp
GI-cat
GEOSS
EuroGEOSS
A EUROPEAN APPROACH TO GEOSS
GEO DISCOVERY AND ACCESS BROKER
Hide sources selection
Knossos
Web Accessible Folder
HIS Central US
One Geology
New Zealand Monitoring Network
OGC WFS
NASA Global Change Master Directory
HIS Central Italy
GEOSS Clearinghouse
IODE
EEA SDI Catalog
Start search
Welcome Page
Configuration page
Powered by and CNR-IIA and EuroGEOSS
Map
Close Tab
Search results
Search Results - All
Access/Use Constraints
Title
No records found.

GI-PORTAL e HIS tramite WPS



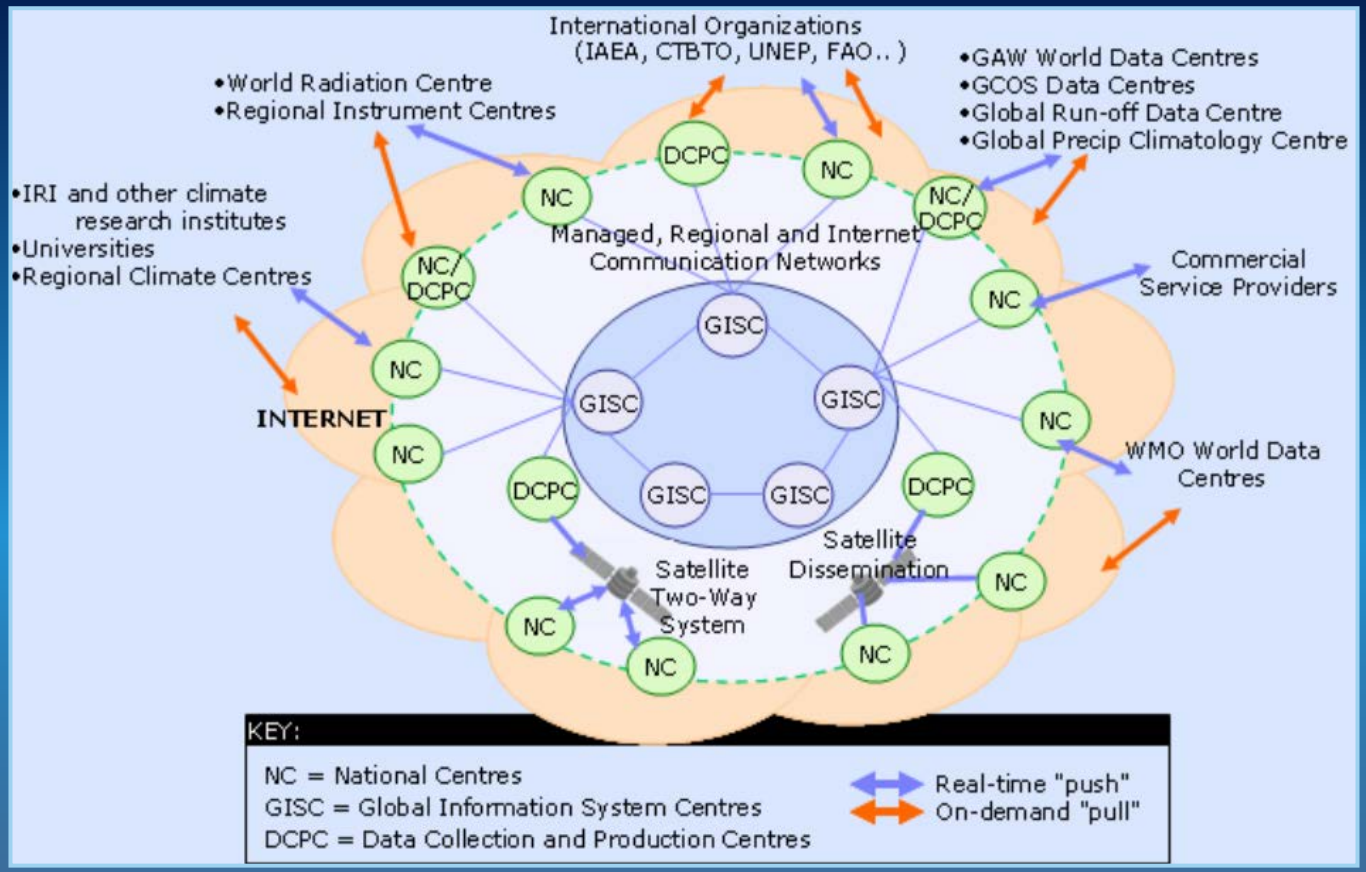
Modello di crescita conoscitiva



Compiled based on Ackoff, R. L. (1989). From data to wisdom. *Journal of Applied Systems Analysis*, *16*(1), 3-9. and Zeleny, M. (1987). Management support systems: towards integrated knowledge management. *Human Systems Management*, *7*(1), 59-70.

WMO INTEGRATED GLOBAL OBSERVING SYSTEM (WIGOS)
and
WMO HYDROLOGICAL OBSERVING SYSTEM (WHOS)

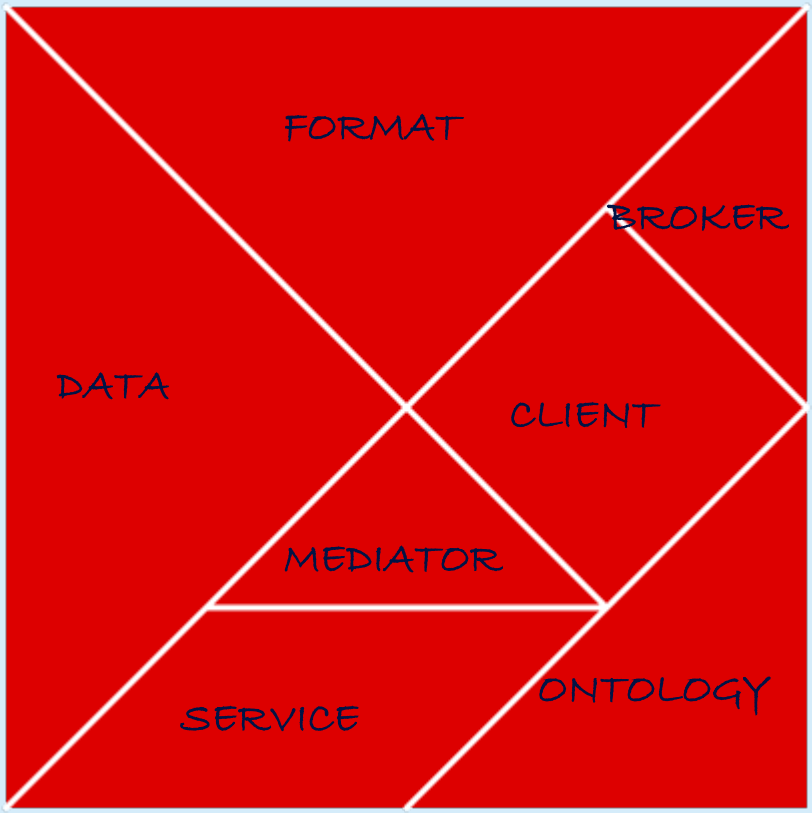
WIS – WMO Information System



Ingests data from National Centers . . .

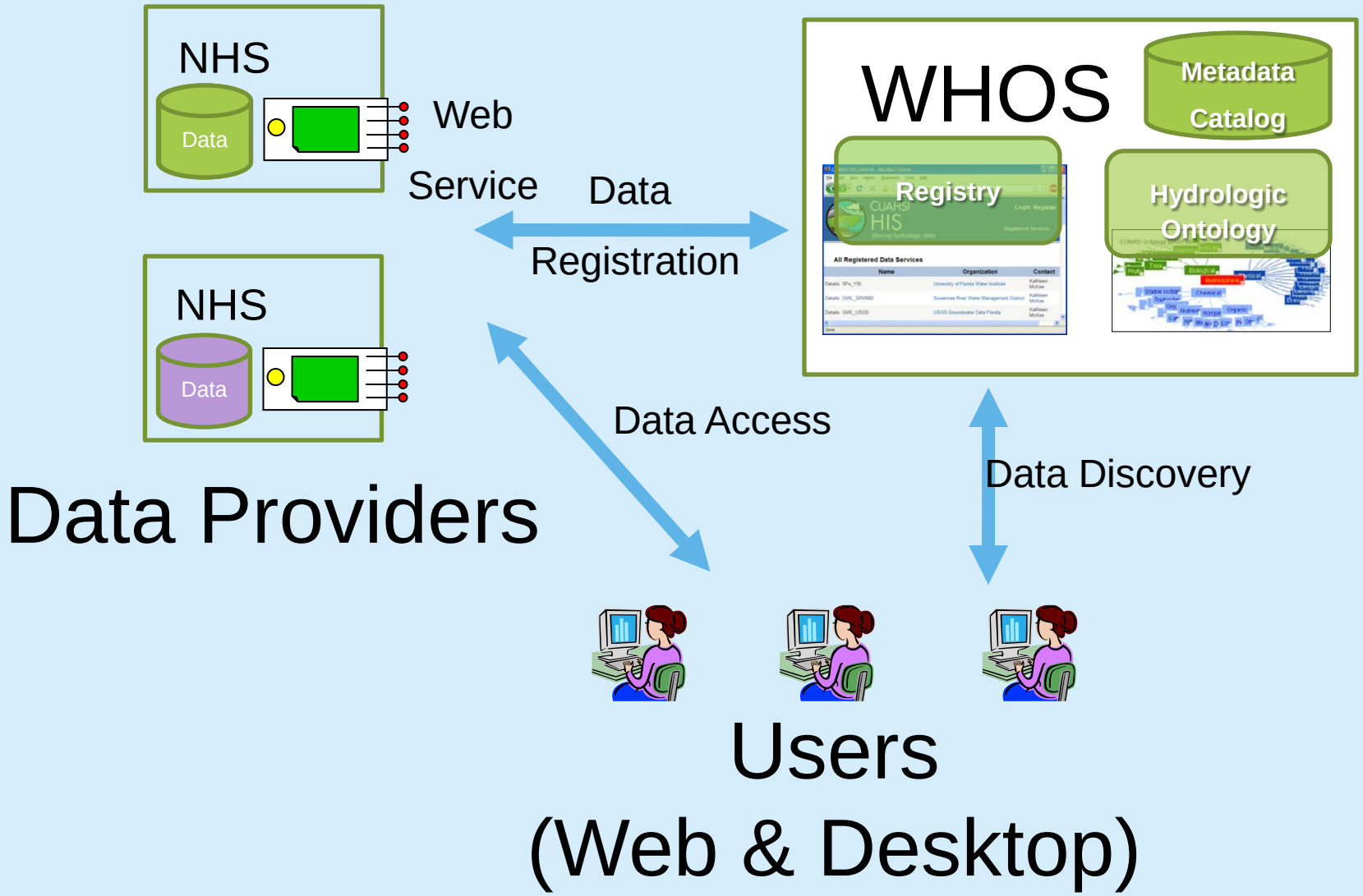
. . . synthesized globally through communication networks

WHOS

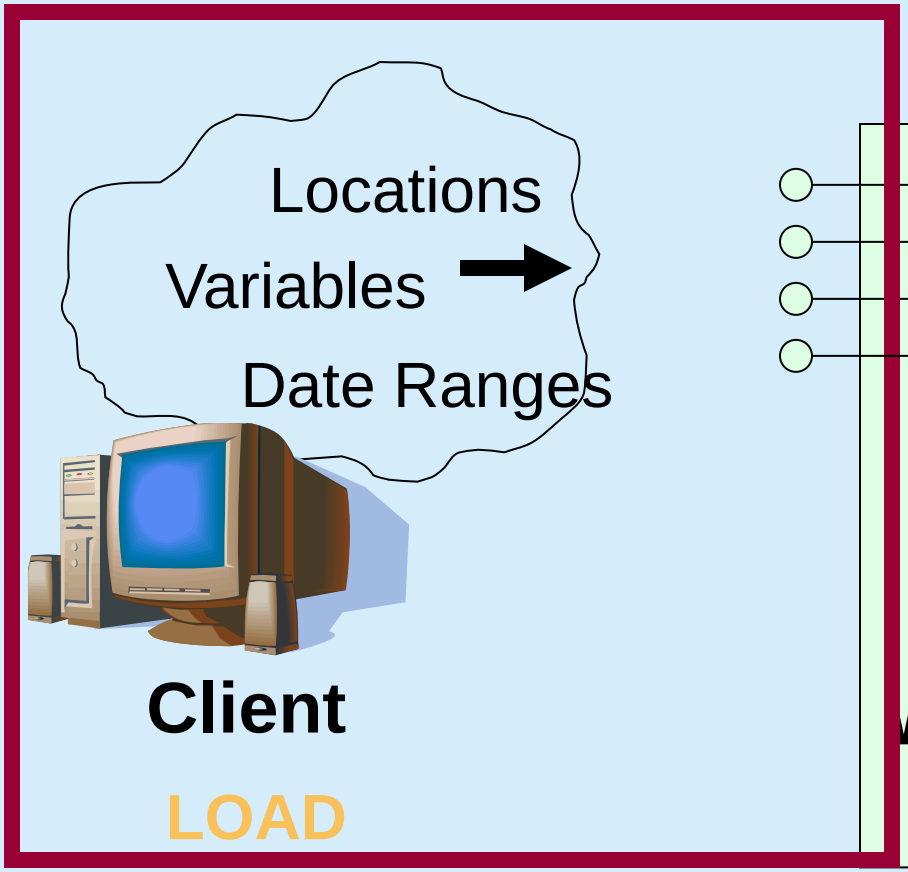


reshaping data in hydrology

WHOS Architecture Overview

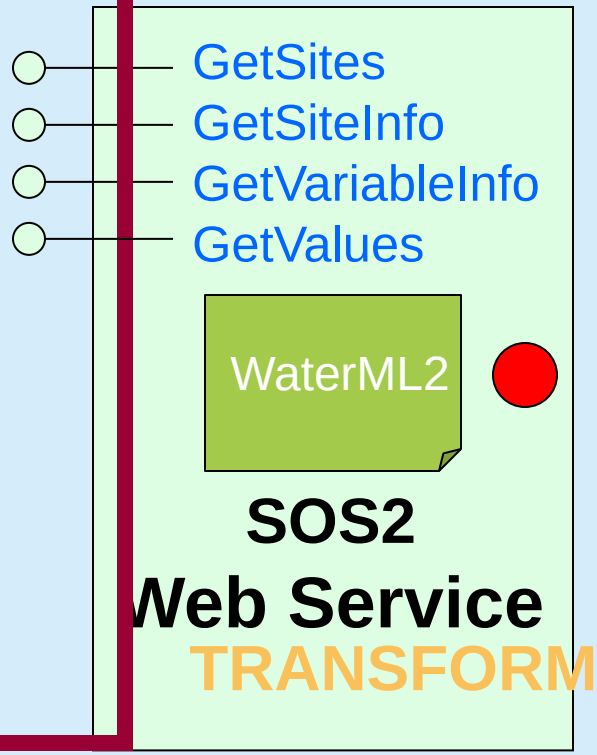


WaterML2 and SOS2



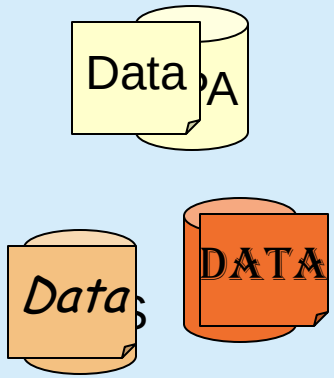
Client

LOAD



SOS2 Web Service

TRANSFORM



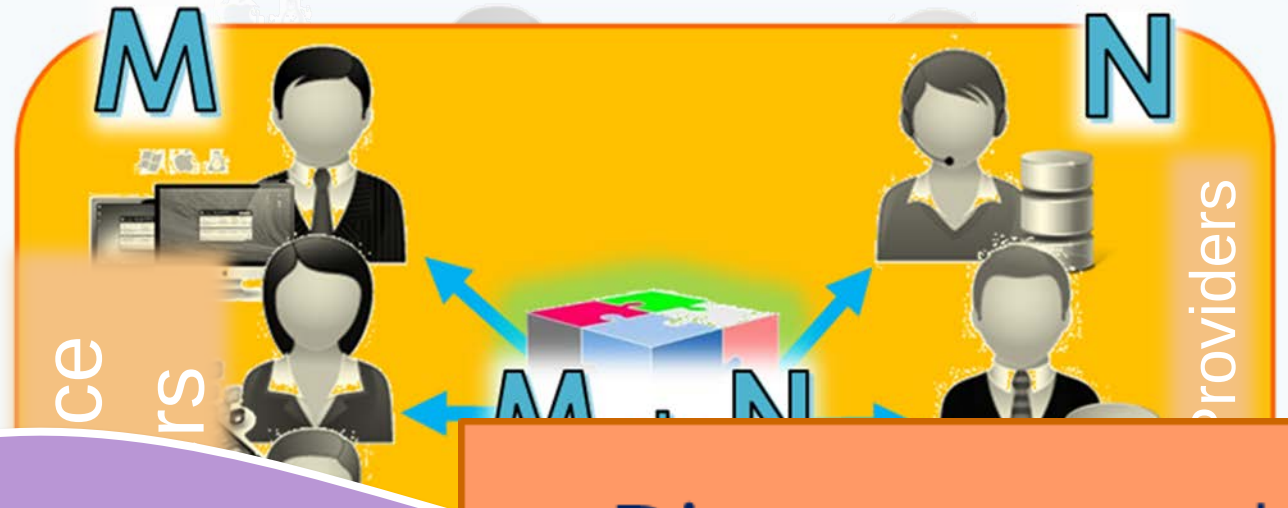
Data Repositories

EXTRACT

SOS2 is how you ask for data

WaterML2 is the format of what comes back

Broker Approach



Discovery and Access
[functionality]

Collaborative-A
Management approach
[Governance]

WHOS

WMO Hydrological Observing System

WMO Hydrological Ontology

The WMO Hydrological Ontology is a formal naming and definition of the types, properties, and interrelationships of entities that really or fundamentally exist in the domain of hydrology; in particular, it compartmentalizes the variables needed in hydrology and establishes the relationships between them.

i More about this visualisation

Legend:

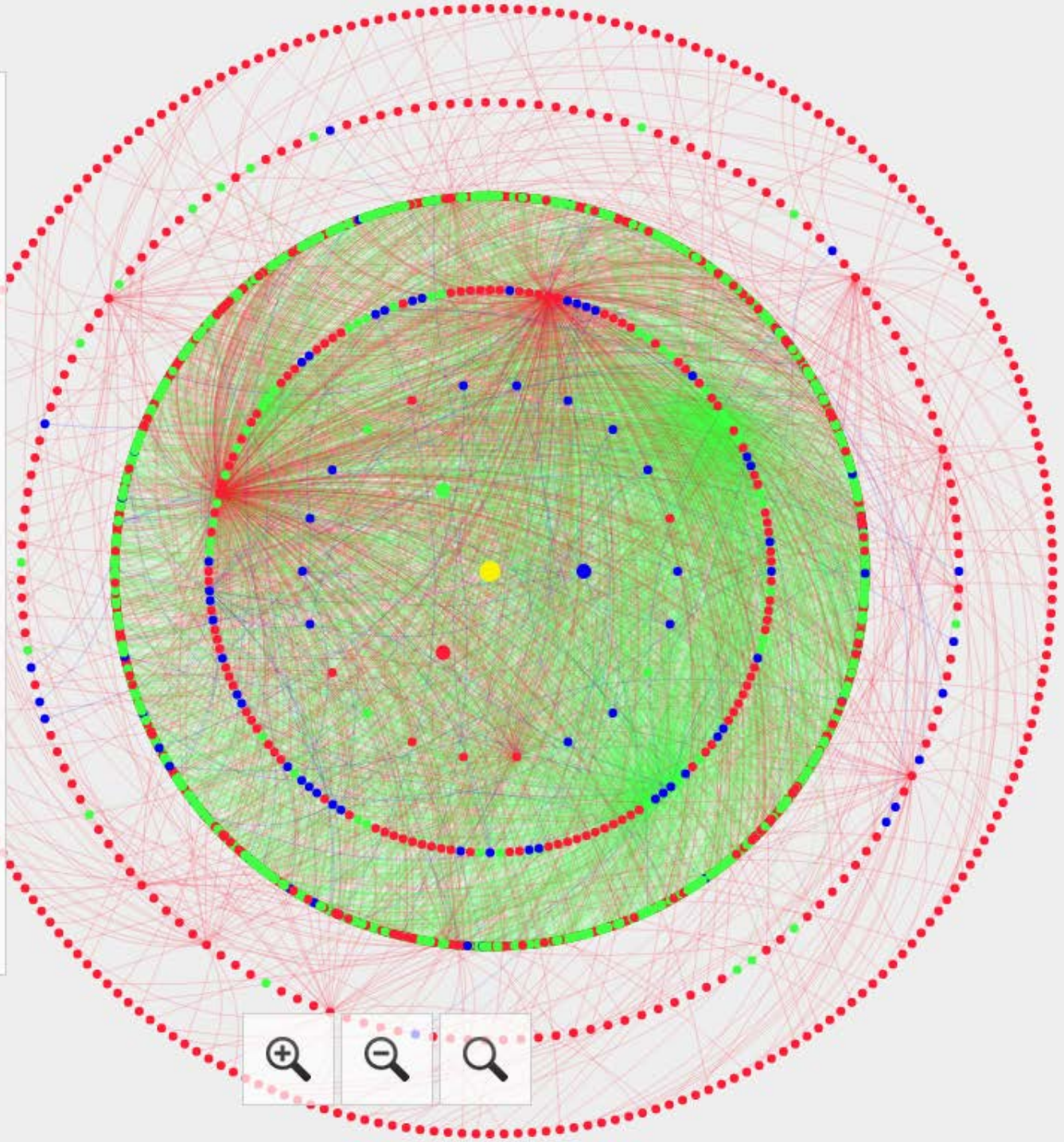
- A concept
- A relationship between two concepts
- Colour represents a grouping of concepts according to their properties

Ontology client

SPARQL

Search:

Search by name



WMO Hydrological Observing System

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i More about this visualisation

Legend:

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Ontology client

SPARQL

Search:

Search by name

Return to the full network

Information Pane

Flux, discharge

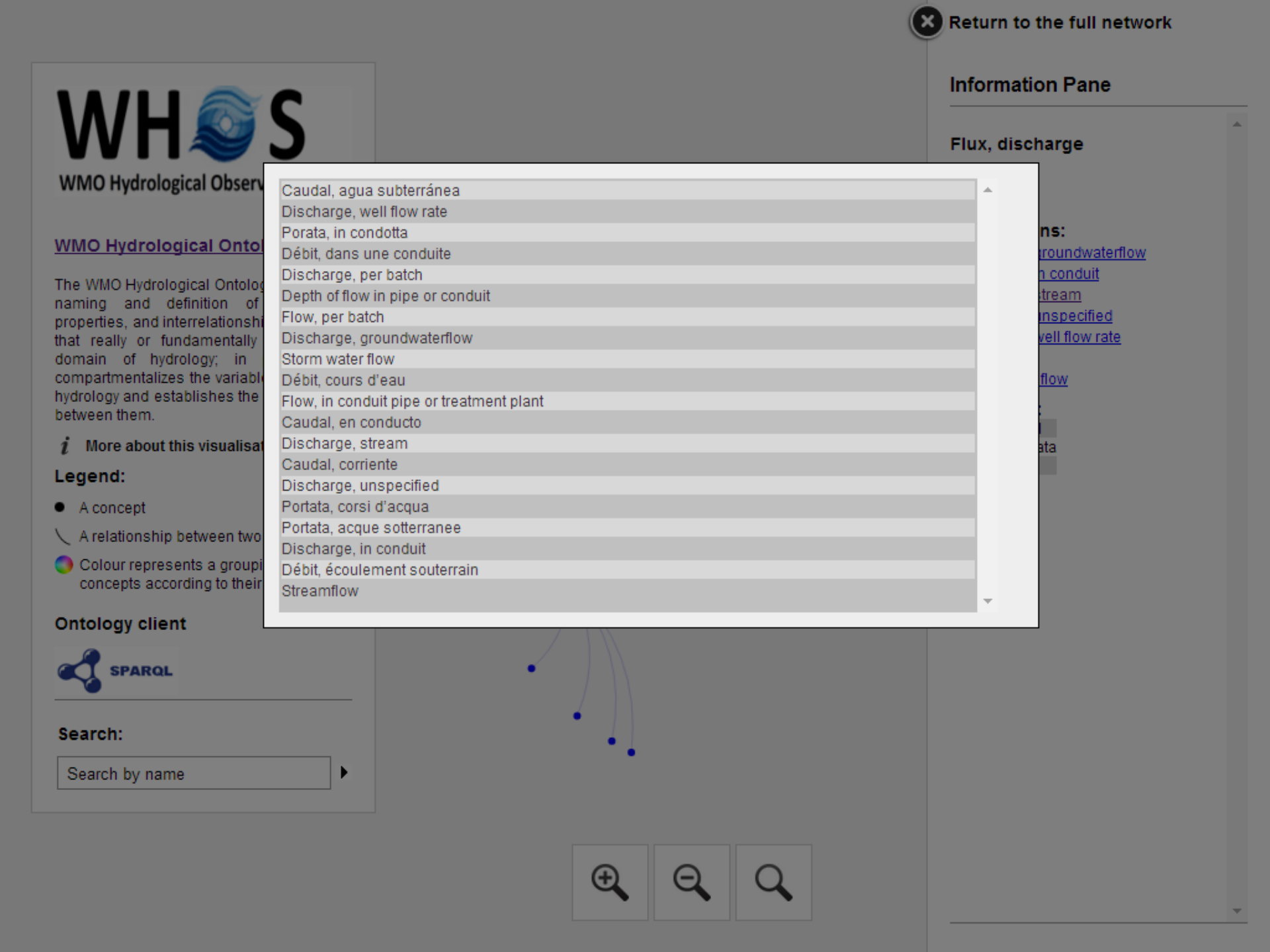
Variables

Connections:

Discharge, groundwaterflow
Discharge, in conduit
Discharge, stream
Discharge, unspecified
Discharge, well flow rate
Flux
Storm water flow

Synonyms:

Flujo, caudal
Flusso, portata
Flux, débit


Return to the full network
Information Pane
Flux, discharge
WMO Hydrological Observ
WMO Hydrological Onto
The WMO Hydrological Ontolo
naming and definition of
properties, and interrelationshi
that really or fundamentally
domain of hydrology; in
compartmentalizes the variabl
hydrology and establishes the
between them.
More about this visualisat
Legend:
A concept
A relationship between two
Colour represents a groupi
concepts according to their
Ontology client
SPARQL
Search:
Search by name
Caudal, agua subterránea
Discharge, well flow rate
Porata, in condotta
Débit, dans une conduite
Discharge, per batch
Depth of flow in pipe or conduit
Flow, per batch
Discharge, groundwaterflow
Storm water flow
Débit, cours d'eau
Flow, in conduit pipe or treatment plant
Caudal, en conducto
Discharge, stream
Caudal, corriente
Discharge, unspecified
Portata, corsi d'acqua
Portata, acque sotterranee
Discharge, in conduit
Débit, écoulement souterrain
Streamflow

```
PREFIX : <http://www.semanticweb.org/ontologies/hydrology#>
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
select distinct ?name
where {?x rdf:type :Variable.
       ?x :variablename ?name.
       ?x :searchedBy ?y.
       ?y rdf:type :Concept.
       ?y :conceptname ?z.
       filter regex(?z, "level, stream", "i" )}
```

Table | Raw Response

Showing 1 to 18 of 18 entries

Search: Show 50 entries

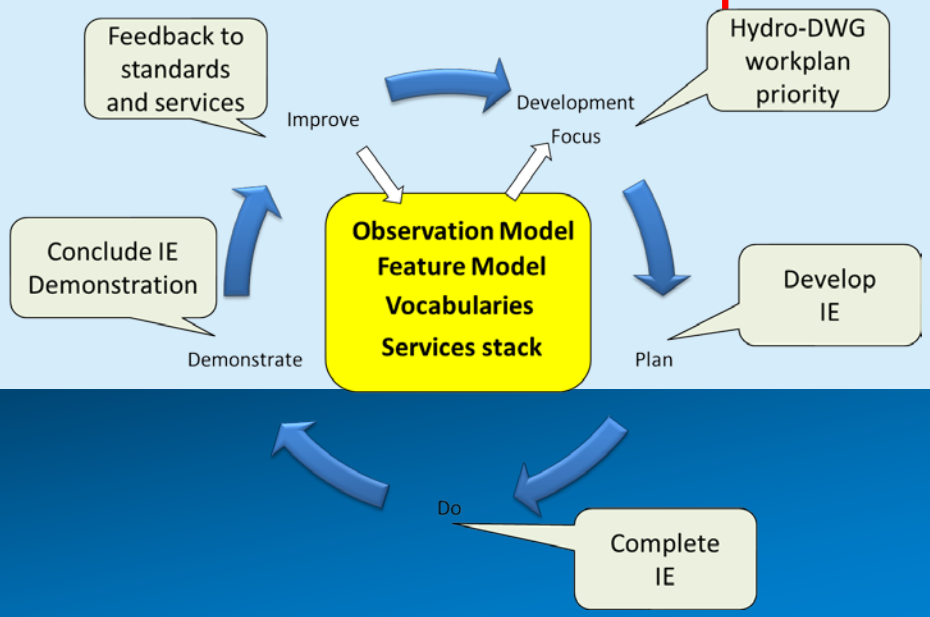
	name
1	Water depth, stream
2	Profondeur de l'eau, cours d'eau
3	Profondità dell'acqua, corsi d'acqua
4	Nivel del agua, corriente
5	Stream gage height
6	Gage height stream
7	Profundidad del agua, sección transversal promedio
8	Hauteur d'eau, cours d'eau
9	Water depth, cross-sectional averaged
10	Profondeur de l'eau, coupe transversale moyenne

International Standardization for Water Data

OGC\WMO Hydrology Domain Working Group
- standards for water data: **WaterML 2.0 suite**
- organizing Interoperability Experiments (IEs) focused on different sub-domains of water

Chairs:
- Silvano Pecora (Italy)
- David Blodgett (USA)
- Tony Boston (Australia)

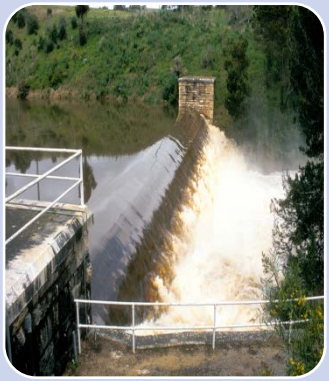
Iterative Development



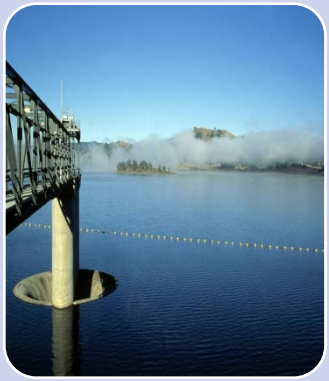
http://external.opengis.org/twiki_public/bin/view/HydrologyDWG/WebHome

WaterML2.0 standards

Part 1 - Timeseries



Part 2 – Ratings, Gaugings and Sections



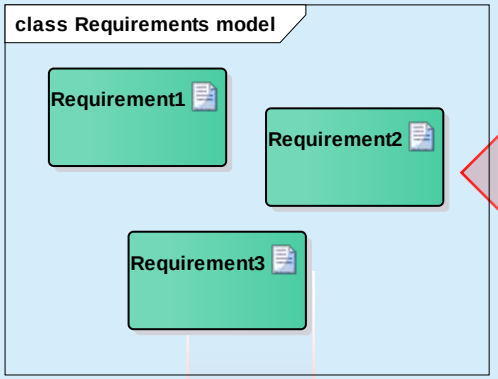
Part 3 – Surface water features

Part 4 – Groundwater

Part 5 – Water quality (best practice)

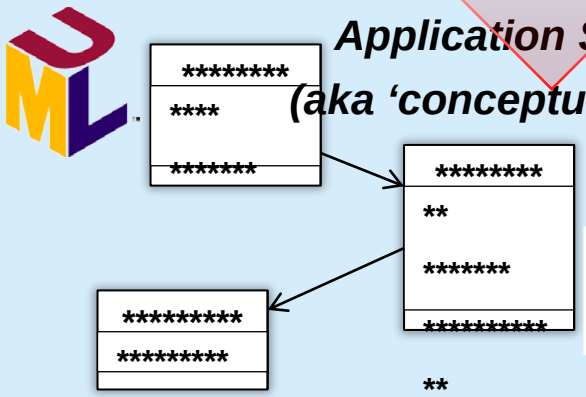
Specification to data encoding

Requirements model



WMO regulation and other specifications

Application Schema (aka 'conceptual model')

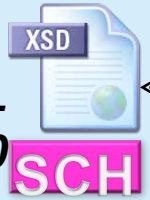


Technology independent description of content and structure of information to be exchanged for a given application

« derived from »

XML Schema 1.0

Schematron



Validation schema and rules

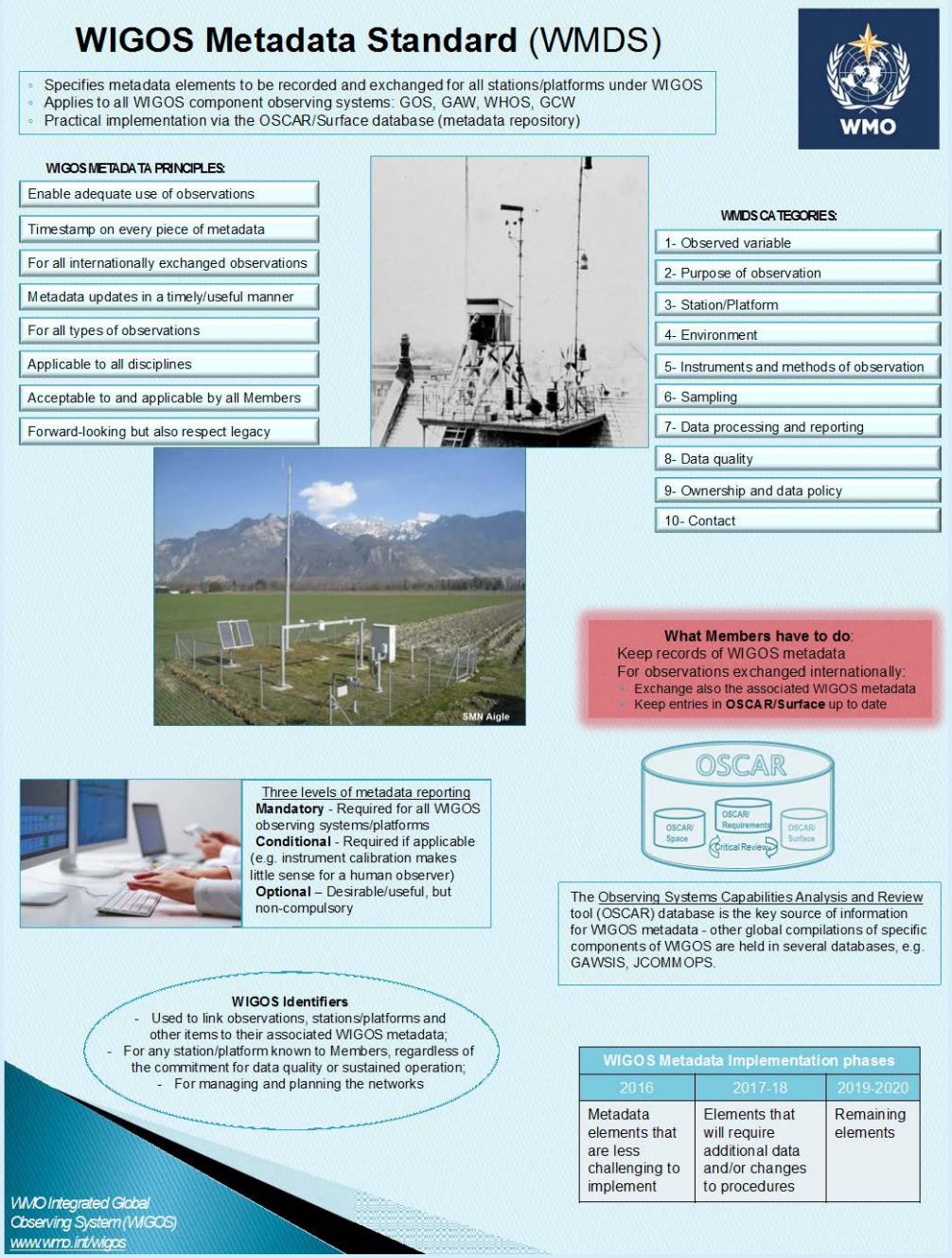
« conforms to »

XML instance documents

***Validatable** data products*

WIGOS Metadata Standard - Approved at Cg-17 June 2015

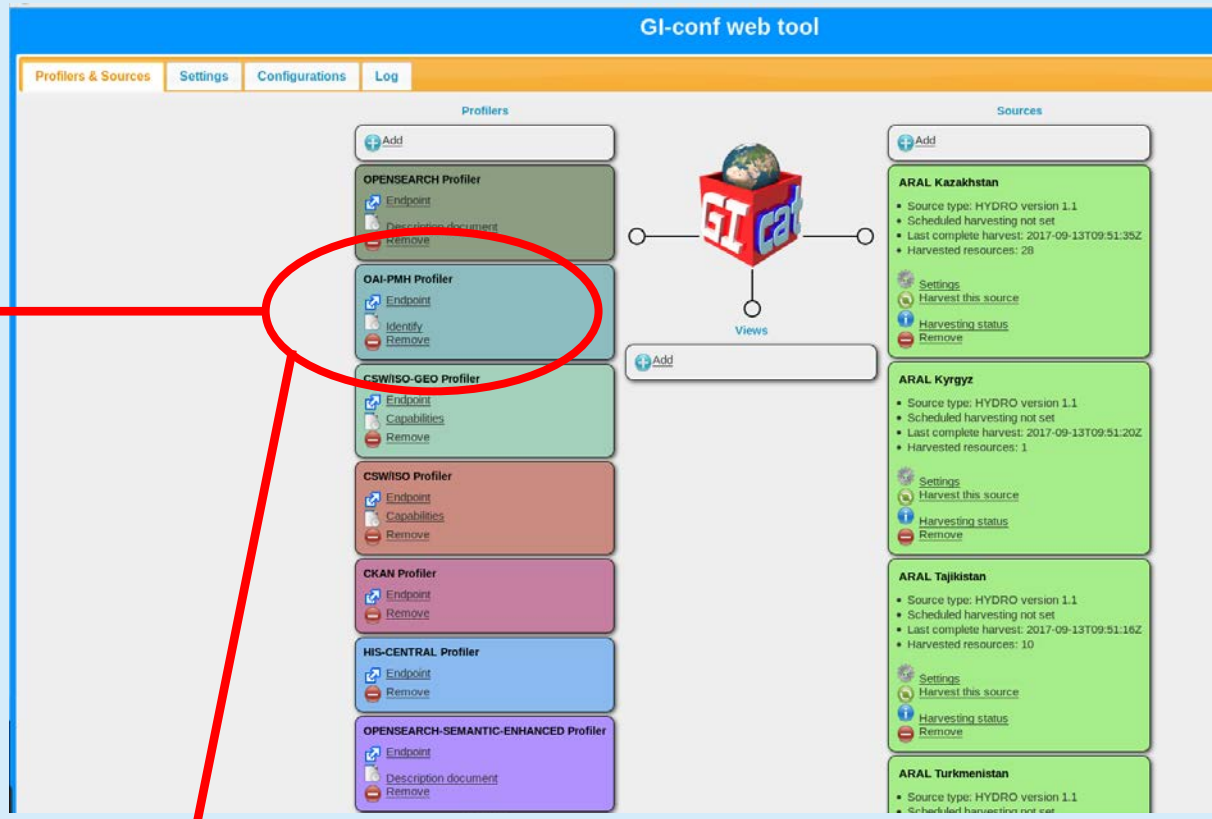
Source: https://www.wmo.int/pages/prog/www/wigos/documents/Cg-17/WIGOS_Metadata.pdf



WHOS interfaces

OAI-PMH interface endpoint can be used to harvest WHOS content as:

- Dublin core
- ISO 19139
  - 2006 schema
  - 2007 schema
- Wigos Metadata Standard



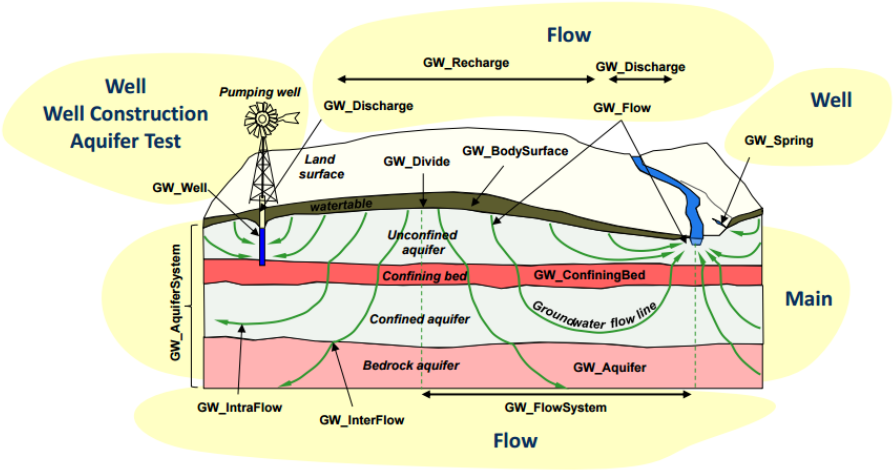
http://arpa-er.geodab.eu/gi-cat-arpa/services/oaipmh

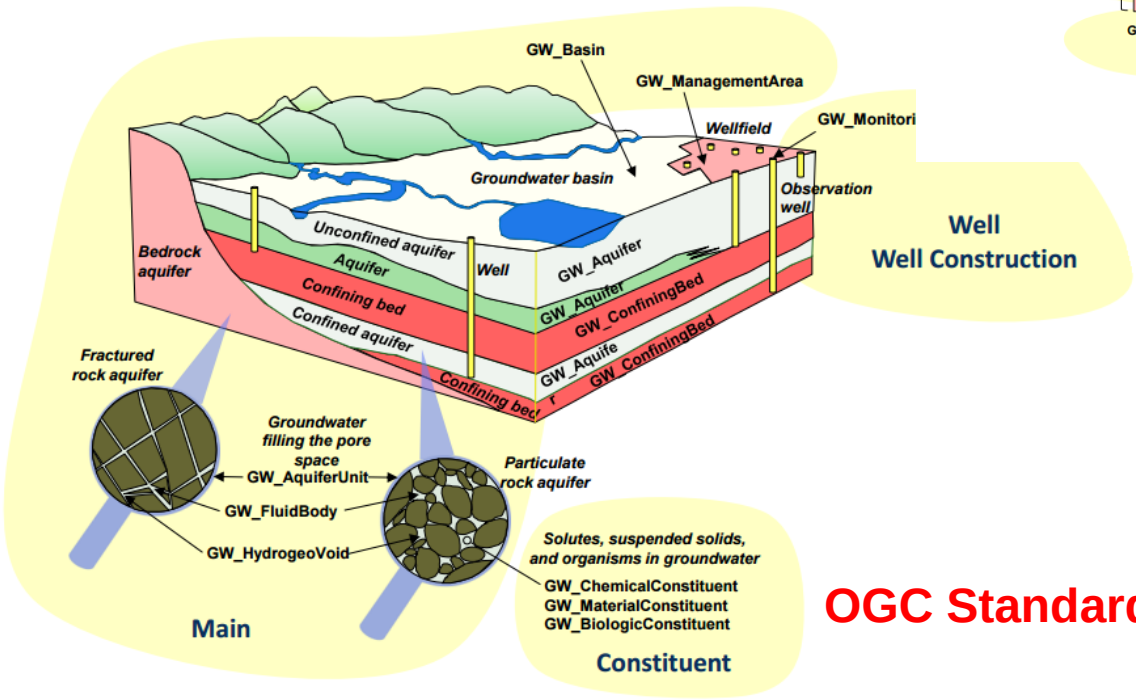
ADOPTIONS by OGC and WMO

- **OGC** adopted WaterML2 Part1 – Timeseries in February 2014, WaterML2 Part2 - Ratings, Gaugings and Sections in February 2016, the conceptual model WaterML2 Part3 - Surface Hydrology Features in January 2018, WaterML2 Part 4 - GroundWaterML2 in March 2017
- **WMO** Executive Council 69th session meeting in May 2017 formally adopted WaterML2 Part 1 & 2 standards (p.133-134)

  decides “To amend the Manual on Codes, Volume I.3 to introduce WaterML2 Parts 1 and 2 as data representations that are suitable for the exchange of hydrological information, as specified in Annex 1 of the Annex to Recommendation 12 (CBS-16)”

```
▼<gsml:gbUnitDescription>
  ▼<gsmle:GeologicUnitDescription>
     <gsmle:bodyMorphology xlink:href="http://resource.geosciml.org/classifier/cgi/geologicunitmorphology/layer
   </gsmle:GeologicUnitDescription>
 </gsml:gbUnitDescription>
 <!--  add more compositions  -->
 <gwml2:gwUnitMedia xlink:href="http://gw-info.net/media/granular" xlink:title="granular"/>
 <gwml2:gwUnitWaterBudget xsi:nil="true"/>
▼<gwml2:gwUnitRecharge>
  ▼<gwml2f:GW_Recharge gml:id="gin.richelieu.recharge.1">
    ▼<gml:location>
       <gml:LocationString>Regional precipitation</gml:Locatio
     </gml:location>
     <gwml2f:gwFlowPersistence nilReason="missing"/>
     <gwml2f:gwFlowProcess xlink:href="urn:Precipitation" xlir
    ▼<gwml2f:gwFlowTime>
      ▼<gml:TimePeriod gml:id="gin.richelieu.recharge.1.ft">
         <gml:beginPosition>2012-04-01</gml:beginPosition>
         <gml:endPosition>2013-03-31</gml:endPosition>
       </gml:TimePeriod>
     </gwml2f:gwFlowTime>
     <gwml2f:gwFlowVelocity xsi:nil="true" nilReason="unknown"
    ▼<gwml2f:gwFlowVolumeRate>
```





GroundWaterML2 (GWML2)

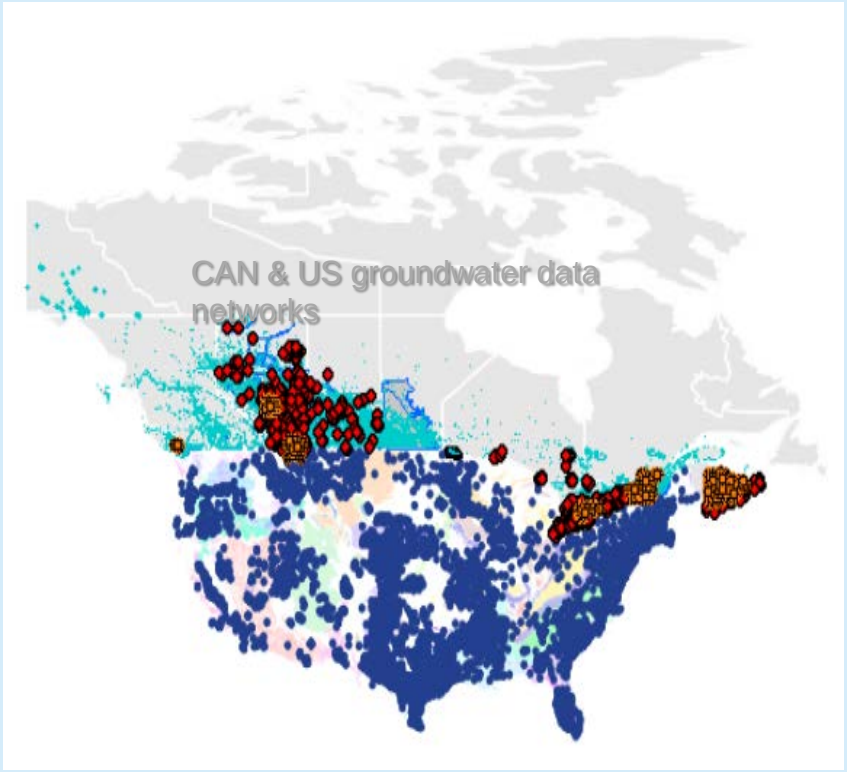
WaterML2 Part4

OGC Standard today -> WMO Standard soon

Context

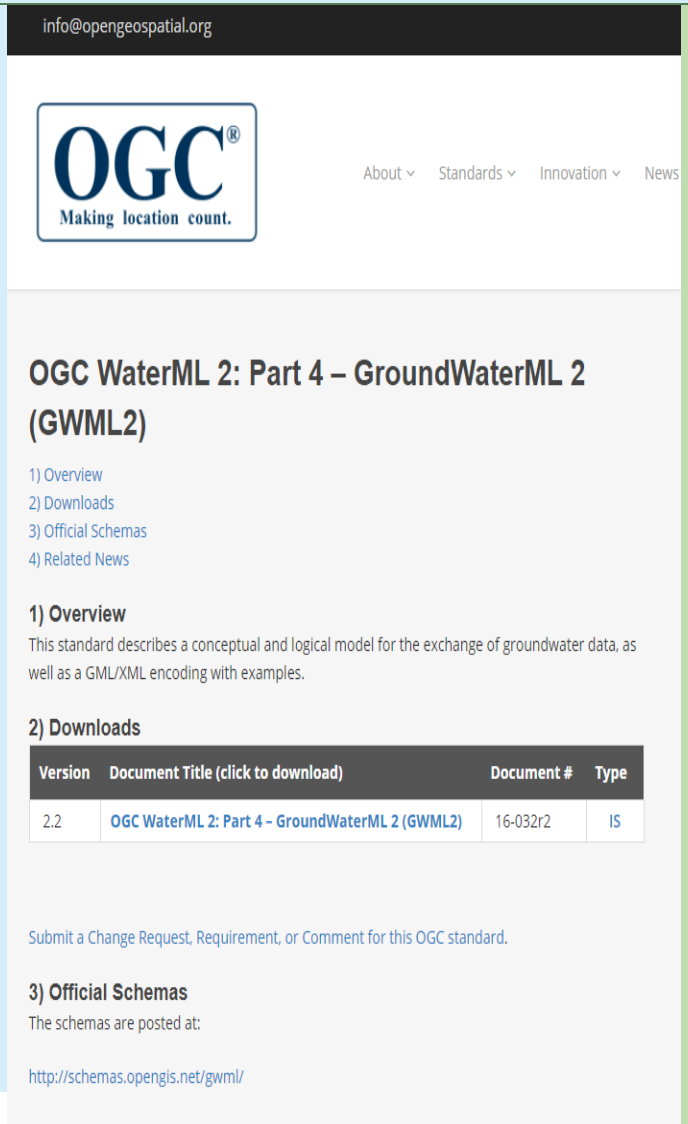
- Big Science and Big Data

- Increasing gw data volume and online availability
- Increasing scientific and societal need for integrated gw data
- Rise of water data networks and software tools
- **No appropriate int'l data standards!**



Standards Development

- GroundwaterML2 (GWML2)



info@opengeospatial.org

OGC® Making location count.

About Standards Innovation News

OGC WaterML 2: Part 4 – GroundWaterML 2 (GWML2)

1) Overview
2) Downloads
3) Official Schemas
4) Related News

1) Overview

This standard describes a conceptual and logical model for the exchange of groundwater data, as well as a GML/XML encoding with examples.

2) Downloads

Version	Document Title (click to download)	Document #	Type
2.2	OGC WaterML 2: Part 4 – GroundWaterML 2 (GWML2)	16-032r2	IS

Submit a Change Request, Requirement, or Comment for this OGC standard.

3) Official Schemas

The schemas are posted at:

http://schemas.opengis.net/gwml/

- **Open Geospatial Consortium**

  Geospatial standards of all kinds

- **Hydro Domain Working Group**

  WaterML2 hydro data standards

- **Groundwater Standards Working Group**

  GWML2
  reuses GeoSciML, O&M, …

  Hydrogeological & data experts

  CAN, USA, FR, DE, AT, NZ, AU

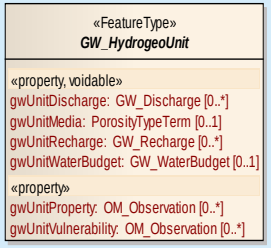
  2012-2017

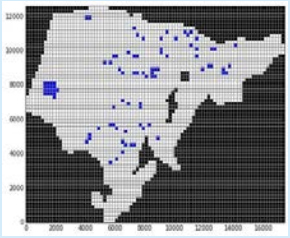
  final approval: March 2017

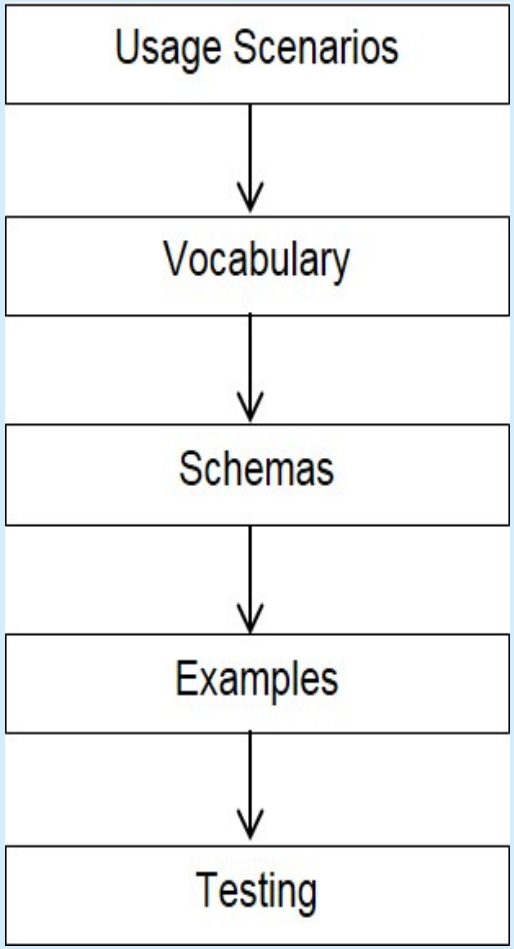
Methods

GWML2 development

flow modeling

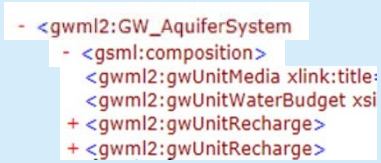






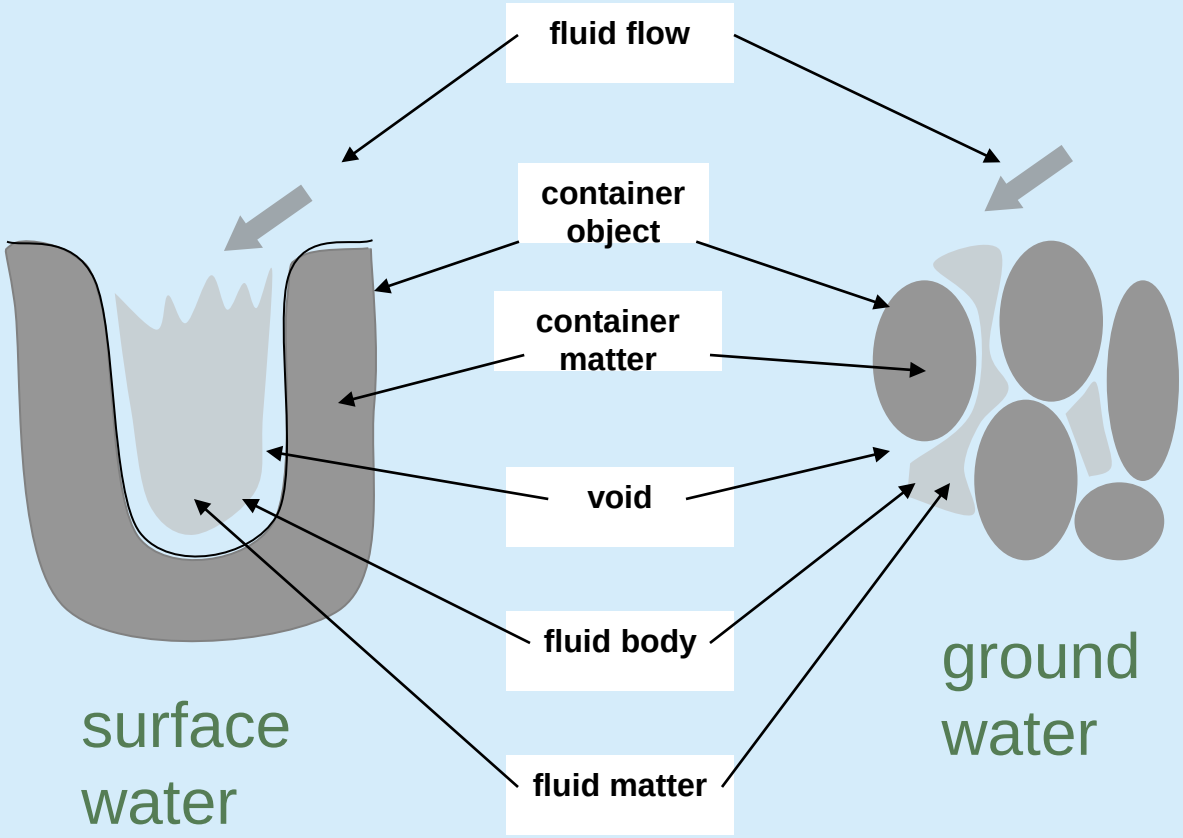
Aquifer: A formation, group
a formation that contains suf
permeable material to yield s
water to wells and springs.

https://water.usgs.gov/ogw/aquiferbasics/



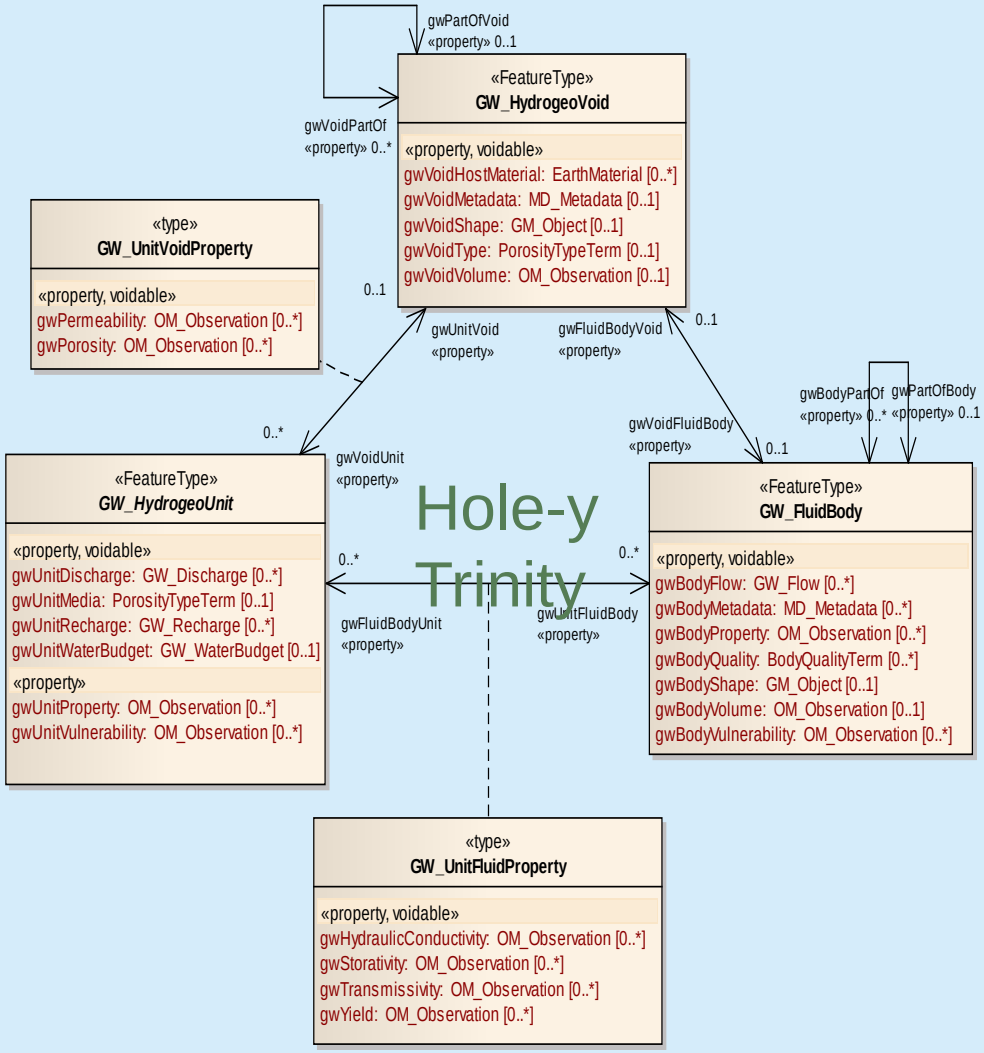
Conceptual Model: GW & SW

Fluid Container Pattern: Containers, Voids, Fluids



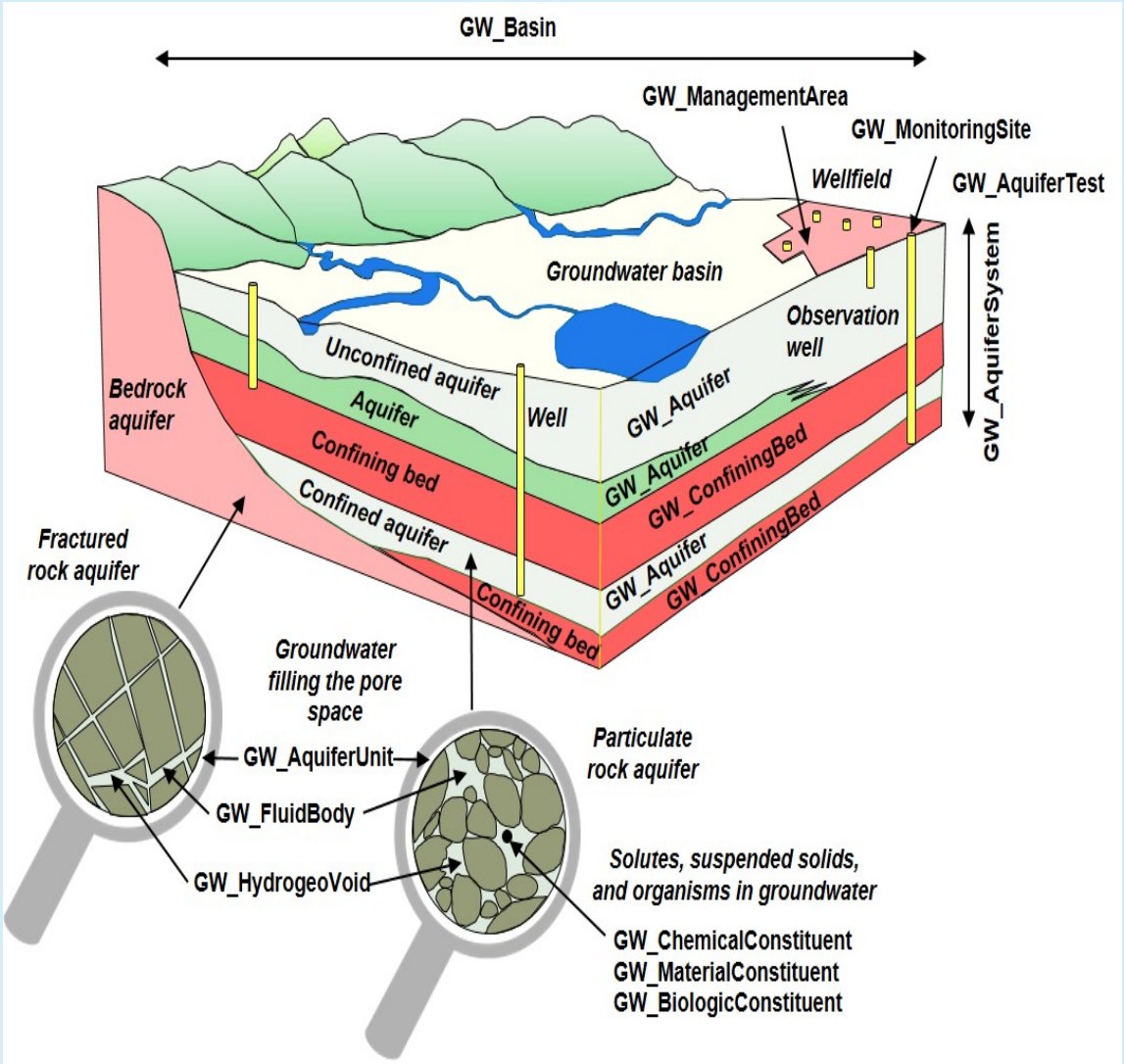
Conceptual Info Model: GW

GW Container Pattern: Units, Voids, Fluids



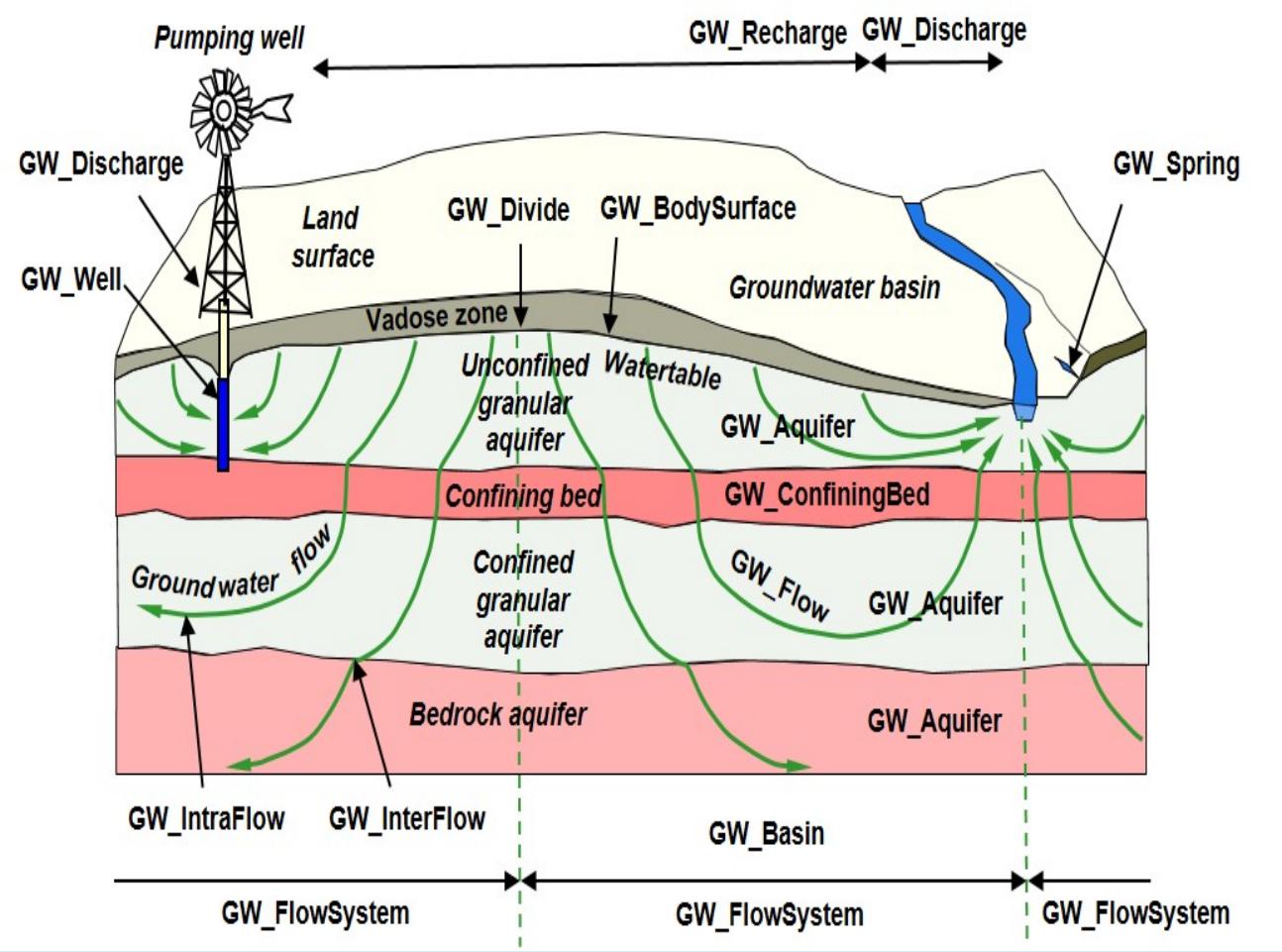
GWML2: contents

Hydrogeological Units, Voids, Fluid bodies



GWML2: contents

Fluid Flow, Water wells, Springs



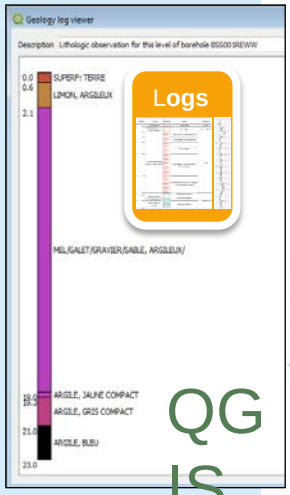
GWML2: GML-XML encoding

Aquifer System: Lithology, Hydraulic Conductivity

```
- <gwml2:GW_AquiferSystem
      [... snip ...]
    <gml:name codeSpace="http://gw-info.net">Appalachian External Zone</gml:name>
      [... snip ...]
   - <gsml:composition>
     - <gsml:CompositionPart>
         <gsml:role nilReason="unknown"/>
         <gsml:material xlink:title="Shale"
           xlink:href="http://resource.geosciml.org/classifier/cgi/lithology/shale"/>
       </gsml:CompositionPart>
     </gsml:composition>
   + <gsml:composition>
   + <gsml:composition>
      [... snip ...]
     <gwml2:gwUnitMedia xlink:title="granular" xlink:href="http://gw-info.net/media/granular"/>
     <gwml2:gwUnitWaterBudget xsi:nil="true"/>
   + <gwml2:gwUnitRecharge>
   + <gwml2:gwUnitRecharge>
      [... snip ...]
   + <gwml2:gwUnitDischarge>
   + <gwml2:gwUnitDischarge>
      [... snip ...]
     - <gwml2:gwHydraulicConductivity>
       - <om:OM_Observation gml:id="gu.fprop.1.1">
           <gml:description>Hydraulic conductivity for the hydrogeological unit. The median value for
             hydraulic conductivity is 10^-6 0.2 m/s, but it ranges from 10^-7 0.8 to 10^-4 0.8 m/s.
             Hydraulic regional conductivity The decreasing trend of transmissivity with depth in the
             rock is observed in all contexts. The average hydraulic conductivity is 10^-3 0.9 m/s near
             the top of bedrock (z = 1 m) which gradually loses an order of magnitude at a depth of 10
             m (10^-4 0.9 m/s), 25 m (10^-5 0.9 m/s), 60 m (10^-6 0.9 m/s) and 200 m (10^-7 0.9
             m/s).</gml:description>
           <om:phenomenonTime xlink:href="http://www.opengis.net/def/uom/nil" nilReason="missing"/>
           <om:resultTime xlink:href="http://www.opengis.net/def/uom/nil" nilReason="missing"/>
           <om:procedure xlink:href="http://www.opengis.net/def/uom/nil" nilReason="missing"/>
           <om:observedProperty xlink:title="Hydraulic Conductivity - Median" xlink:href="http://ngwd-
             bdnes.cits.nrcan.gc.ca/Reference/uri-
             cgi/classifier/ca.gin/NRCanGroundWaterTopics/1404"/>
           <om:featureOfInterest xlink:href="#gin.1"/>
           <om:result uom="http://sweet.jpl.nasa.gov/2.3/reprSciUnits.owl#meterPerSecond"
             xsi:type="gml:MeasureType">0.2E-6</om:result>
         </om:OM_Observation>
       </gwml2:gwHydraulicConductivity>
</gwml2:GW_AquiferSystem>
```

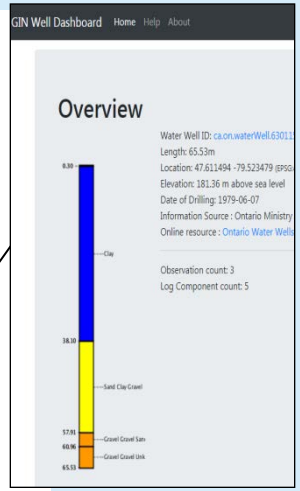
Implementation

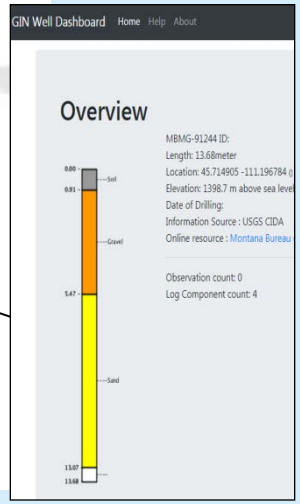
Commercial Scenario: Wells, Units, Levels,…



QG IS

GW Info Network (CAN)

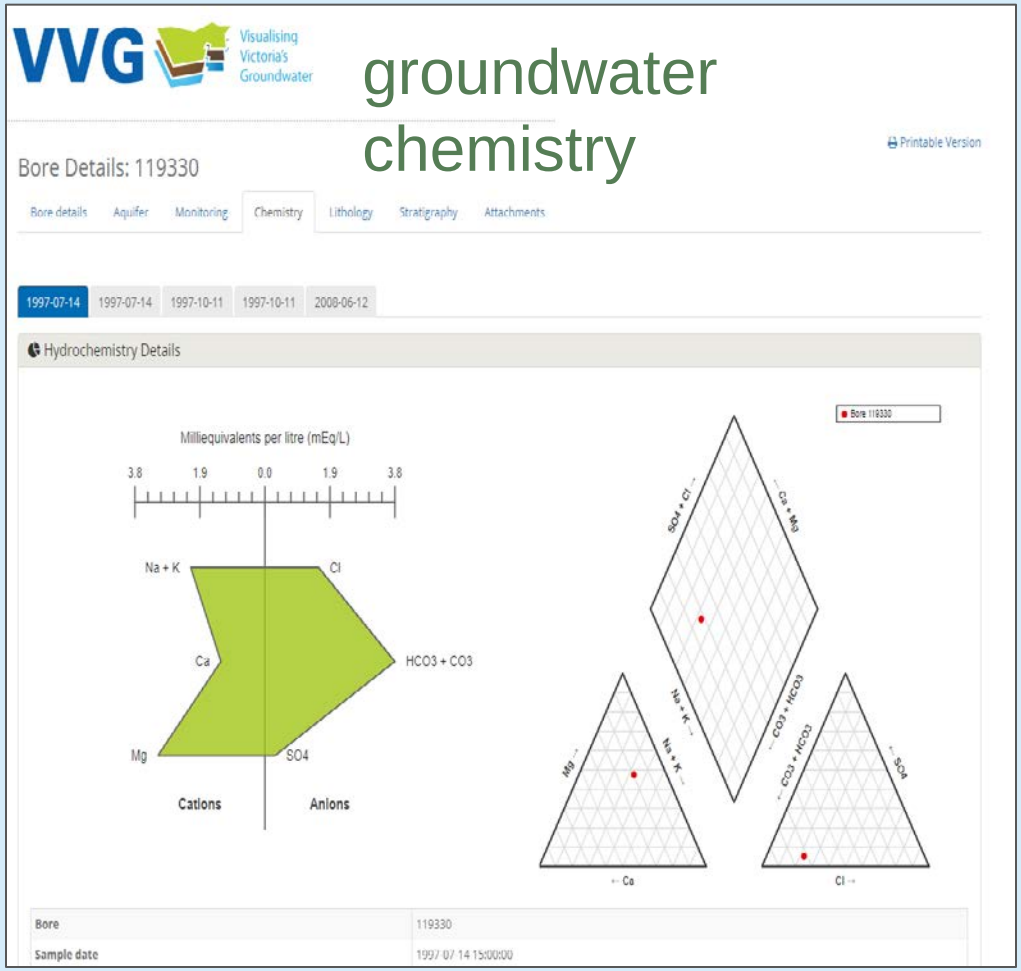




National GW Monitoring Network (USA)

Implementation

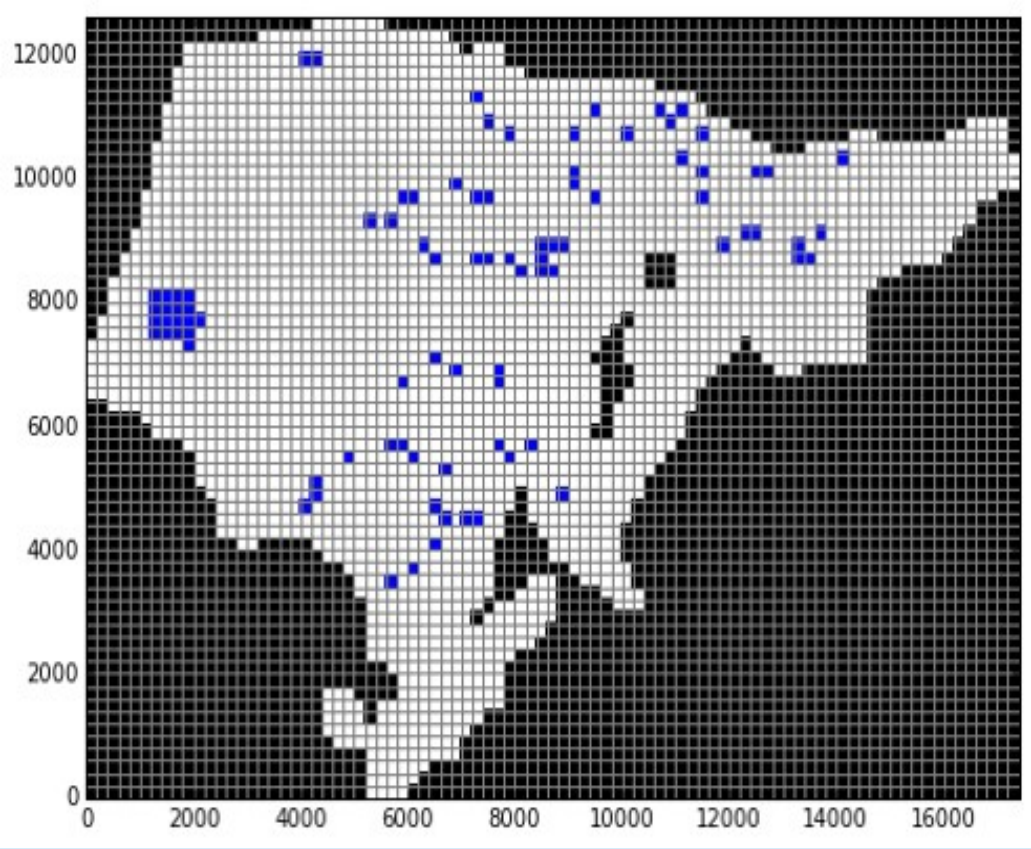
Environmental Scenario: Monitoring, Flow,…



Implementation

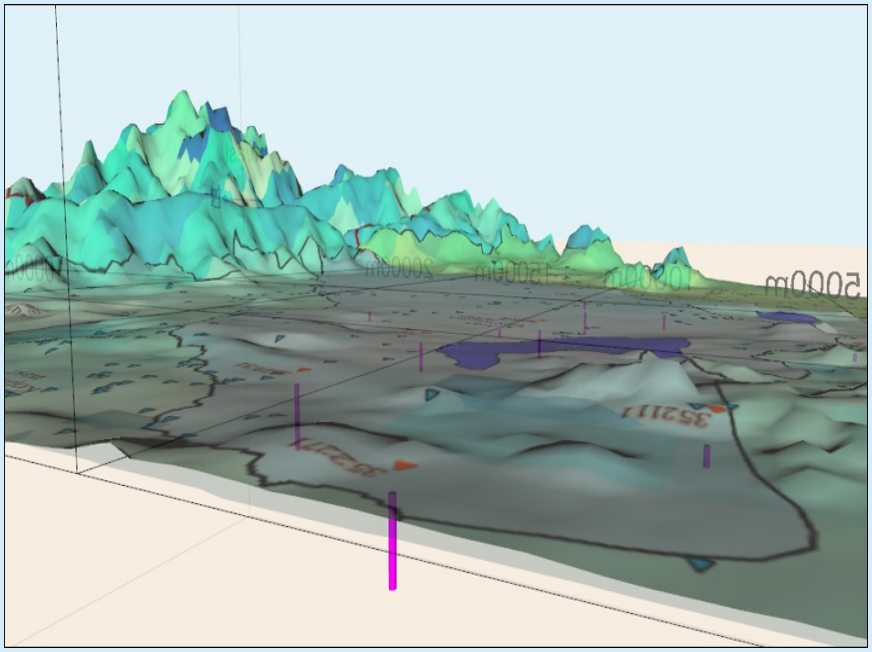
Scientific Scenario: Units, Wells, Measurements,…

MODFLOW model from GWML2 inputs (Horowhenua, NZ)



Implementation

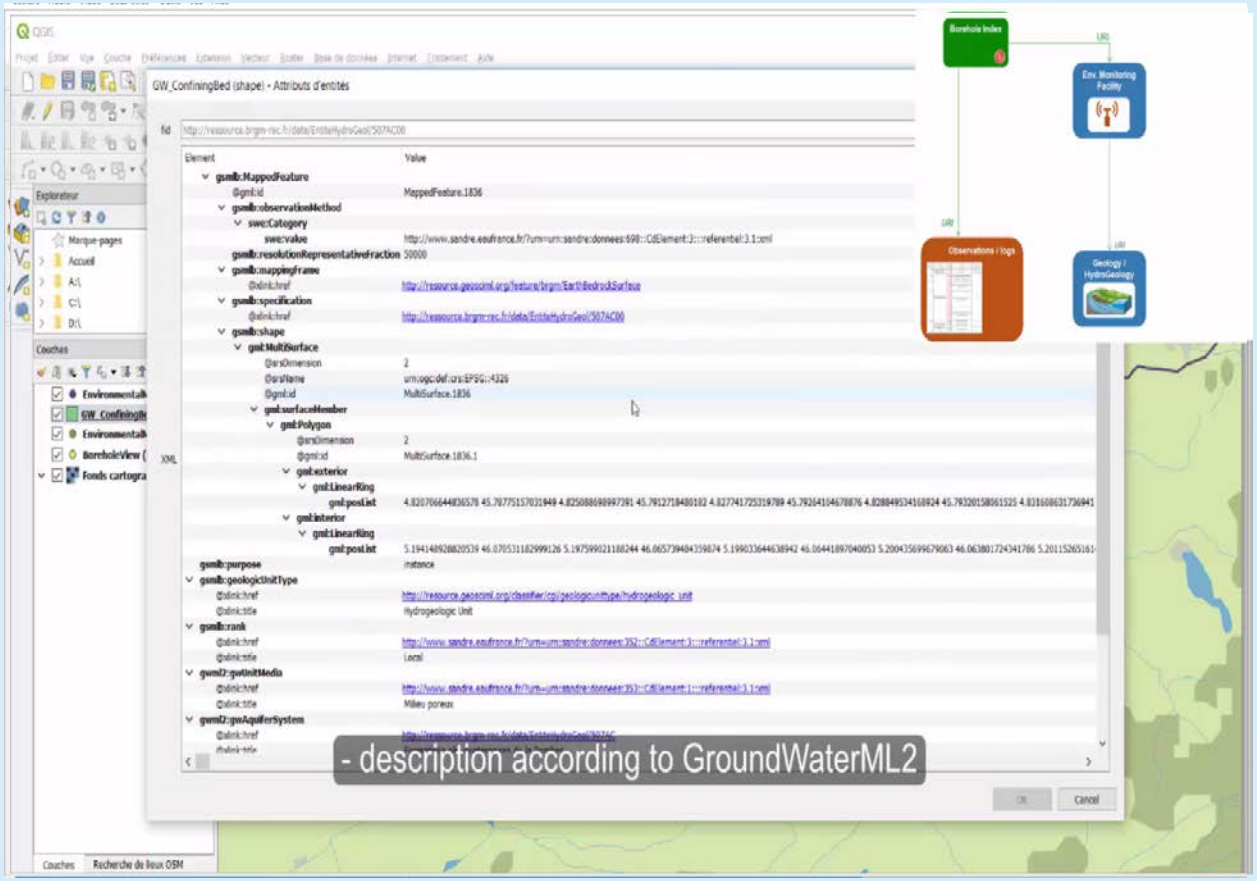
Policy Scenario: Management Areas, Units,…



3D visualization of GWML2 data for Horowhenua Management Area (NZ)

Implementation

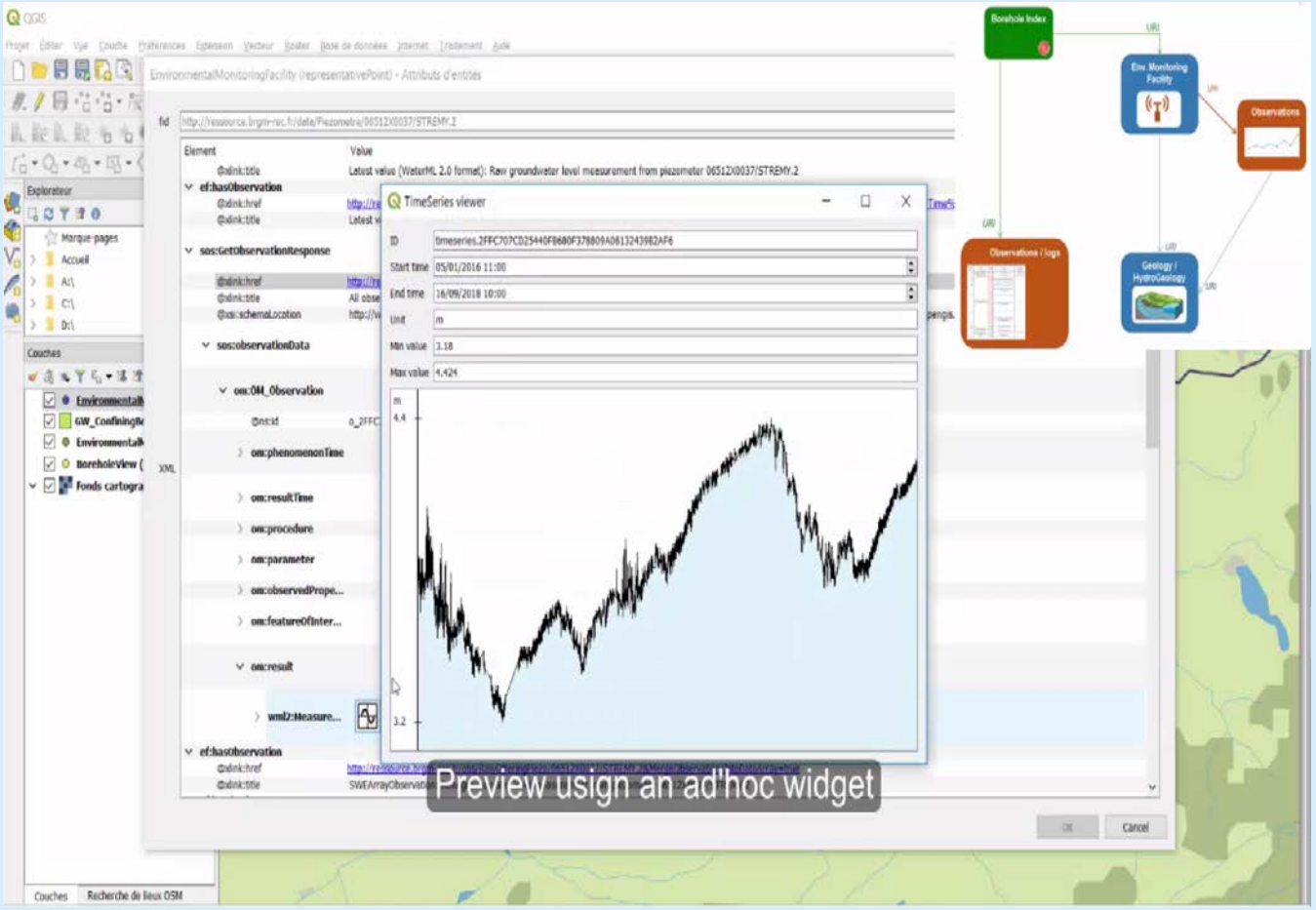
Technical scenario: GWML2 data used in QGIS



Screenshot QGIS GMLAS toolbox interaction with French Groundwater Information Network: linking stations to aquifers

Implementation

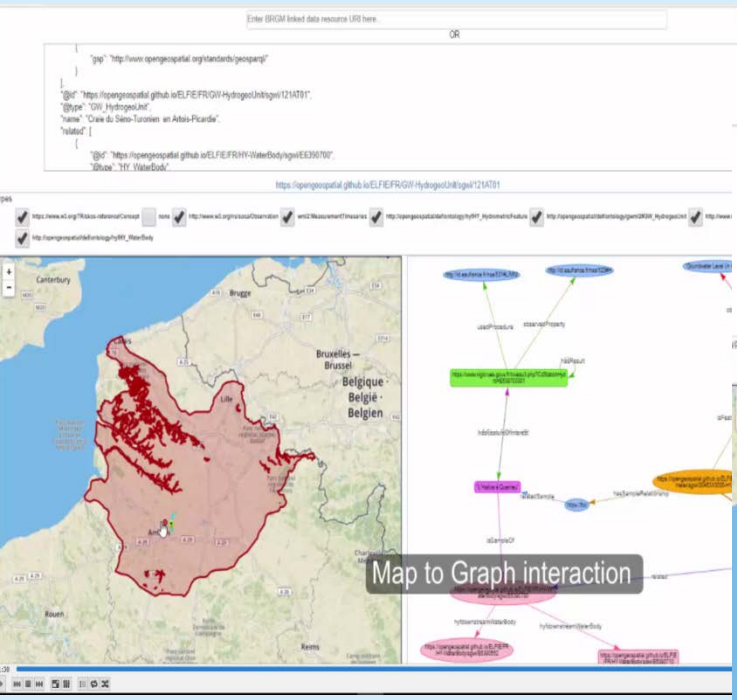
Technical scenario: GWML2 data used in QGIS

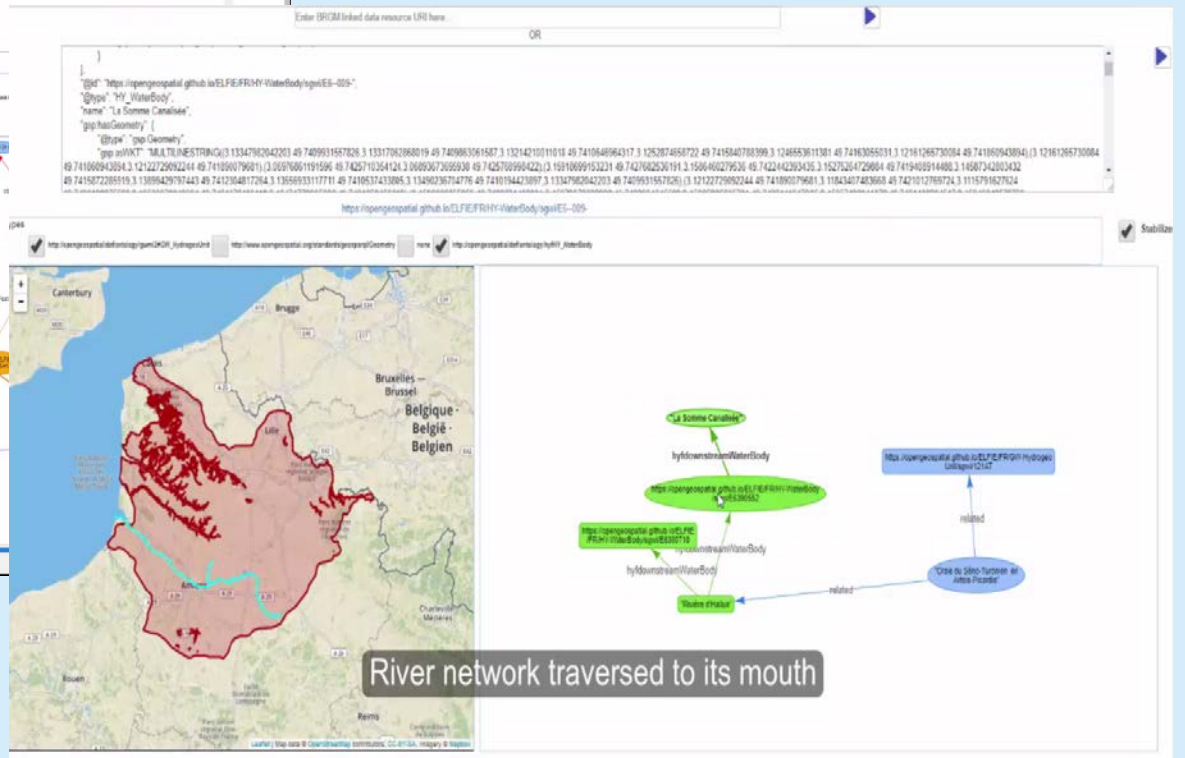


Screenshot QGIS GMLAS toolbox interaction with French Groundwater Information Network : linking stations to groundwater level observations

Implementation

Linked data scenario – surface/ground water interaction





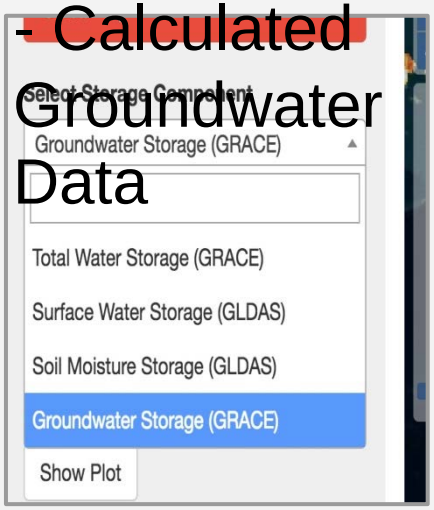
GWML2 data exposed in LinkedData and consumed in a JSON-LD aware viewer (BRGM : BLiV)

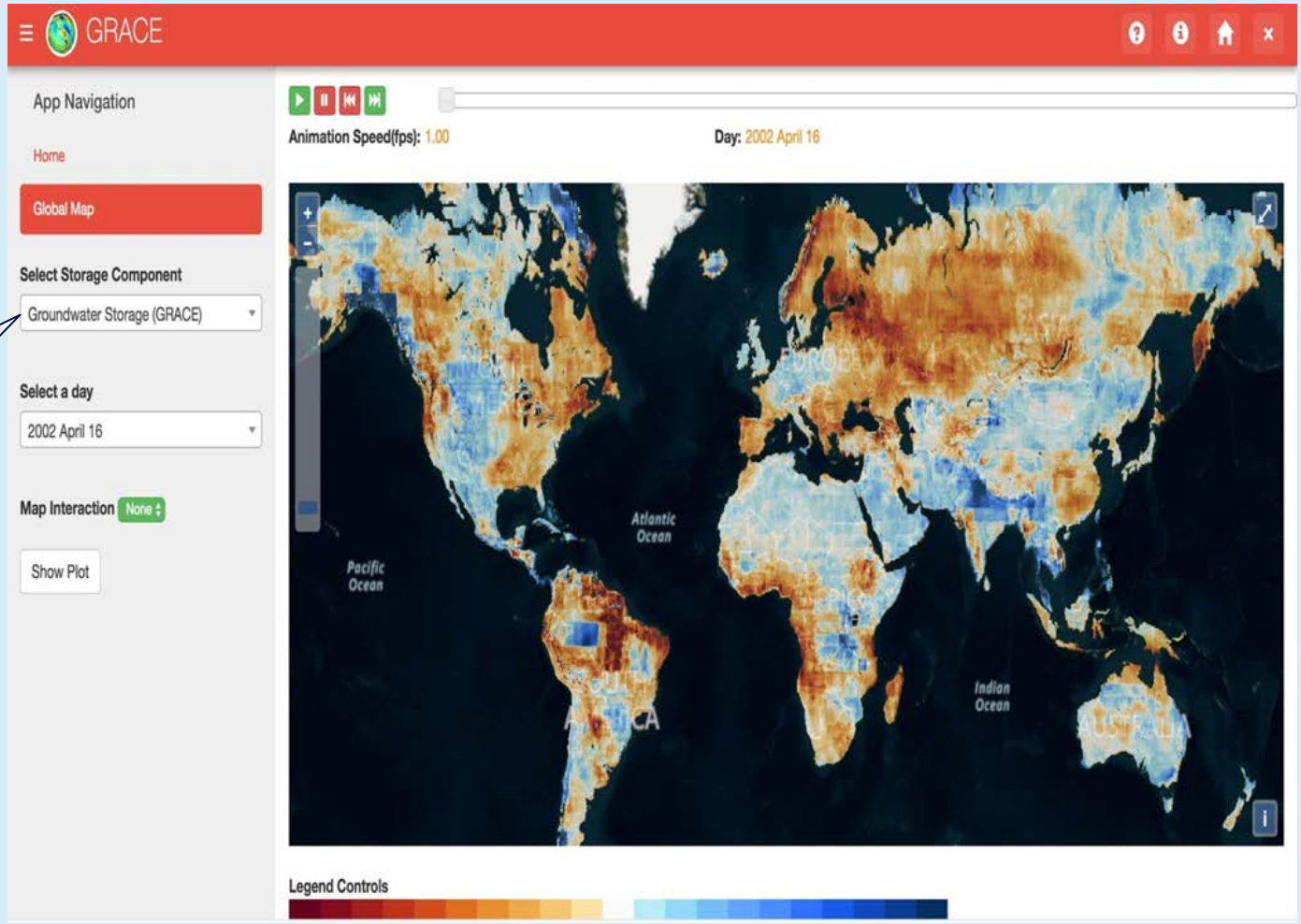
Tethys GRACE App

- GRACE Data

- GLDAS Data

- Calculated Groundwater Data





COMMISSION FOR BASIC SYSTEMS

World Meteorological Organization
Working together in weather, climate and water

Inter-Program Expert Team on Data Representation Development (IPET-DD)
Zagreb, Croatia 18-20 February 2019

IPET-DD-1
Agenda Item [xx]
6.2.2019

Submitted by: Silvano Pecora vice-President CHy

Proposal for WMLGW - WATERML2 GROUNDWATER

Background

A significant portion of the global water supply can be attributed to groundwater resources. Effective management of such resources requires the collection, management and delivery of related data, but these are impeded by issues related to data availability, distribution, fragmentation, and heterogeneity: collected data are not all readily available and accessible, available data is distributed across many agencies in different sectors, often thematically fragmented, and similar types of data are diversely structured by the various data providers. This situation holds both within and between political entities, such as countries or states, impairing groundwater management across all jurisdictions. The Hydrology Domain Working Group, a Joint Working Group of the WMO and the OGC, promoted the development of GroundWaterML2, a common groundwater data standard, which is the Part 4 of WaterML2, whose primary goal is to capture the semantics, schema, and encoding syntax of key groundwater data, to enable information systems to interoperate with such data. After its adoption as an OGC standard and having tested it successfully into WHOS (WMO Hydrological Observing System) for sharing groundwater information in WIGOS, facilitating groundwater data discovery and access through WIS, the schema WMLGW-XML will complete the standard WaterML2, already adopted in the Manual on Codes Vol. I.3, for the exchange of hydrogeological information groundwater as well.

Proposal

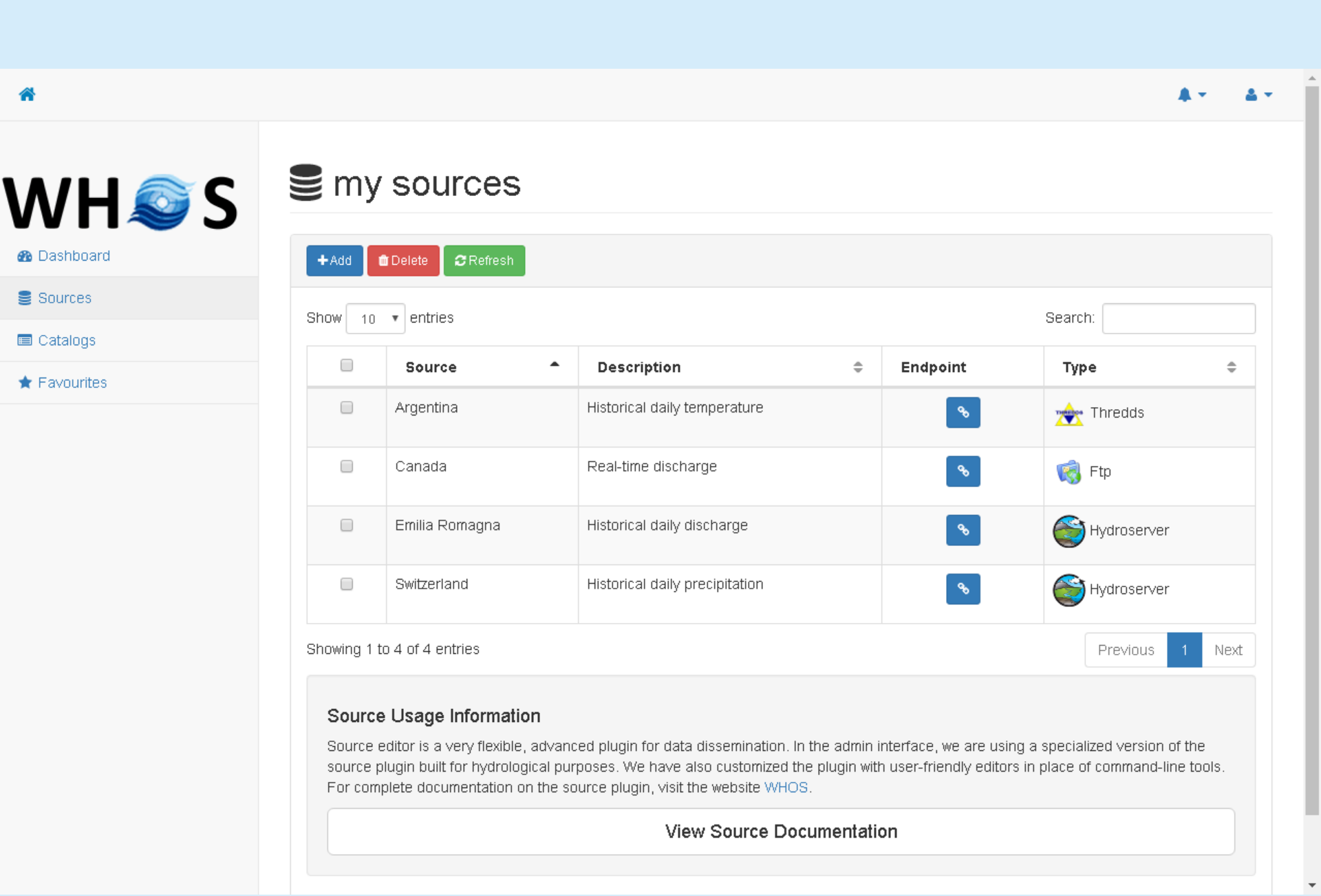
The change to the Manual on Codes Vol. I.3 in attachment is proposed. The team is requested to examine the proposal and the document referenced with the aim to propose the change with the appropriate procedure.

References

[1] https://www.opengeospatial.org/standards/gwml2

[2] https://link.springer.com/article/10.1007/s10040-018-1747-9

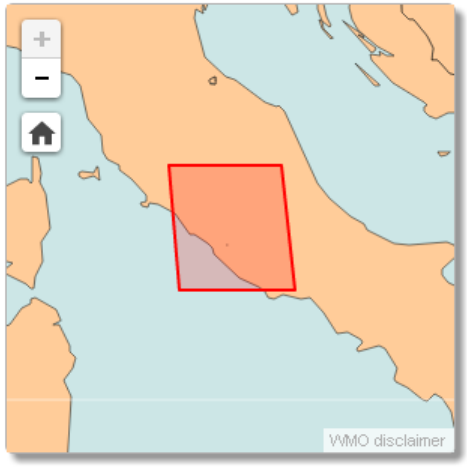
[3] https://link.springer.com/article/10.1186%2Fs40965-018-0058-3


WHOS
Dashboard
Sources
Catalogs
Favourites
my sources
+Add
Delete
Refresh
Show 10 entries
Search:
Source
Description
Endpoint
Type
Argentina
Historical daily temperature
Thredds
Canada
Real-time discharge
Ftp
Emilia Romagna
Historical daily discharge
Hydroserver
Switzerland
Historical daily precipitation
Hydroserver
Showing 1 to 4 of 4 entries
Previous
1
Next
Source Usage Information
Source editor is a very flexible, advanced plugin for data dissemination. In the admin interface, we are using a specialized version of the source plugin built for hydrological purposes. We have also customized the plugin with user-friendly editors in place of command-line tools. For complete documentation on the source plugin, visit the website WHOS.
View Source Documentation

WMO Hydrological Observing System

ITA Lazio

The ultimate goal of data collection in hydrology, be it precipitation measurements, water-level recordings, discharge time series, groundwater monitoring and water quality sampling, is to provide a set of sufficient verified quality data that can be used in water resources management decision-making. Such needs span all aspects of water resources management, in a wide range of operational applications, as well as in research. Decisions may be made directly from raw data measurements, based on derived statistics, or from the results of many stages of modelling beyond the raw data stage. Regardless of any added value though, it is the collected data that form the basis for these decisions. Data sets are of great intrinsic value as they are collected through a huge commitment of human and financial resources and often during a long period of time. Further, they have additional value when they are made available in a usable form for the many users to respond to their specific needs. The portal provides access to the available hydrological observations. In particular, the portal provides additional operational capability, for in situ water observations, as an international registry of hydrological data services catalogued using the standards and procedures of the Open Geospatial Consortium and the World Meteorological Organization.



Brokered services: 1
Brokered sites: 114
Brokered variables: 4
Geographic extent: [11.5989, 42.8942, 13.4633, 41.3422]

WHOS

WMO Hydrological Observing System

Published interfaces

The following catalog interfaces are available:

CUAHSI API interface
Endpoint: *http://arpa-er.geodab.eu/gi-cat-arpa/services/hiscentral/vae113e0745bc4894bd03be86cdae24fe*
Target namespace: *http://hiscentral.cuahsi.org/20100205/*
Capabilities document

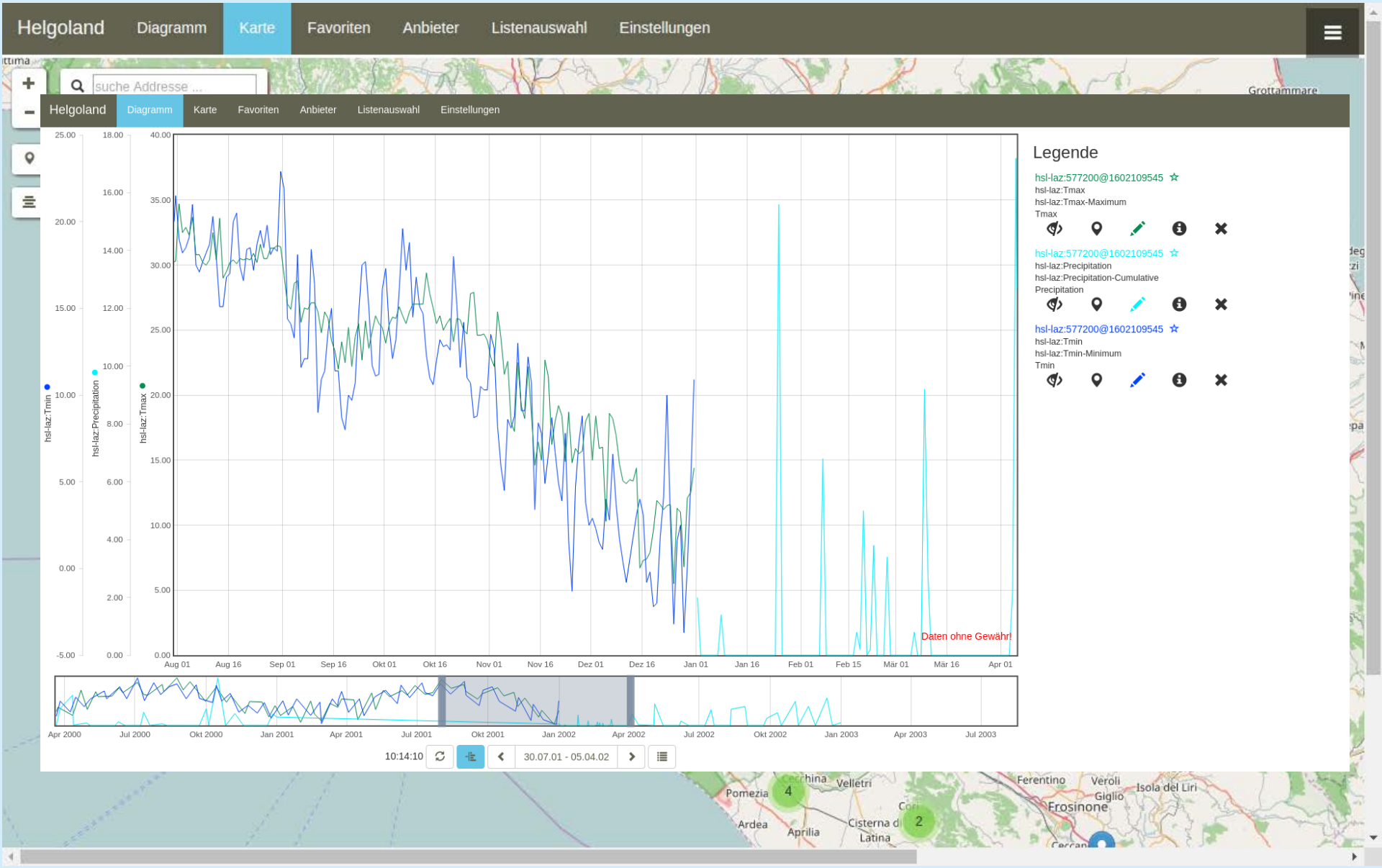
REST interface
Endpoint: *http://arpa-er.geodab.eu/gi-cat-arpa/services/api-rest/vae113e0745bc4894bd03be86cdae24fe/datasets/report*
Capabilities document

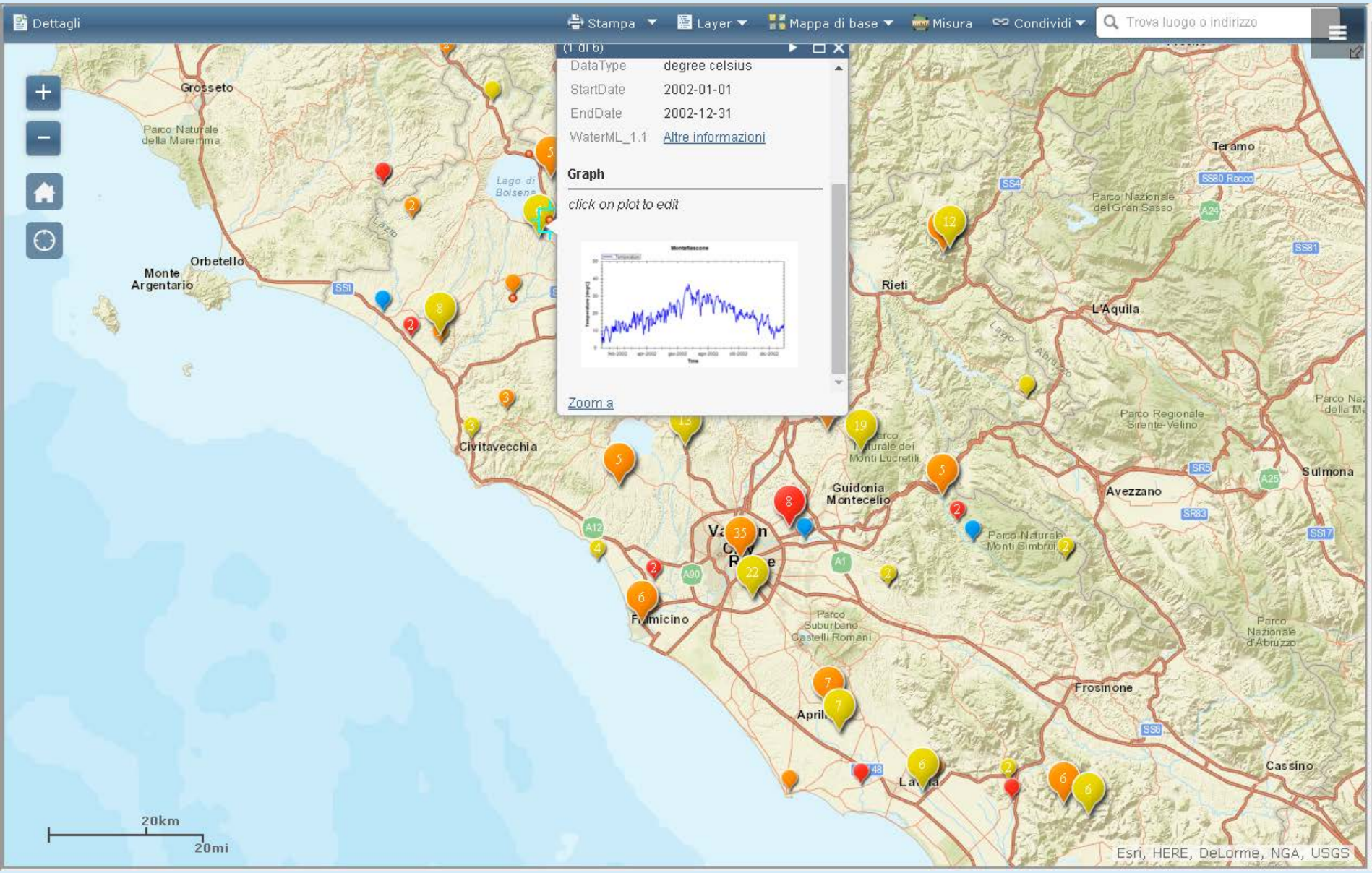
OAIPMH interface
Endpoint: *http://arpa-er.geodab.eu/gi-cat-arpa/services/oaipmh/vae113e0745bc4894bd03be86cdae24fe*
Target namespace: *http://oai_pmh.sdi.floraresearch.eu/*
Capabilities document

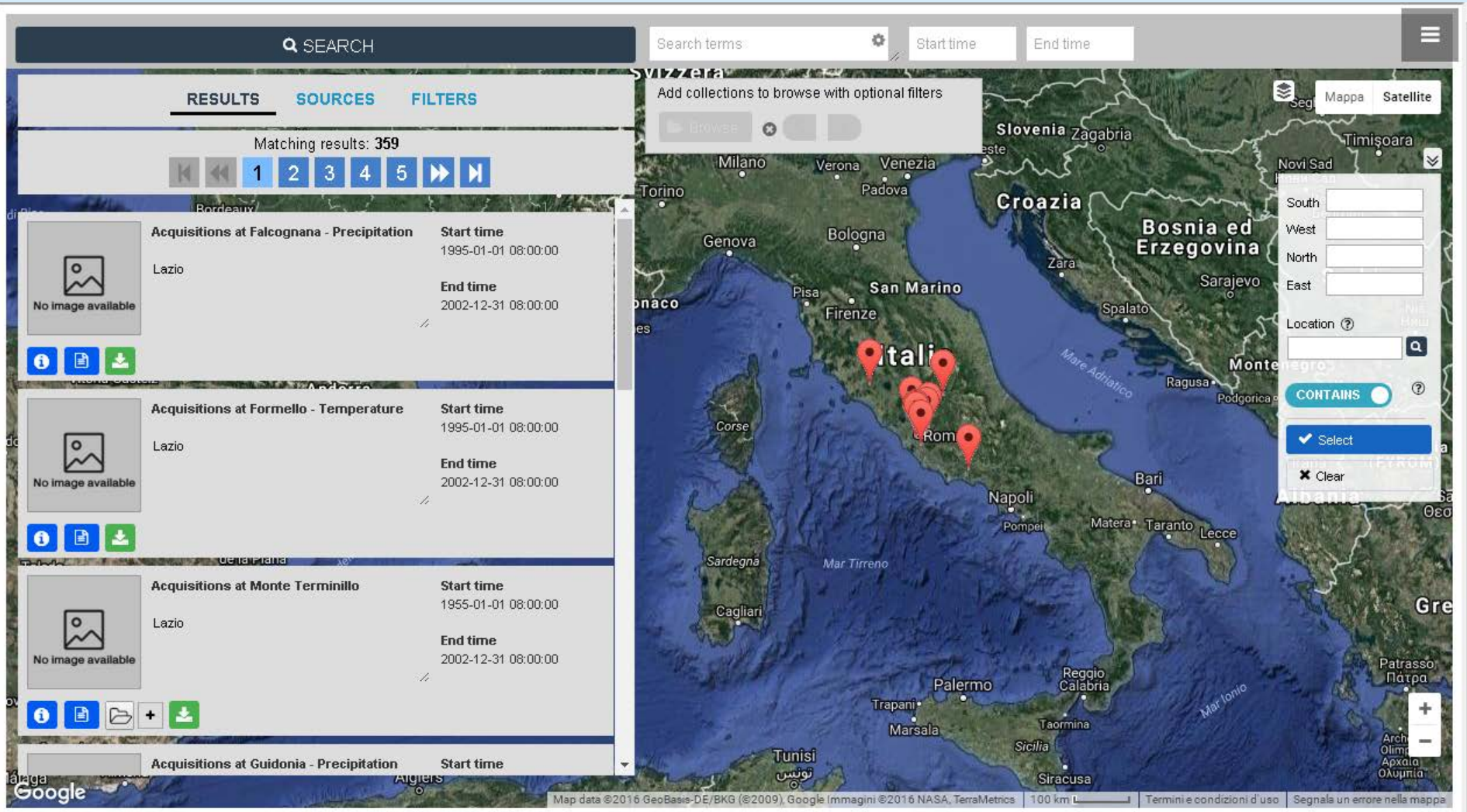
OAIPMH ISO 2007 interface
Endpoint: *http://arpa-er.geodab.eu/gi-cat-arpa/services/oaipmhiso2007/vae113e0745bc4894bd03be86cdae24fe*
Target namespace: *http://oai_pmh.sdi.floraresearch.eu/*
Capabilities document

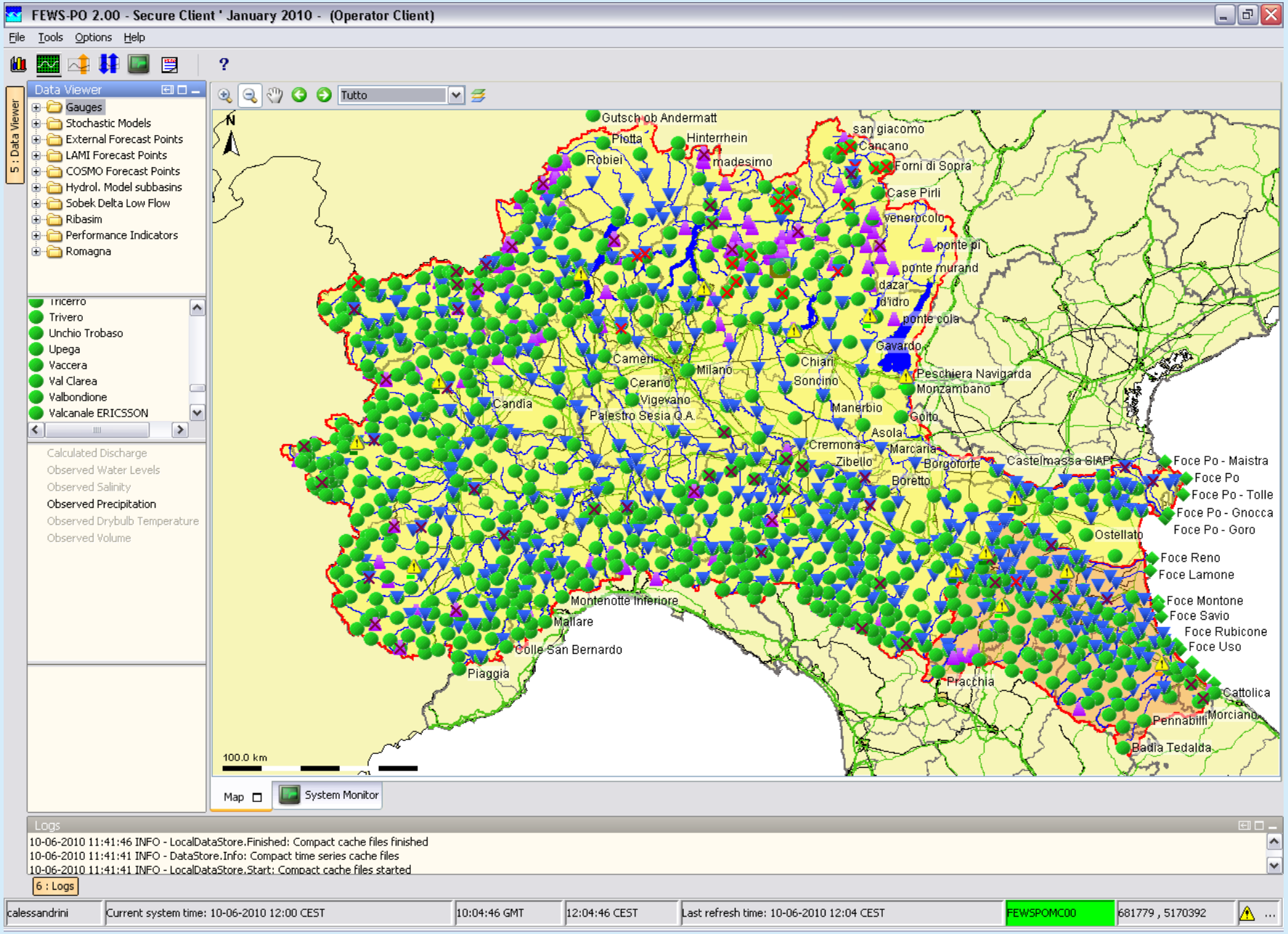
Test Portal interface
Endpoint: *http://arpa-er.geodab.eu/gi-cat-arpa/search?viewId=vae113e0745bc4894bd03be86cdae24fe*
Capabilities document

OPENSEARCH interface
Endpoint: *http://arpa-er.geodab.eu/gi-cat-arpa/services/opensearch/vae113e0745bc4894bd03be86cdae24fe*


Helgoland
Diagramm
Karte
Favoriten
Anbieter
Listenauswahl
Einstellungen
suche Addresse ...
Grottammare
Helgoland
Diagramm
Karte
Favoriten
Anbieter
Listenauswahl
Einstellungen
hsl-laz:Tmin
hsl-laz:Precipitation
hsl-laz:Tmax
Aug 01
Aug 16
Sep 01
Sep 16
Okt 01
Okt 16
Nov 01
Nov 16
Dez 01
Dez 16
Jan 01
Jan 16
Feb 01
Feb 15
Mär 01
Mär 16
Apr 01
Daten ohne Gewähr!
Apr 2000
Jul 2000
Okt 2000
Jan 2001
Apr 2001
Jul 2001
Okt 2001
Jan 2002
Apr 2002
Jul 2002
Okt 2002
Jan 2003
Apr 2003
Jul 2003
10:14:10
30.07.01 - 05.04.02
Legende
hsl-laz:577200@1602109545
hsl-laz:Tmax
hsl-laz:Tmax-Maximum
Tmax
hsl-laz:577200@1602109545
hsl-laz:Precipitation
hsl-laz:Precipitation-Cumulative
Precipitation
hsl-laz:577200@1602109545
hsl-laz:Tmin
hsl-laz:Tmin-Minimum
Tmin
Pomezia
Velletri
Ardea
Aprilia
Cisterna di Latina
Ferentino
Veroli
Giglio
Isola del Liri
Frosinone


Dettagli
Stampa
Layer
Mappa di base
Misura
Condividi
Trova luogo o indirizzo
(1 di 6)
DataType degree celsius
StartDate 2002-01-01
EndDate 2002-12-31
WaterML_1.1 Altre informazioni
Graph
click on plot to edit
Zoom a
Grosseto
Parco Naturale della Maremma
Orbetello
Monte Argentario
Civitavecchia
Lago di Bolsena
Lazio
Rieti
L'Aquila
Teramo
Parco Nazionale del Gran Sasso
Parco Regionale Sirente-Velino
Parco Naturale dei Monti Lucretili
Guidonia Montecelio
Avezzano
Sulmona
Parco Naturale Monti Simbruini
Parco Suburbano Castelli Romani
Parco Nazionale d'Abruzzo
Frosinone
Cassino
20km
20mi
Esri, HERE, DeLorme, NGA, USGS


SEARCH
Search terms
Start time
End time
RESULTS
SOURCES
FILTERS
Matching results: 359
1
2
3
4
5
Acquisitions at Falcognana - Precipitation
Start time
1995-01-01 08:00:00
Lazio
End time
2002-12-31 08:00:00
No image available
Acquisitions at Formello - Temperature
Start time
1995-01-01 08:00:00
Lazio
End time
2002-12-31 08:00:00
No image available
Acquisitions at Monte Terminillo
Start time
1955-01-01 08:00:00
Lazio
End time
2002-12-31 08:00:00
No image available
Acquisitions at Guidonia - Precipitation
Start time
Add collections to browse with optional filters
Browse
Mappa
Satellite
South
West
North
East
Location
CONTAINS
Select
Clear
Milano
Verona
Venezia
Padova
Torino
Genova
Bologna
Pisa
San Marino
Firenze
Roma
Corse
Sardegna
Mar Tirreno
Cagliari
Napoli
Pompei
Bari
Matera
Taranto
Lecce
Palermo
Trapani
Marsala
Reggio Calabria
Taormina
Sicilia
Siracusa
Tunisi
Croazia
Slovenia
Zagabria
Timişoara
Novi Sad
Bosnia ed Erzegovina
Zara
Sarajevo
Spalato
Ragusa
Podgorica
Mare Adriatico
Mar Ionio
Patrasso
Πάτρα
Google
Map data ©2016 GeoBasis-DE/BKG (©2009), Google Immagini ©2016 NASA, TerraMetrics
100 km
Termini e condizioni d'uso
Segnala un errore nella mappa


FEWS-PO 2.00 - Secure Client ' January 2010 - (Operator Client)
File Tools Options Help
5 : Data Viewer
Data Viewer
Gauges
Stochastic Models
External Forecast Points
LAMI Forecast Points
COSMO Forecast Points
Hydrol. Model subbasins
Sobek Delta Low Flow
Ribasim
Performance Indicators
Romagna
Tricerro
Trivero
Unchio Trobaso
Upega
Vaccera
Val Clarea
Valbondione
Valcanale ERICSSON
Calculated Discharge
Observed Water Levels
Observed Salinity
Observed Precipitation
Observed Drybulb Temperature
Observed Volume
Tutto
N
Gutsch ob Andermatt
Piotta
Hinterrhein
Robiei
madesimo
san giacomo
Cancano
Forni di Sopra
Case Pirli
venerocolo
ponte pi
ponte murand
dazar
d'idro
ponte cola
Gavardo
Cameri
Milano
Cerano
Vigevano
Palestro Sesia Q.A.
Candia
Chiari
Soncino
Peschiera Navigarda
Monzambano
Manerbio
Golto
Asola
Cremona
Marcaria
Zibello
Borgoforte
Castelmassa SIAP
Boretto
Foce Po - Maistra
Foce Po
Foce Po - Tolle
Foce Po - Gnocca
Foce Po - Goro
Ostellato
Foce Reno
Foce Lamone
Foce Montone
Foce Savio
Foce Rubicone
Foce Uso
Montenotte Inferiore
Mallare
Colle San Bernardo
Piaggia
Pracchia
Cattolica
Morciano
Pennabilli
Badia Tedalda
100.0 km
Map
System Monitor
Logs
10-06-2010 11:41:46 INFO - LocalDataStore.Finished: Compact cache files finished
10-06-2010 11:41:41 INFO - DataStore.Info: Compact time series cache files
10-06-2010 11:41:41 INFO - LocalDataStore.Start: Compact cache files started
6 : Logs
calessandrini
Current system time: 10-06-2010 12:00 CEST
10:04:46 GMT
12:04:46 CEST
Last refresh time: 10-06-2010 12:04 CEST
FEWSPOMC00
681779 , 5170392

Import data from a WaterML2 webserver

WaterML2 Server import

Here is an example import module configuration file that imports data from a WaterMl2 webserver:

```
<?xml version="1.0" encoding="UTF-8"?>
<timeSeriesImportRun xmlns="http://www.wldelft.nl/fews"
                     xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
                     xsi:schemaLocation="http://www.wldelft.nl/fews http://fews.wldelft.nl/schemas/version1.0/timeSeriesImportRun.xsd">
    <!-- This is an example import configuration file for importing WaterML data from a WaterMl server    -->
    <import>
        <general>
           <!-- Class name of WaterML server parser -->
            <parserClassName>nl.wldelft.waterml.timeseriesparsers.WaterMlServerParser</parserClassName>

            <!-- Path to directory containing libraries -->
            <binDir>%REGION_HOME%/Modules/waterml-bin</binDir>

            <!-- Directory from which CSV files are to be imported -->
            <serverUrl>http://nwisvaws02.er.usgs.gov/ogc-swie/wml2/uv/sos</serverUrl>
            <idMapId>IdImportWaterML2_usgs</idMapId>
            <importTimeZone>
                <timeZoneOffset>-06:00</timeZoneOffset>
            </importTimeZone>
        </general>
        <timeSeriesSet>
            <moduleInstanceId>ImportWaterML2_usgs</moduleInstanceId>
            <valueType>scalar</valueType>
            <parameterId>MyPar</parameterId>
            <locationSetId>MyLocSet</locationSetId>
            <timeSeriesType>external historical</timeSeriesType>
            <timeStep unit="nonequidistant"/>
            <readWriteMode>add originals</readWriteMode>
            <synchLevel>1</synchLevel>
        </timeSeriesSet>
    </import>
</timeSeriesImportRun>
```

Import WaterML2 data from a directory

WaterML2 file import

Here is an example import module configuration file that imports data from a directory

```
<?xml version="1.0" encoding="UTF-8"?>
<timeSeriesImportRun xmlns="http://www.wldelft.nl/fews"
                     xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
                     xsi:schemaLocation="http://www.wldelft.nl/fews http://fews.wldelft.nl/schemas/version1.0/timeSeriesImportRun.xsd">
    <!-- This is an example import configuration file for importing WaterML data from a WaterMl server    -->
    <import>
        <general>
           <!-- Class name of WaterML server parser -->
            <parserClassName>nl.wldelft.waterml.timeseriesparsers.WaterMlTimeSeriesParser</parserClassName>

            <!-- Path to directory containing libraries -->
            <binDir>%REGION_HOME%/Modules/waterml-bin</binDir>

            <!-- Directory from which CSV files are to be imported -->
        <folder>$IMPORT_FOLDER_WATERML$</folder>
            <idMapId>IdImportWaterML2_usgs</idMapId>
            <importTimeZone>
                <timeZoneOffset>-06:00</timeZoneOffset>
            </importTimeZone>
        </general>
        <timeSeriesSet>
            <moduleInstanceId>ImportWaterML2_usgs</moduleInstanceId>
            <valueType>scalar</valueType>
            <parameterId>MyPar</parameterId>
            <locationSetId>MyLocSet</locationSetId>
            <timeSeriesType>external historical</timeSeriesType>
            <timeStep unit="nonequidistant"/>
            <readWriteMode>add originals</readWriteMode>
            <synchLevel>1</synchLevel>
        </timeSeriesSet>
    </import>
</timeSeriesImportRun>
```

Archive use case analysis

Event analysis

Event review/ inquiry

Simulation results

Post event reports

Communication notes

Forecast Products

Initial model state

Model run settings

NWP forecasts

Rating Curves

Observations

Model setup

Model verification

Model calibration

Informative event

Training materials

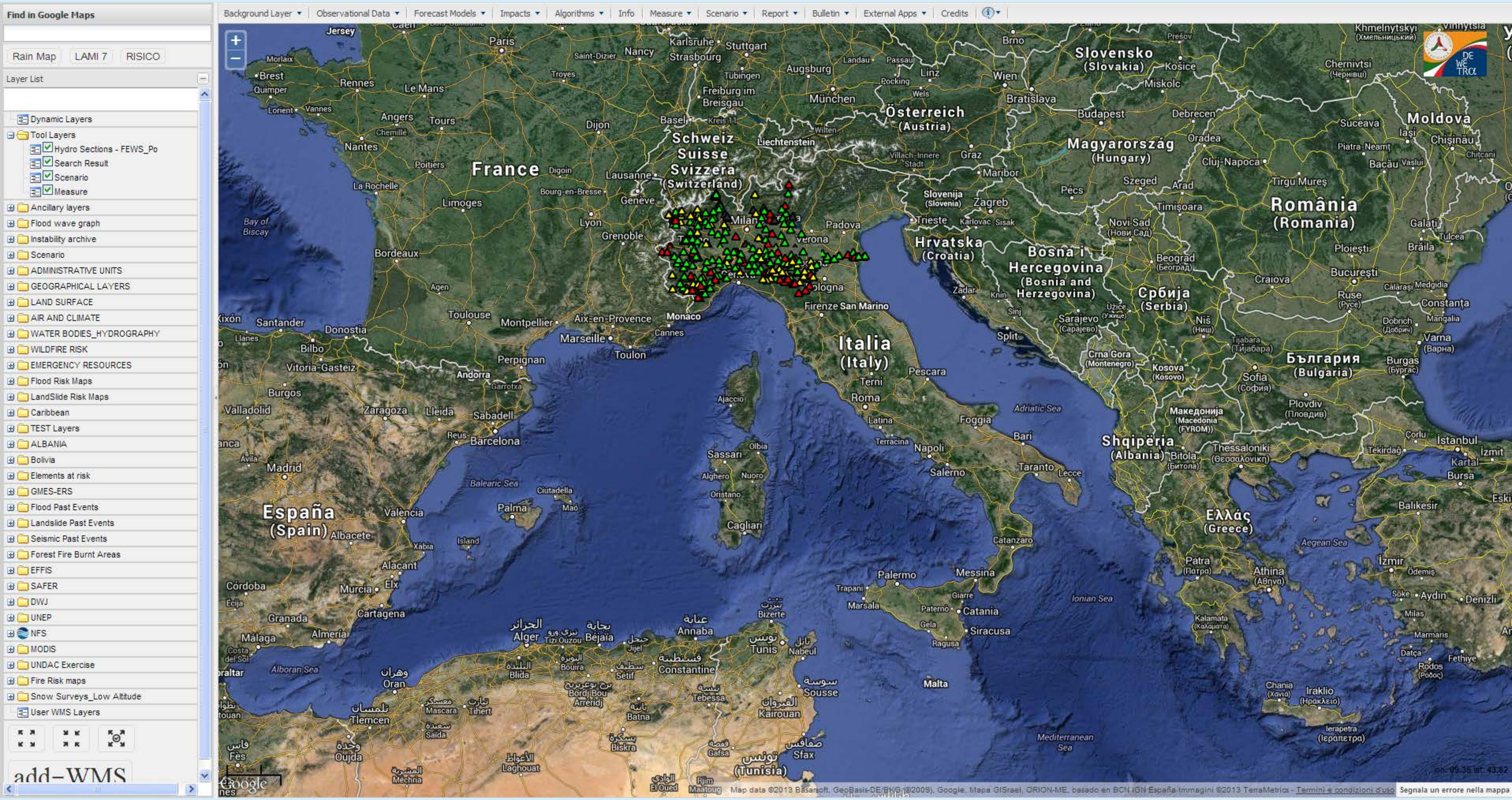
Data types:

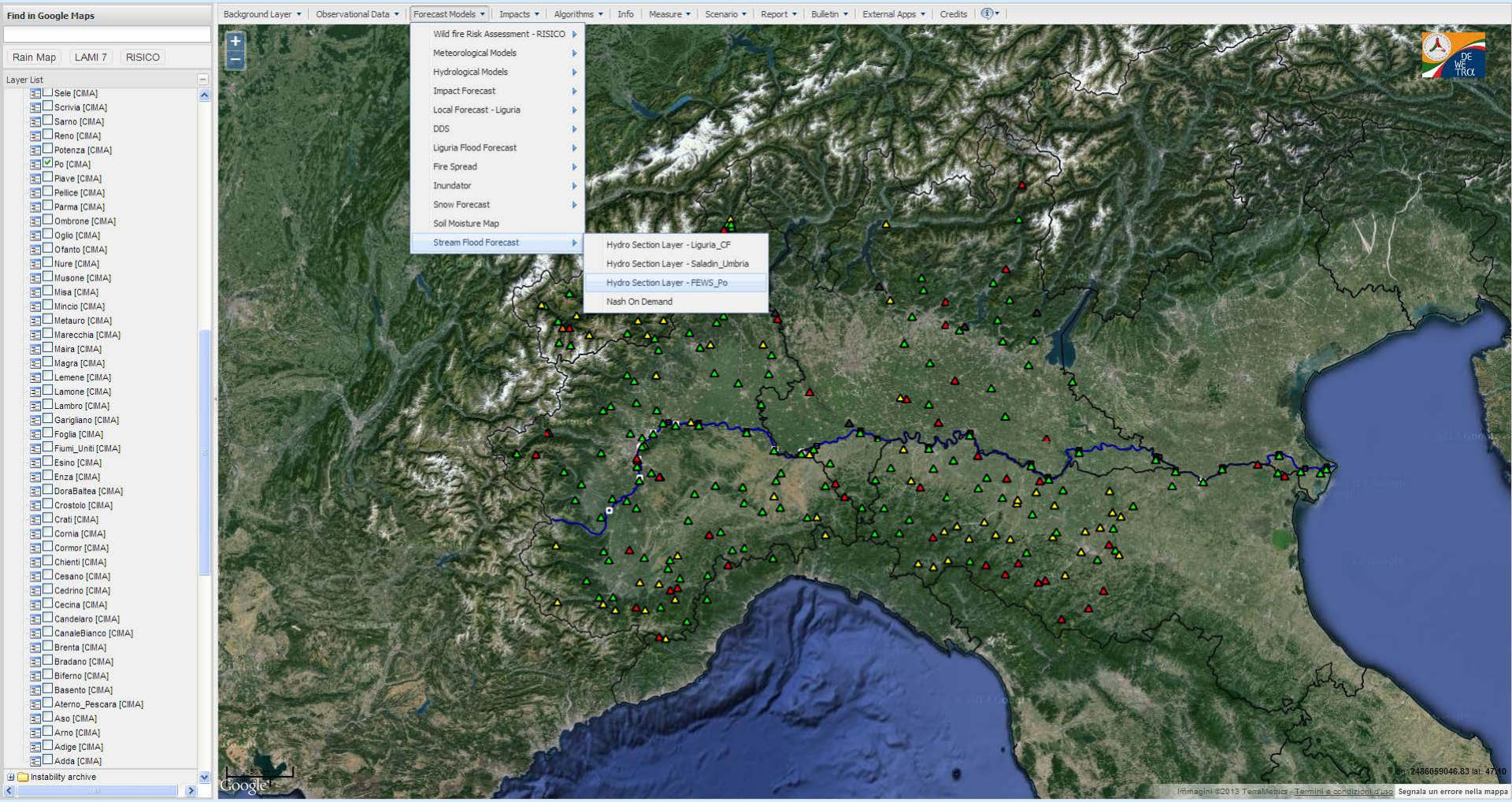
Time series

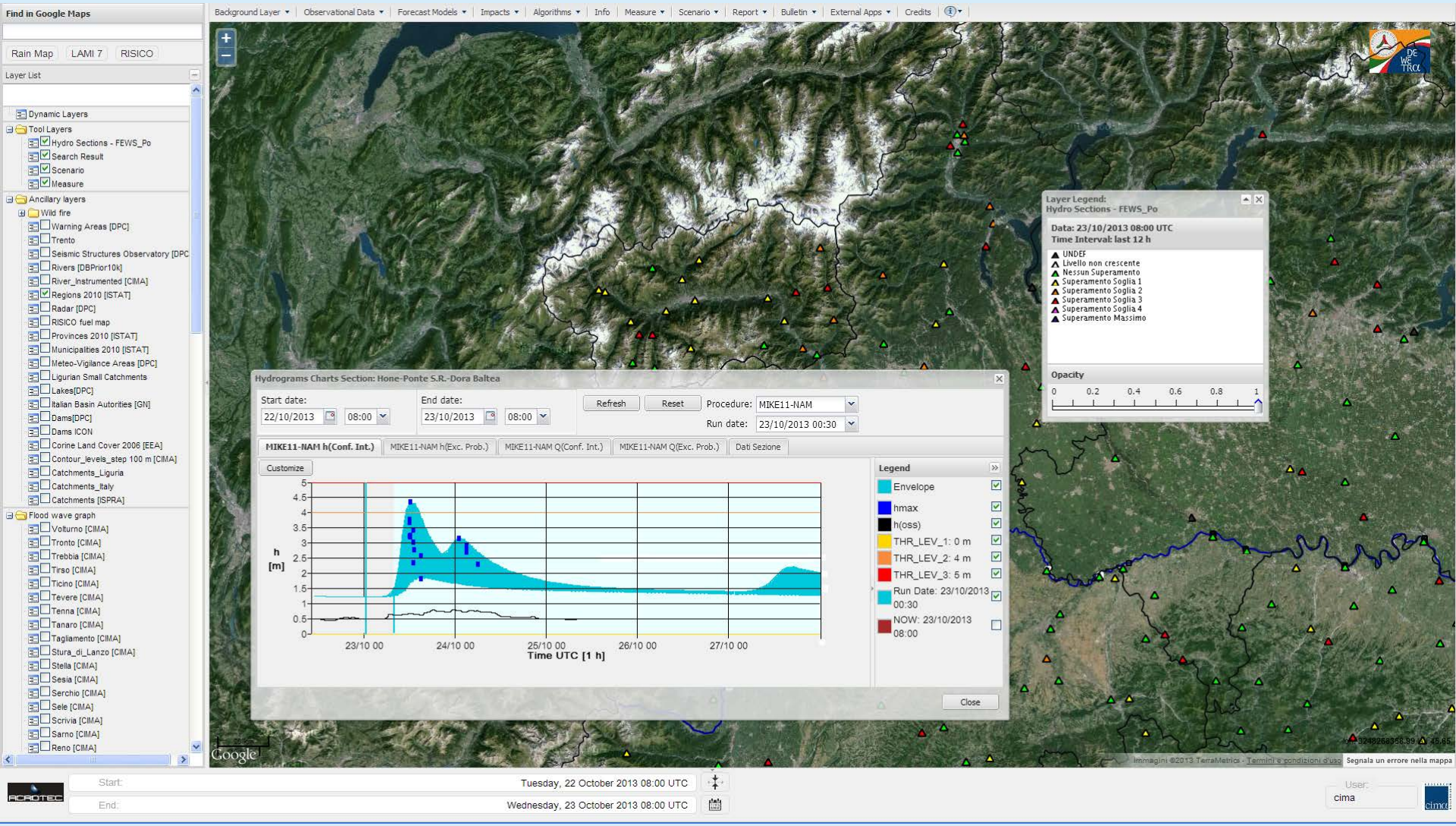
Model data (native)

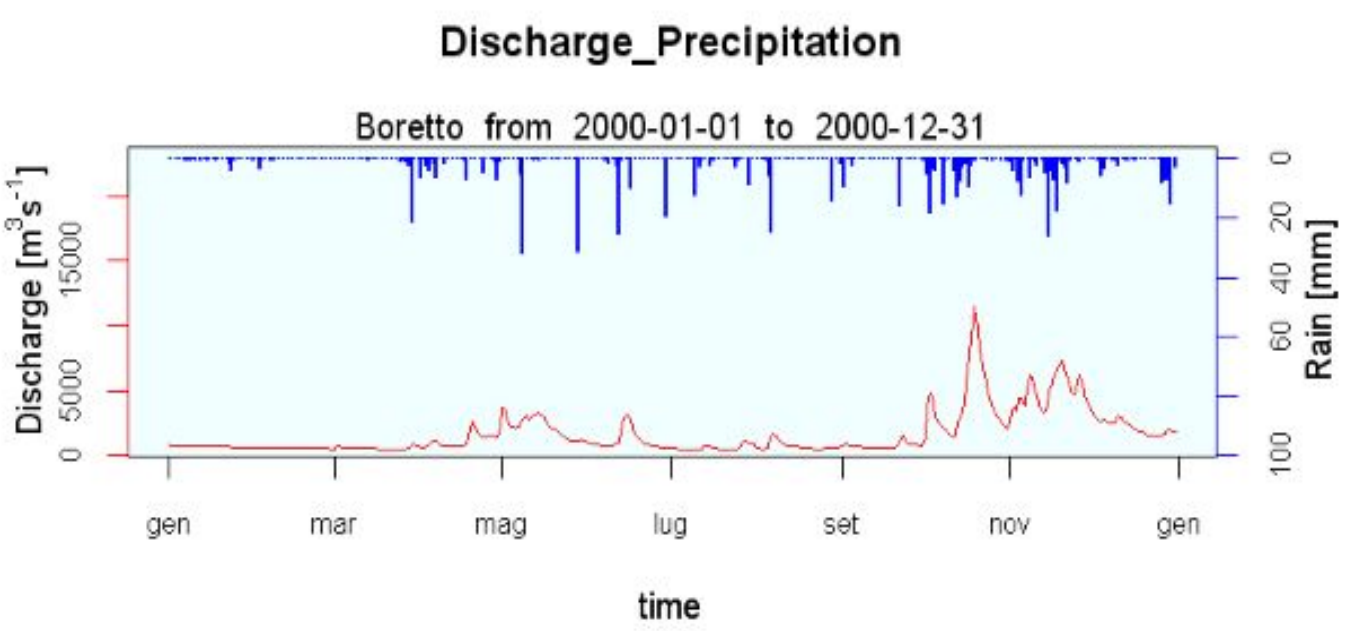
Documents & images

DEWETRA and the Po river basin

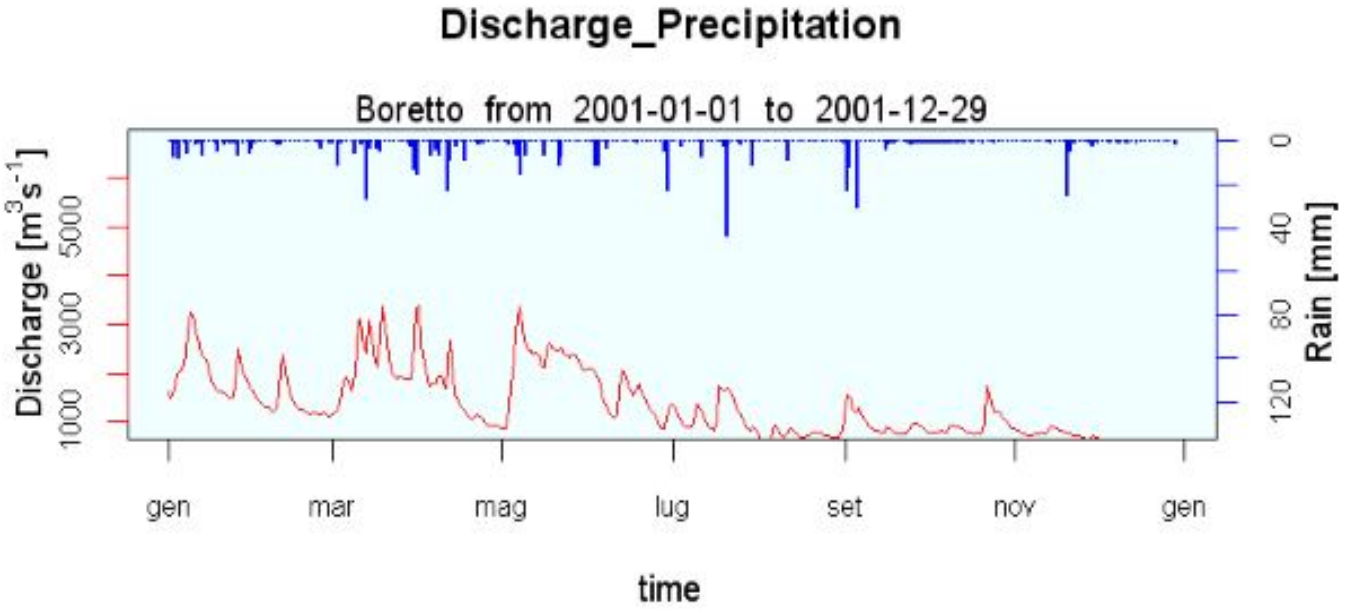



Find in Google Maps
Rain Map
LAMI 7
RISICO
Layer List
Sele [CIMA]
Scrivia [CIMA]
Sarno [CIMA]
Reno [CIMA]
Potenza [CIMA]
Po [CIMA]
Piave [CIMA]
Pellice [CIMA]
Parma [CIMA]
Ombrone [CIMA]
Oglio [CIMA]
Ofanto [CIMA]
Nure [CIMA]
Musone [CIMA]
Misa [CIMA]
Mincio [CIMA]
Metauro [CIMA]
Marecchia [CIMA]
Maira [CIMA]
Magra [CIMA]
Lemene [CIMA]
Lamone [CIMA]
Lambro [CIMA]
Garigliano [CIMA]
Foglia [CIMA]
Fiumi_Uniti [CIMA]
Esino [CIMA]
Enza [CIMA]
DoraBaltea [CIMA]
Crostolo [CIMA]
Crati [CIMA]
Cornia [CIMA]
Cormor [CIMA]
Chienti [CIMA]
Cesano [CIMA]
Cedrino [CIMA]
Cecina [CIMA]
Candelaro [CIMA]
CanaleBianco [CIMA]
Brenta [CIMA]
Bradano [CIMA]
Biferno [CIMA]
Basento [CIMA]
Aterno_Pescara [CIMA]
Aso [CIMA]
Arno [CIMA]
Adige [CIMA]
Adda [CIMA]
Instability archive
Background Layer
Observational Data
Forecast Models
Impacts
Algorithms
Info
Measure
Scenario
Report
Bulletin
External Apps
Credits
Wild fire Risk Assessment - RISICO
Meteorological Models
Hydrological Models
Impact Forecast
Local Forecast - Liguria
DDS
Liguria Flood Forecast
Fire Spread
Inundator
Snow Forecast
Soil Moisture Map
Stream Flood Forecast
Hydro Section Layer - Liguria_CF
Hydro Section Layer - Saladin_Umbria
Hydro Section Layer - FEWS_Po
Nash On Demand
Google
Immagini ©2013 TerraMetrics - Termini e condizioni d'uso
Segnala un errore nella mappa


Find in Google Maps
Rain Map
LAMI 7
RISICO
Layer List
Dynamic Layers
Tool Layers
Hydro Sections - FEWS_Po
Search Result
Scenario
Measure
Ancillary layers
Wild fire
Warning Areas [DPC]
Trento
Seismic Structures Observatory [DPC]
Rivers [DBPrior10k]
River_Instrumented [CIMA]
Regions 2010 [ISTAT]
Radar [DPC]
RISICO fuel map
Provinces 2010 [ISTAT]
Municipalities 2010 [ISTAT]
Meteo-Vigilance Areas [DPC]
Ligurian Small Catchments
Lakes[DPC]
Italian Basin Autorities [GN]
Dams[DPC]
Dams ICON
Corine Land Cover 2006 [EEA]
Contour_levels_step 100 m [CIMA]
Catchments_Liguria
Catchments_Italy
Catchments [ISPRA]
Flood wave graph
Volturno [CIMA]
Tronto [CIMA]
Trebbia [CIMA]
Tirso [CIMA]
Ticino [CIMA]
Tevere [CIMA]
Tenna [CIMA]
Tanaro [CIMA]
Tagliamento [CIMA]
Stura_di_Lanzo [CIMA]
Stella [CIMA]
Sesia [CIMA]
Serchio [CIMA]
Sele [CIMA]
Scrivia [CIMA]
Sarno [CIMA]
Reno [CIMA]
Background Layer
Observational Data
Forecast Models
Impacts
Algorithms
Info
Measure
Scenario
Report
Bulletin
External Apps
Credits
Layer Legend:
Hydro Sections - FEWS_Po
Data: 23/10/2013 08:00 UTC
Time Interval: last 12 h
UNDEF
Livello non crescente
Nessun Superamento
Superamento Soglia 1
Superamento Soglia 2
Superamento Soglia 3
Superamento Soglia 4
Superamento Massimo
Opacity
0
0.2
0.4
0.6
0.8
1
Hydrograms Charts Section: Hone-Ponte S.R.-Dora Baltea
Start date:
22/10/2013
08:00
End date:
23/10/2013
08:00
Refresh
Reset
Procedure:
MIKE11-NAM
Run date:
23/10/2013 00:30
MIKE11-NAM h(Conf. Int.)
MIKE11-NAM h(Exc. Prob.)
MIKE11-NAM Q(Conf. Int.)
MIKE11-NAM Q(Exc. Prob.)
Dati Sezione
Customize
h [m]
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
23/10 00
24/10 00
25/10 00
26/10 00
27/10 00
Time UTC [1 h]
Legend
Envelope
hmax
h(oss)
THR_LEV_1: 0 m
THR_LEV_2: 4 m
THR_LEV_3: 5 m
Run Date: 23/10/2013 00:30
NOW: 23/10/2013 08:00
Close
Google
Segnala un errore nella mappa
Start:
Tuesday, 22 October 2013 08:00 UTC
End:
Wednesday, 23 October 2013 08:00 UTC
User:
cima



L'utente può scaricare i dati e visualizzare in diverse modalità le elaborazioni di interesse



Amministrazioni Regionali e Statali in Idrologia Operativa

ISPRA
Istituto Superiore per la Protezione e la Ricerca Ambientale

WHOS
WMO Hydrological Observing System

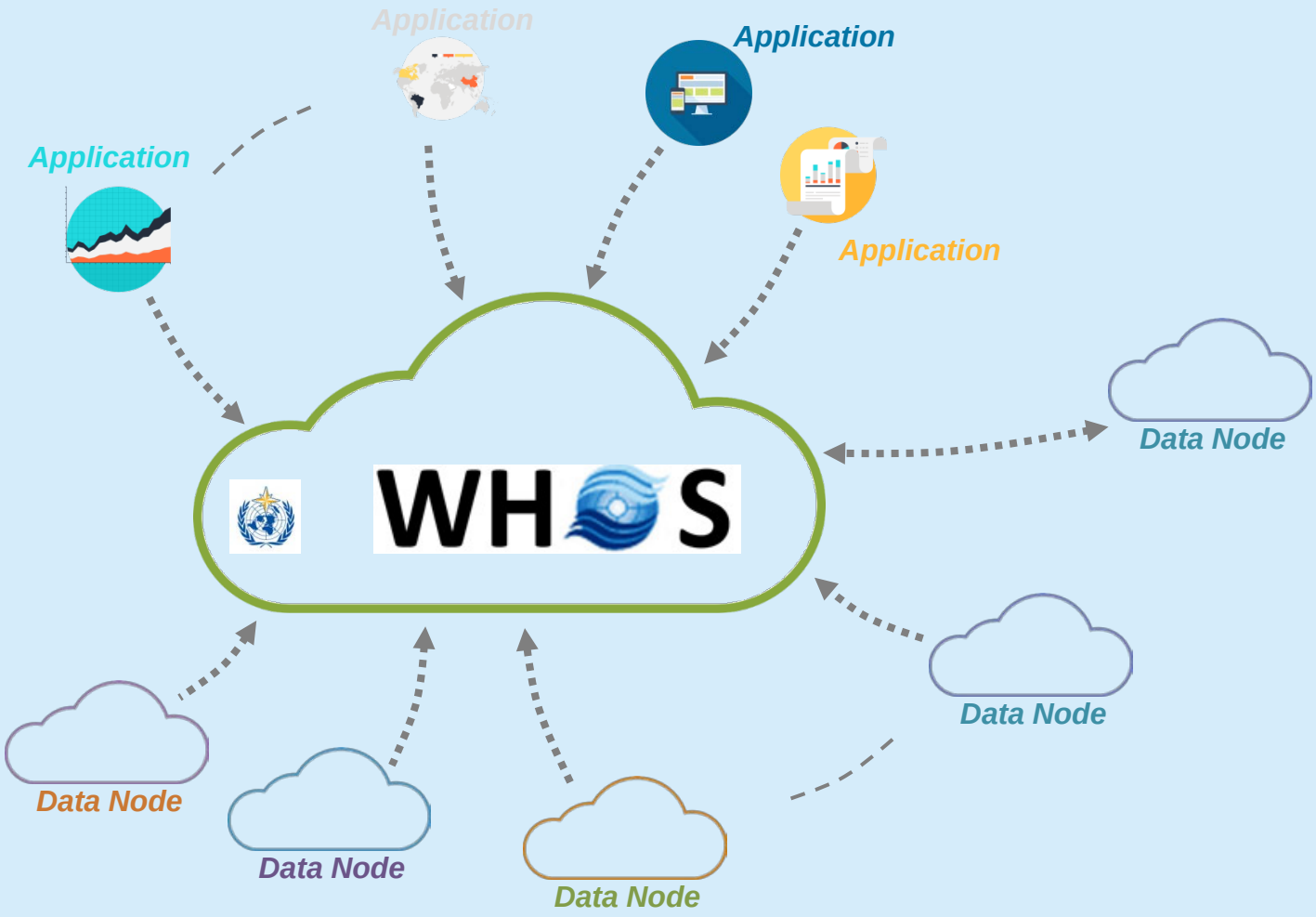
Home | Services | Tools | About

WMO

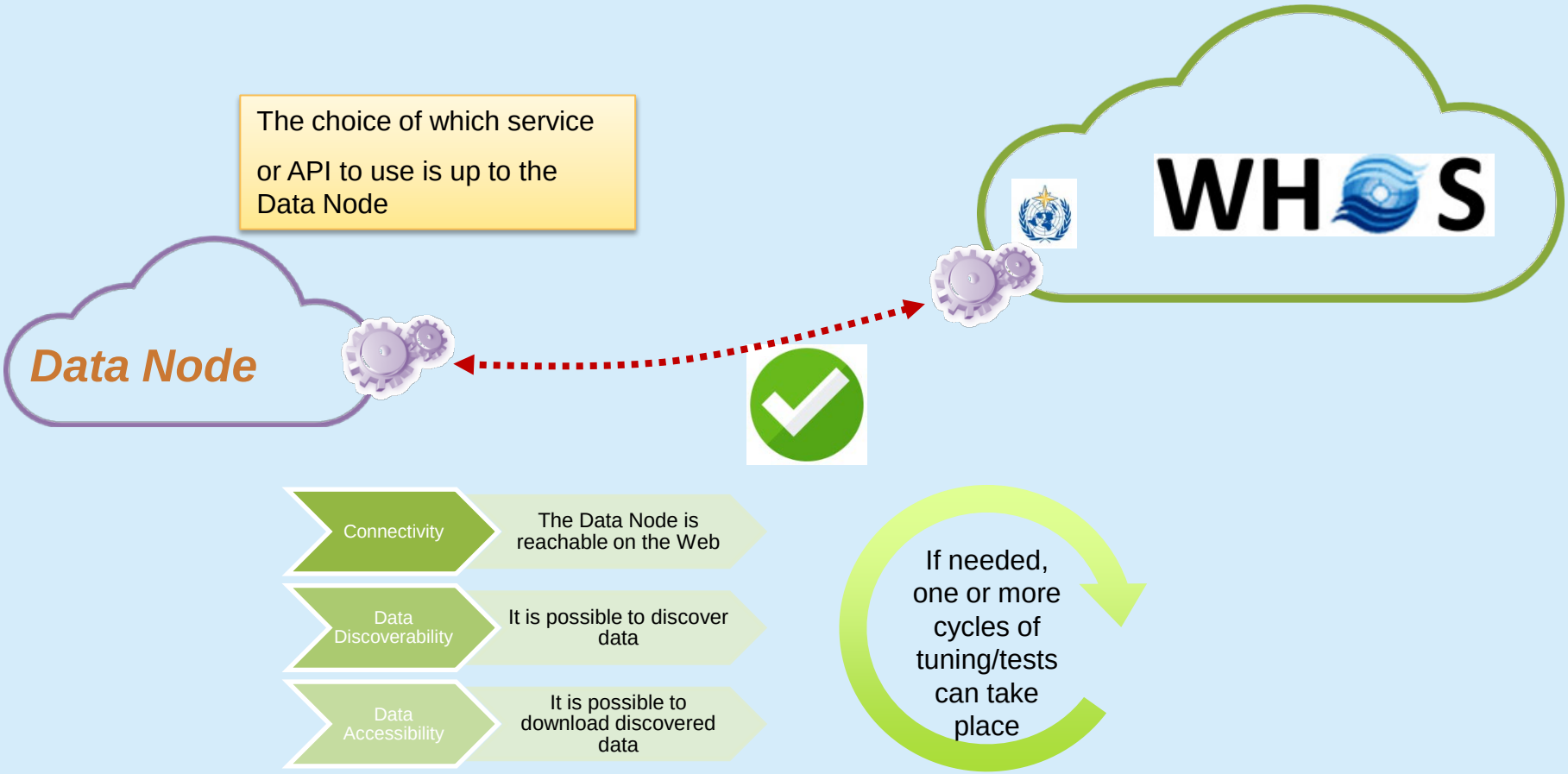
Brokered services

Data Service Title	Observation Network Name	WSDL	CreatedDate	Organization	Status	Earliest Start Date	Latest End Date
Provincia Autonoma di Bolzano	Provincia di Bolzano	WSDL	2013.09.04	Provincia Autonoma di Bolzano - Ripartizione Protezione anticendi e civile - Ufficio Idrografico		1920.01.01	1999.01.01
Regione Abruzzo	Regione Abruzzo	WSDL	2013.09.04	Dipartimento Opere Pubbliche, Governo del Territorio e Politiche Ambientali, Servizio Emergenza di Protezione Civile, Ufficio Idrografico Mareografico (PE), Gestione Colonna Mobile		1921.01.01	2014.11.30
Regione Basilicata	Regione Basilicata	WSDL	2013.09.04	Protezione Civile Regione Basilicata		2001.01.01	2014.11.29
Regione Calabria	Regione Calabria	WSDL	2013.09.04	ARPACAL - Centro Funzionale Multirischi		1900.01.01	2014.10.31
Regione Campania	Regione Campania	WSDL	2013.09.04	Centro Funzionale Regione Campania - CEMPID		1995.01.01	2014.12.31
Regione Emilia Romagna	Regione Emilia Romagna	WSDL	2013.02.28	ARPA Emilia Romagna		1918.01.01	2014.12.31
Regione Friuli Venezia Giulia	Regione Friuli Venezia Giulia	WSDL	2013.09.04	Regione Autonoma Friuli Venezia Giulia		1912.01.01	2012.12.31
Regione Lazio	Regione Lazio	WSDL	2013.09.04	Regione Lazio - Centro Funzionale Regionale		1921.01.01	2004.12.31
Regione Liguria	Regione Liguria	WSDL	2013.09.04	ARPA Liguria - Centro Funzionale Meteo Idrologico di Protezione Civile		1913.01.01	2009.12.31
Regione Lombardia	Regione Lombardia	WSDL	2013.09.04	U.O. Servizio Meteorologico e Rete Idro-Meteo regionale		1763.01.01	2014.11.25
Regione Marche	Regione Marche	WSDL	2013.09.04	Dipartimento per le politiche integrate di sicurezza e per la protezione civile della Regione Marche - Centro Funzionale		1928.01.30	2013.12.31
Regione Molise	Regione Molise	WSDL	2013.09.04	Agenzia Regionale di Protezione Civile - Centro Funzionale del Molise		2007.01.01	2014.12.31
Regione Piemonte	Regione Piemonte	WSDL	2013.09.04	Arpa Piemonte - Agenzia Regionale per la Protezione Ambientale del Piemonte - Dipartimento Sistemi Previsionali		1987.09.25	2013.12.31
Regione Puglia	Regione Puglia	WSDL	2013.09.04	Centro Funzionale - Servizio Protezione Civile		2004.01.01	2004.12.31
Regione Sardegna	Regione Sardegna	WSDL	2013.09.04	ARDIS - Servizio Tutela e Gestione delle Risorse Idriche, vigilanza sui servizi idrici e gestione delle siccità		1920.01.01	2008.12.31
Regione Sicilia	Regione Sicilia	WSDL	2013.09.04	Regione Siciliana - Osservatorio delle Acque		1916.01.01	2008.12.31
Regione Toscana	Regione Toscana	WSDL	2013.09.04	Servizio Idrologico - Centro Funzionale		1916.01.01	2015.03.31
Regione Valle d'Aosta	Regione Valle d'Aosta	WSDL	2013.09.04	Assessorato opere pubbliche, difesa del suolo e edilizia residenziale pubblica - Centro funzionale regionale		1994.12.31	2013.12.31
Regione Veneto	Regione Veneto	WSDL	2013.09.04	Agenzia Regionale per la Prevenzione e Protezione Ambientale del Veneto		1992.01.01	2013.12.31

WHOS System Overview



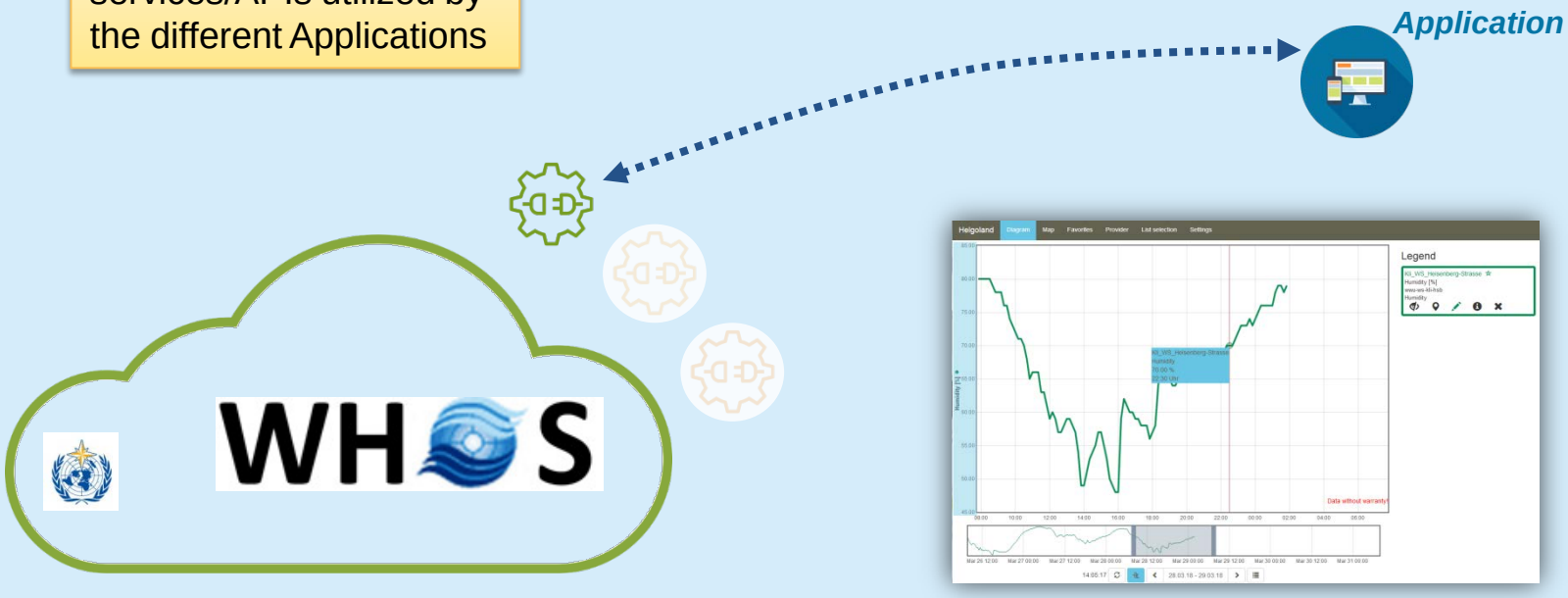
Brokering a Data Node



Connecting an Application

The System must support required services/APIs utilized by the different Applications

Applications will interact with the System as if it was a single server

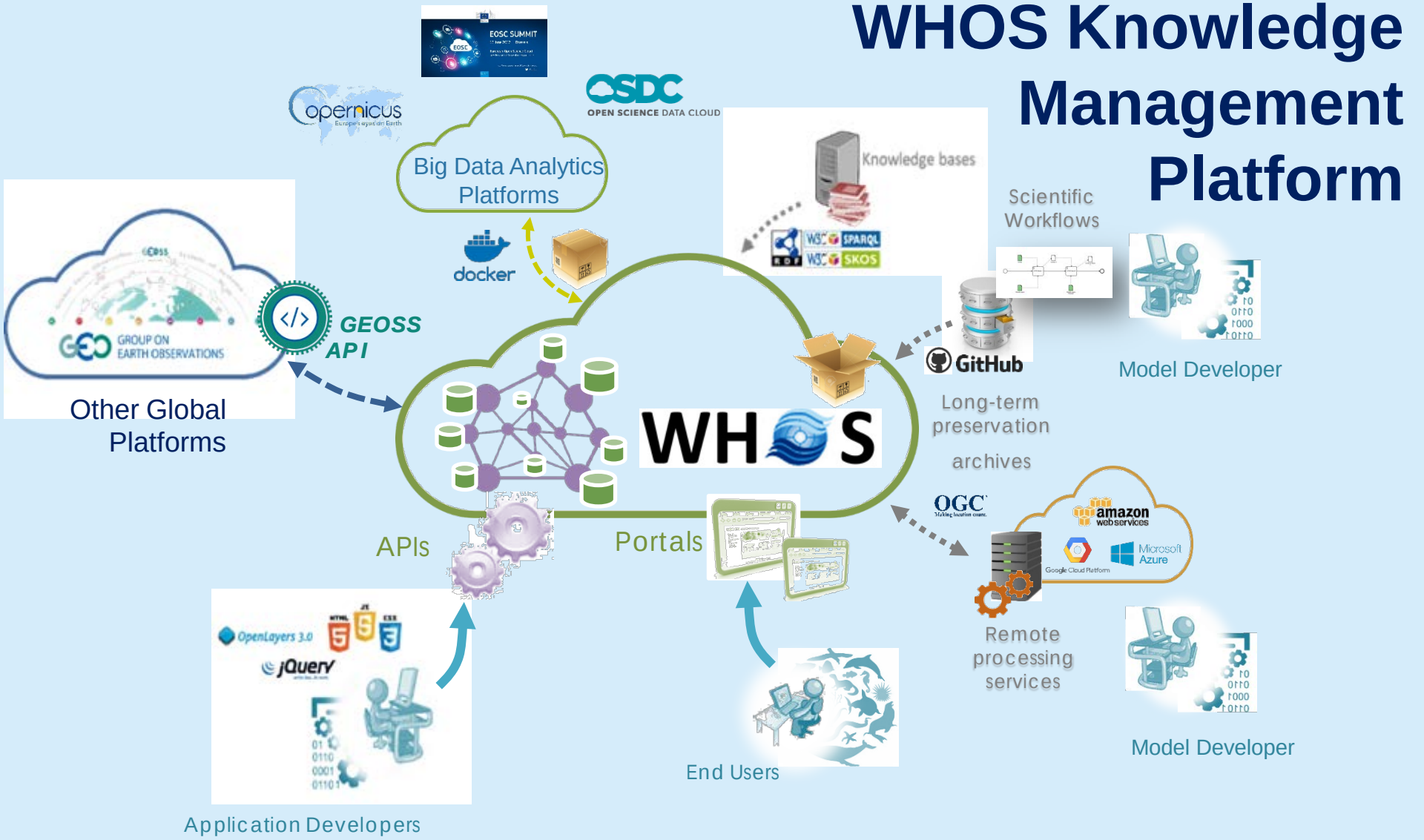


Publishes a set of web services/APIs

Can use any service/API to connect to the System

Accesses the entire content of the System and displays it to user

WHOS Knowledge Management Platform

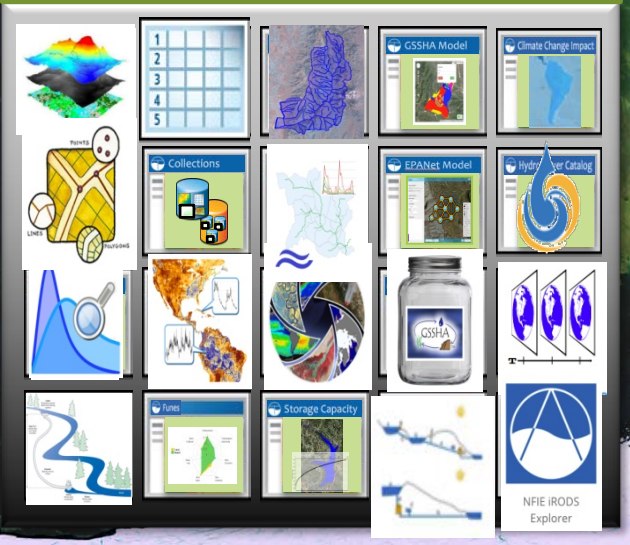


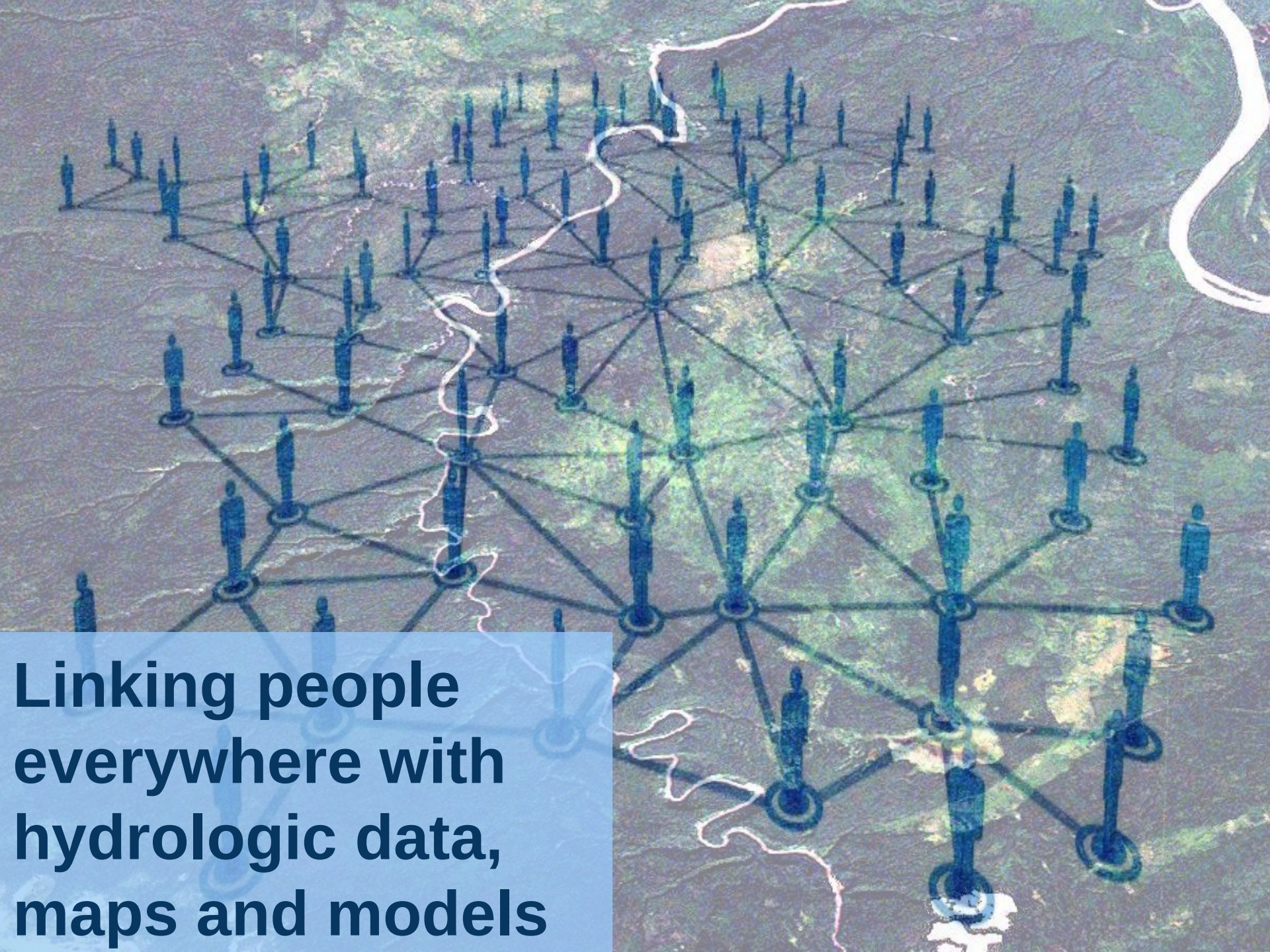
ITALIAN NHS PORTAL

REGIONAL WATER PORTAL

BASIN DISTRICT PORTAL

APP WAREHOUSE





Linking people everywhere with hydrologic data, maps and models

GRAZIE PER L'ATTENZIONE

insieme per l'Idrologia Operativa del nostro Paese nel Mondo