WEATHER CLIMATE WATER
TEMPS CLIMAT EAU

WHOS IMPLEMENTATION IN RA VI

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Vice-President of CHy

WMO RA VI Hydrology Forum, 2 - 4 April 2019

Bratislava, Slovakia

2-4 April 2019

WMO OMM

World Meteorological Organization
Organisation météorologique mondiale

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

In June 2015 the President of CHy informed Cg-17 of CHy proposal to develop WHOS as the CHy contribution to WIGOS

- *Congress welcomed the effort and urged the president of CHy to continue guiding WHOS to full implementation*
- *Congress urged the promotion of WHOS among NHSs and the hydrological community*

WMO Hydrological Observing System (WHOS)

Implementation:

Phase 1:

Map interface with links to those NHSs that make their real-time and historical stage and discharge data available online. implemented in August 2015.

Phase 2:

A fully WIS/WIGOS compliant services-oriented framework linking hydrologic data providers and users through a hydrologic information system enabling data registration, data discovery, and data access.

Beta version for CHy-15 review and endorsement (Dec 2016)
Initial implementation for EC approval (June 2018)

World Meteorological Organization
EXECUTIVE COUNCIL
Seventieth Session
Geneva, 20 to 29 June 2018

EC-70/Doc. 6(1)
Submitted by:
President of WMO
29.VI.2018
APPROVED

AGENDA ITEM 6: HYDROLOGICAL SERVICES

HYDROLOGY AND WATER MANAGEMENT

DRAFT RESOLUTIONS

Draft Resolution 6(1)/1 (EC-70)

GUIDANCE ON ONGOING HYDROLOGY AND WATER RESOURCES INITIATIVES

THE EXECUTIVE COUNCIL,

Recalling:

WMO OMM

Draft Resolution 6(1)/2 (EC-70)

IMPLEMENTATION PLAN OF WHOS PHASE II

Noting:

(1) That World Hydrological Observing System (WHOS) Phase II, as decided by CHy-15 and endorsed by EC-69, aims at providing a fully WIS compliant services-oriented framework linking hydrologic data providers and users through a hydrologic information system enabling data registration, discovery and access,

(2) That WHOS, its operations and procedures for those centres contributing to it, are described in the *Manual on WIGOS* (WMO-No. 1160),

(3) That the hydrological data from WHOS need to be available to the broader WMO and partner community,

(4) That the initial WHOS implementation plan was developed by the Advisory Working Group of the Commission of Hydrology, as requested by CHy-15,

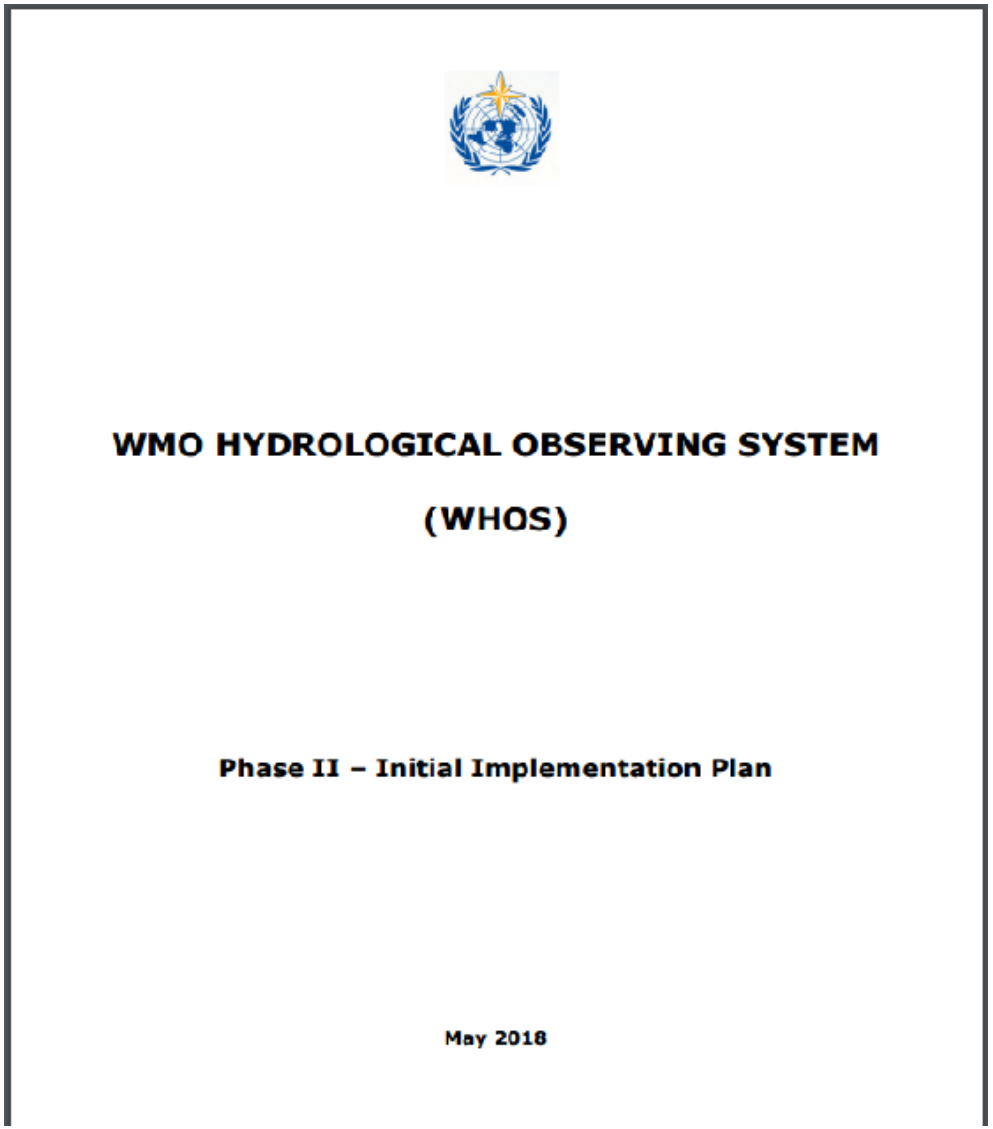
(5) That the report on the evolving role of the global hydrological data centres requested by Cg-17 will take into consideration WHOS requirements and governing principles,

(6) The additional benefit that the future development of WHOS can derive from the World Water Data Initiative, now under the aegis of WMO (see Draft Decision EC-70/6(2)/1),

Endorses the initial implementation plan of WHOS, the table of content of which is included in the Annex to this draft Resolution, including its governance and architecture compliant to the WIGOS, WIS and GDPFS programmes;

Decides that the procedures and governance for data provision from national and data collection centres, as described for NCs and DCPCs in the *Manual on WIS* (WMO-No. 1060) are applicable and sufficient for authorising WHOS centre(s) to make their data available through

EC-70 DOCUMENT on THE INITIAL IMPLEMENTATION



WMO HYDROLOGICAL OBSERVING SYSTEM

(WHOS)

Phase II – Initial Implementation Plan

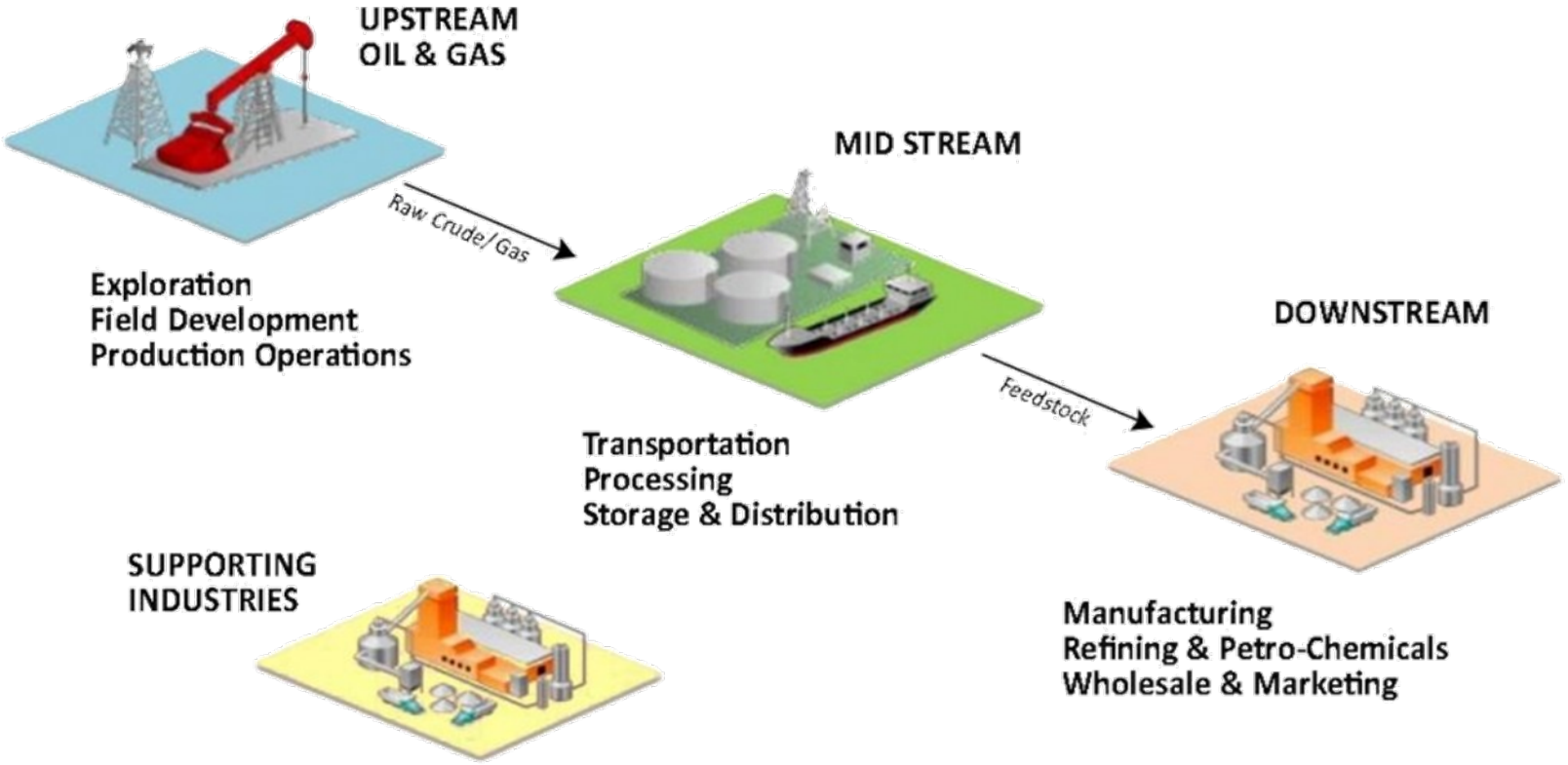
May 2018

WMO OMM

http://www.wmo.int/pages/prog/hwrp/chy/whos/documents/WHOS_Phase-II_Initial_Implementation_Plan.pdf

System of Systems: Supply-chain model

Data/information is the new “oil”



Ecosystem: Supply-chain model

Governance

WORLD METEOROLOGICAL ORGANIZATION

Sourcing

Quality Check

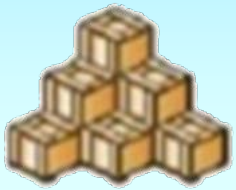
Harmonization, Quality Assessment, Ranking, Enrichment

Warehousing

Transformation

Distribution

Retailing, Corporate selling



Users uptake

Feedbacks

UPSTREAM

MIDSTREAM

DOWNSTREAM

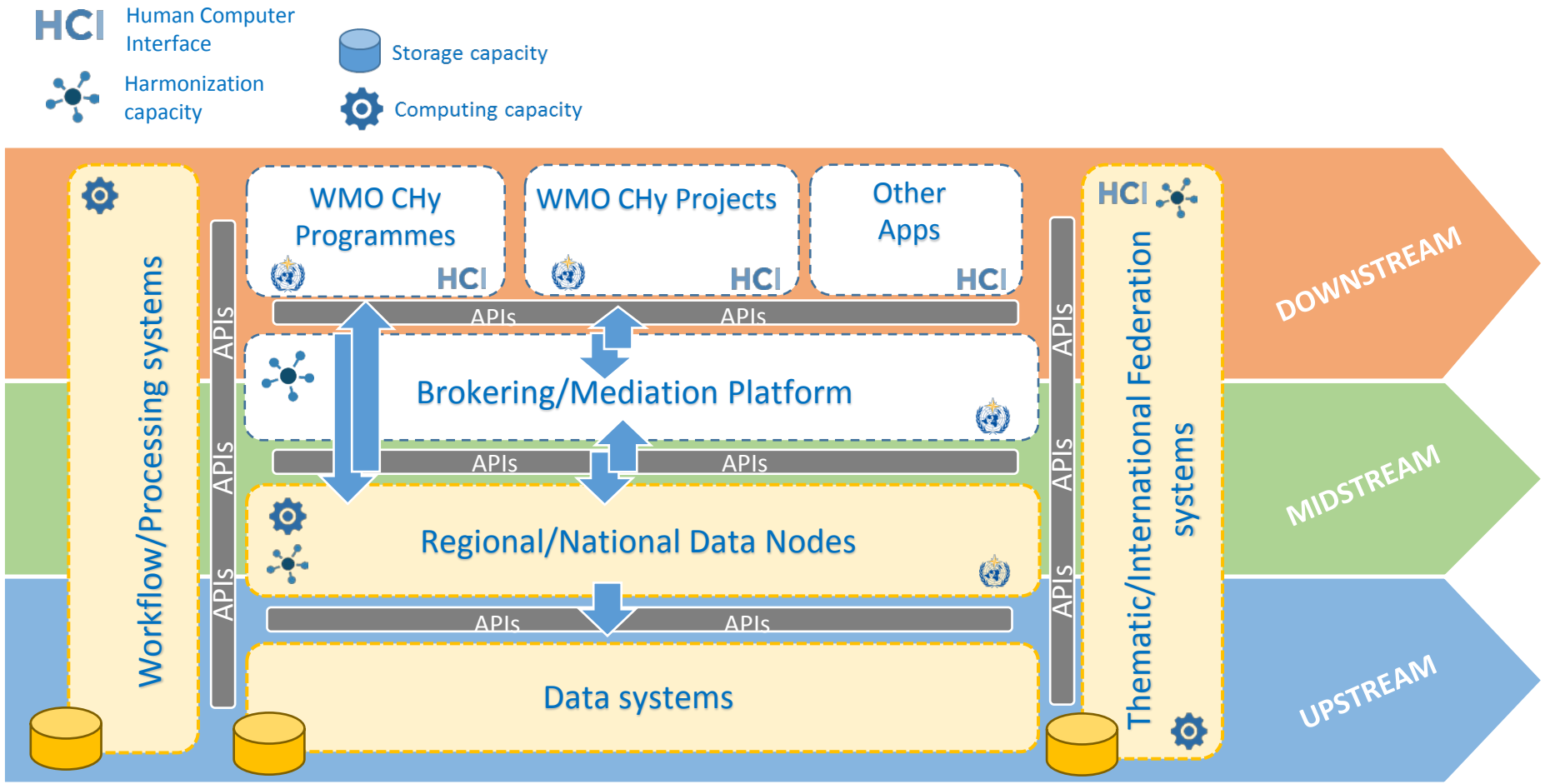
Resource Providers

Interoperability Platform

Intermediate Users

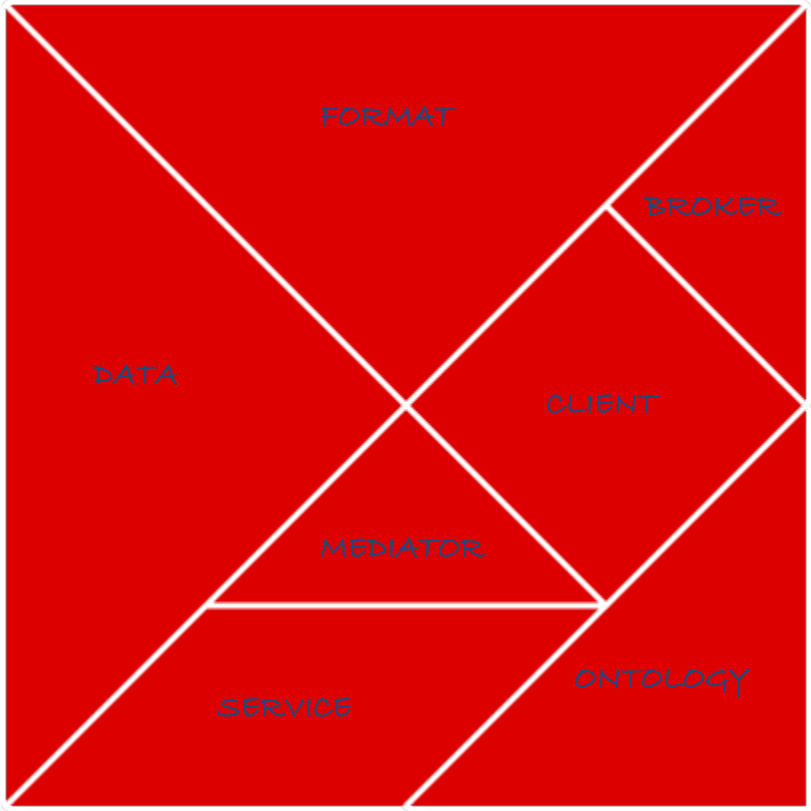
Final Users

Supply-chain SECO



WMO OMM

WHOS



reshaping data in hydrology

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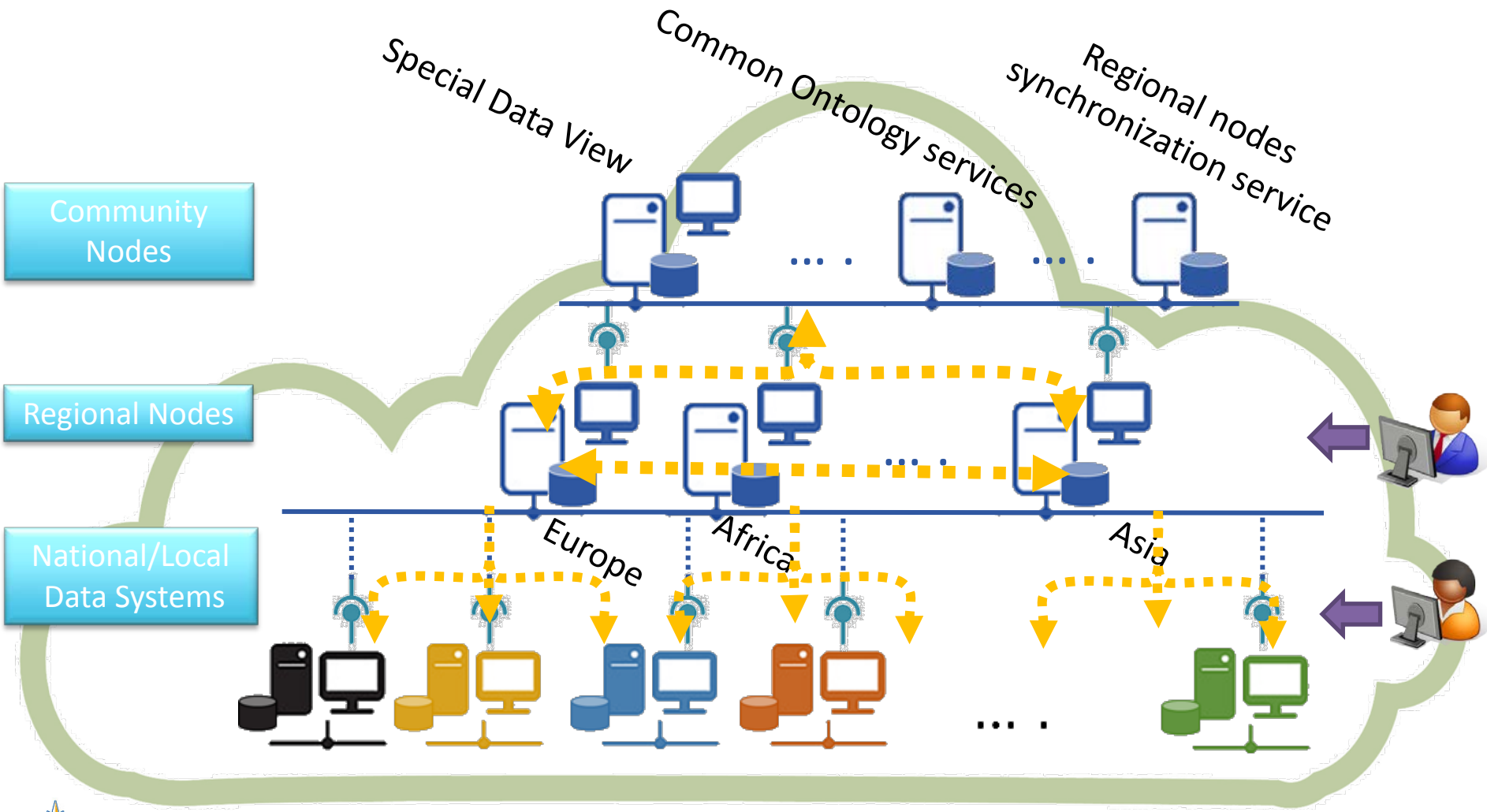
Interoperability and Information Flow



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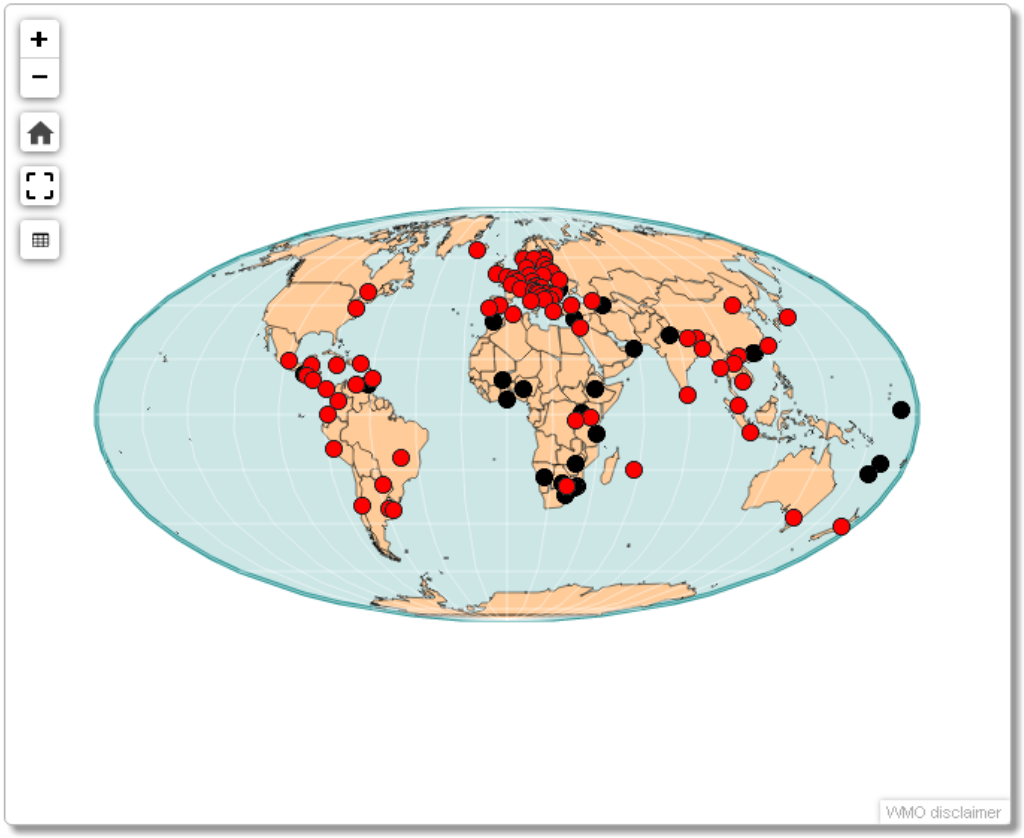
AN OPERATIONAL PROTOTYPE

WMO OMM

http://hydrolite.ddns.net/whos/

WHOS is being developed and implemented in phases. The map interface appearing below is a provisional product designed for demonstration and testing in preparation for a review of the WHOS concept at the 15th Session of the Commission for Hydrology (CHy-15) in December 2016. A full WHOS implementation is subject to approval by CHy-15.

This web portal features some advanced operations supported by the designed cyberinfrastructure.



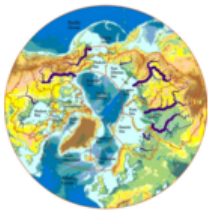
National Hydrological Service, website only
National Hydrological Service, website and data

Access to the data comprising WHOS can be obtained via map-based links on the following map. Red dots appear in countries where the

WHOS
WMO Hydrological Observing System
data discovery and access

← Go Back | Reset | 10 per page ▼ | Title A-Z ▼ | Filter by Title | Hycos

Filter by category ▼ | Discharge | Level | Precipitation | Temperature | Page 1 of 1



ARCTIC

ARCTIC Hydrologic Information System Central Web Service Registry

The Arctic-HYCOS program is being promoted through the World Hydrological Cycle Observing System (WHYCOS). The main goal of the Arctic-HYCOS program is to improve monitoring, data accuracy, availabili ...

Discharge Precipitation Level temperature

NIGER

NIGER Hydrologic Information System Central Web Service Registry

The Niger river basin hydrological observing system, designated Niger-HYCOS, is a federated network composed by 9 States (Benin, Burkina Faso, Cameroon, Cote d'Ivoire, Guinea, Mali, Niger, Nigeria and ...

Discharge Precipitation Level temperature

SADC

SADC Hydrologic Information System Central Web Service Registry

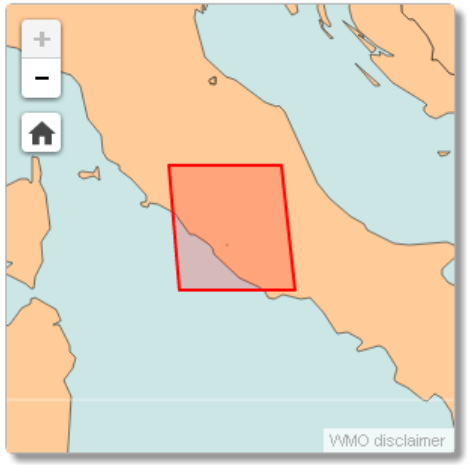
The SADC-HYCOS program is a regional component of the World Hydrological Cycle Observing System (WHYCOS). The main goal of the SADC-HYCOS program is to ensure that participating countries, individuall ...

Discharge Precipitation Level temperature

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]

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*

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:

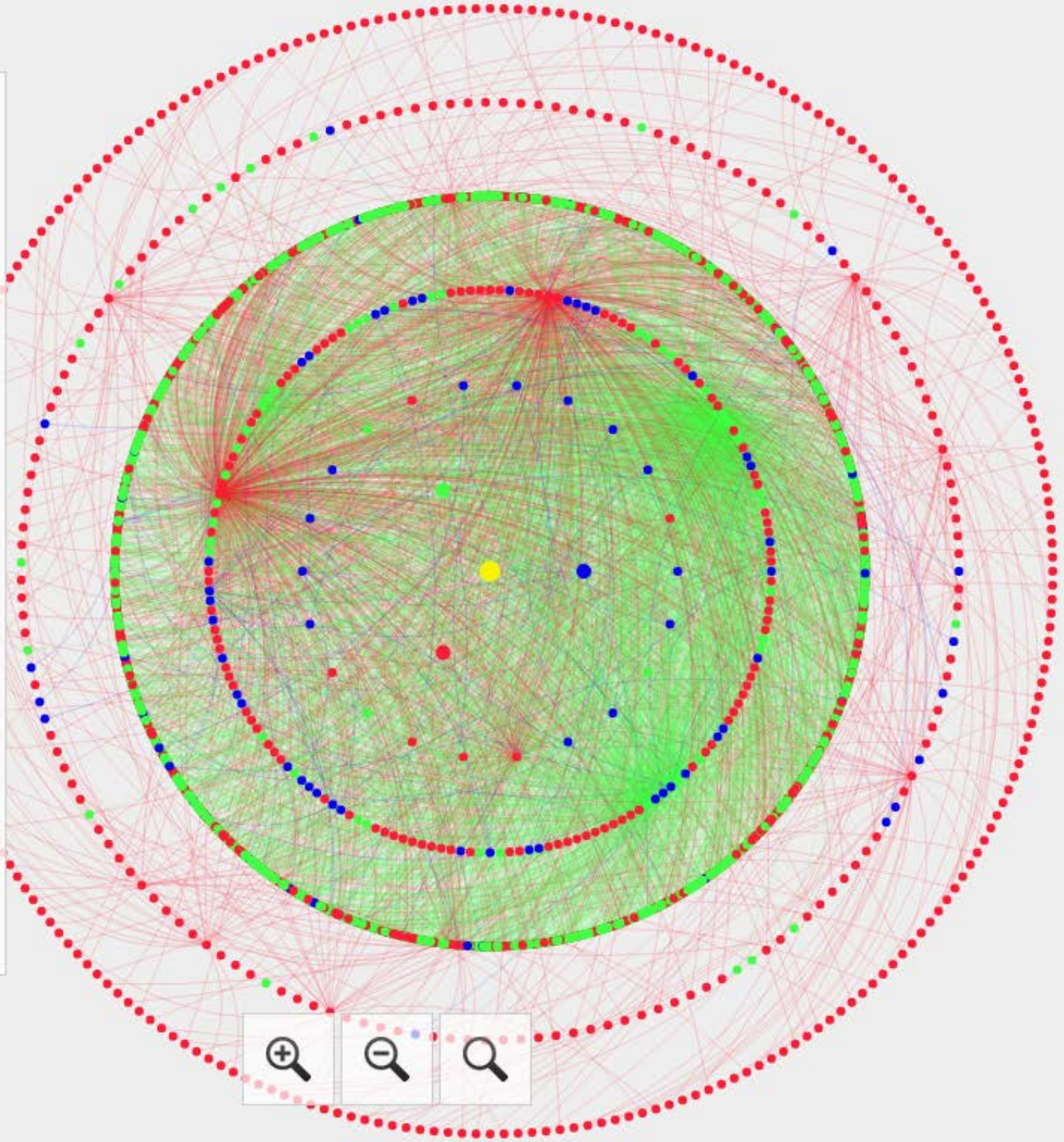
- A concept
- A relationship between two concepts
- Colour represents a grouping of concepts according to their properties

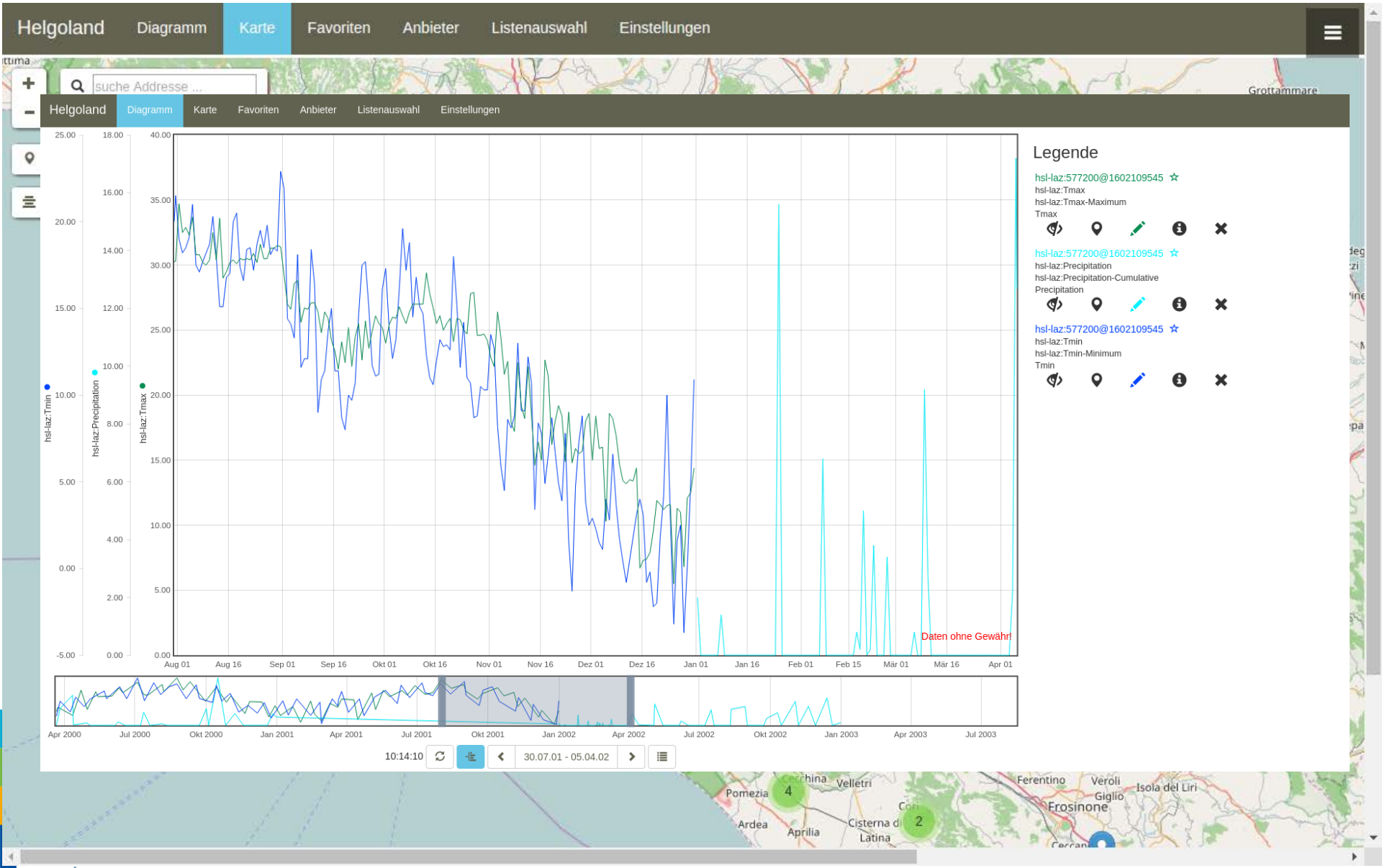
Ontology client

SPARQL

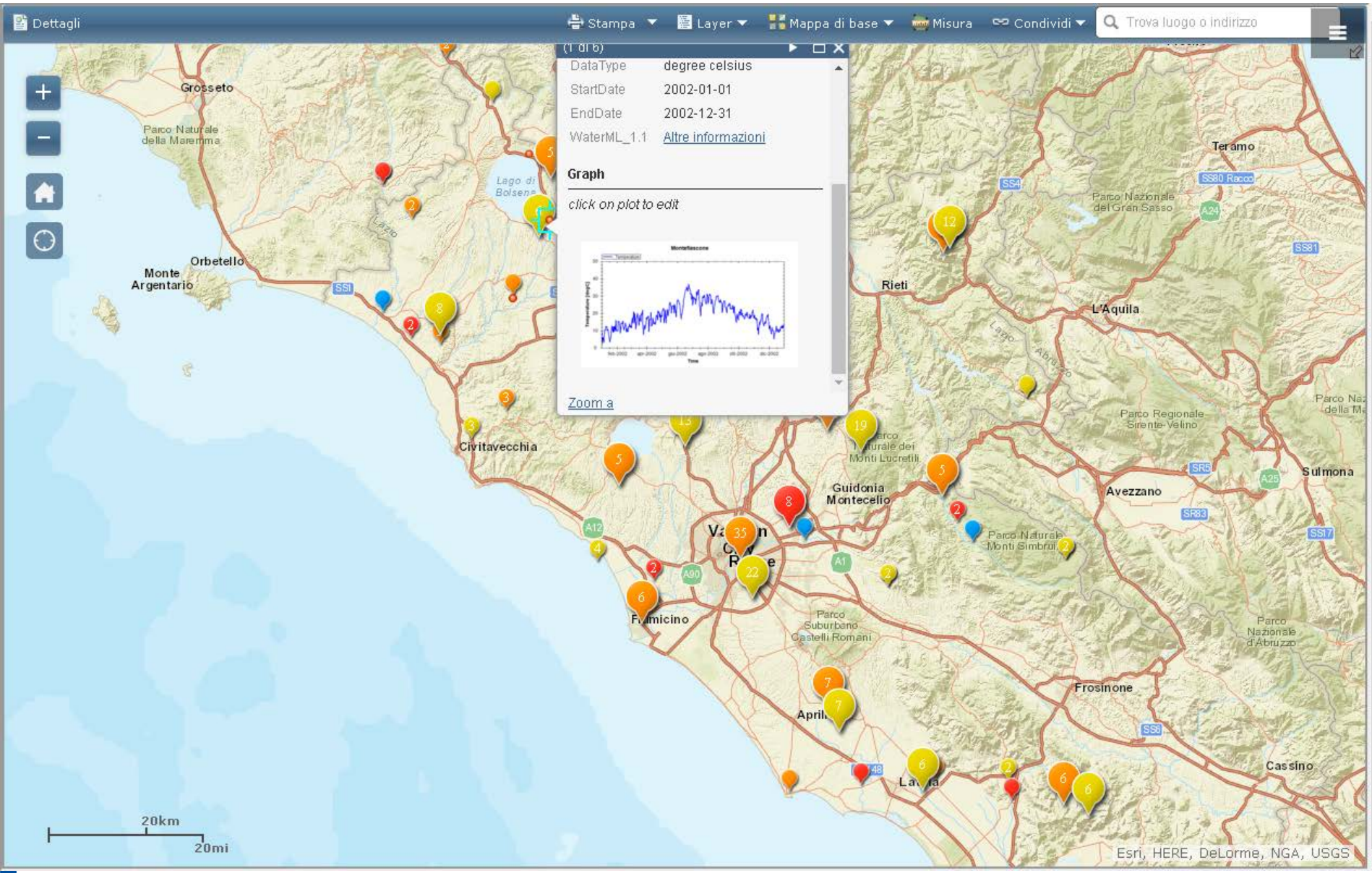
Search:

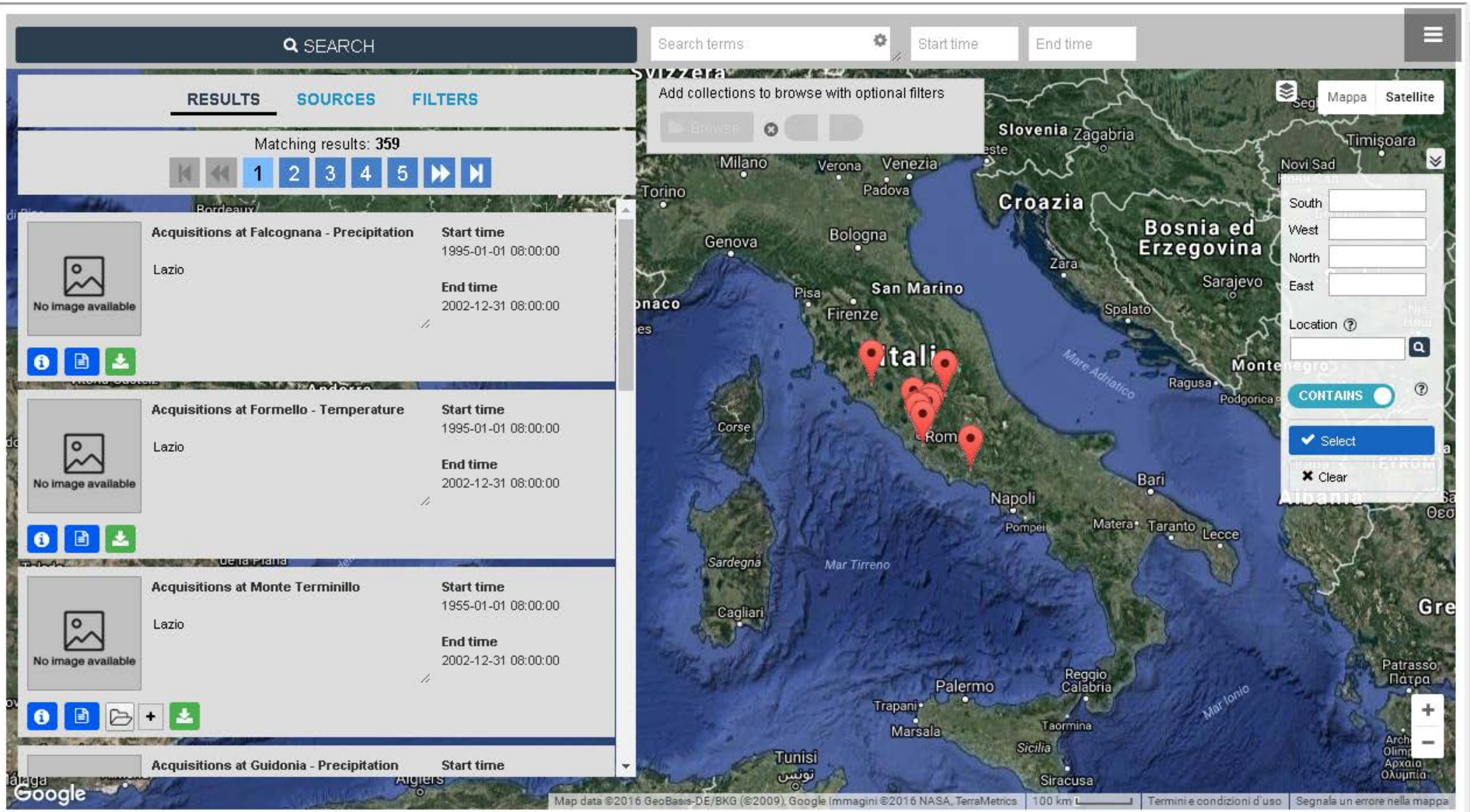
Search by name

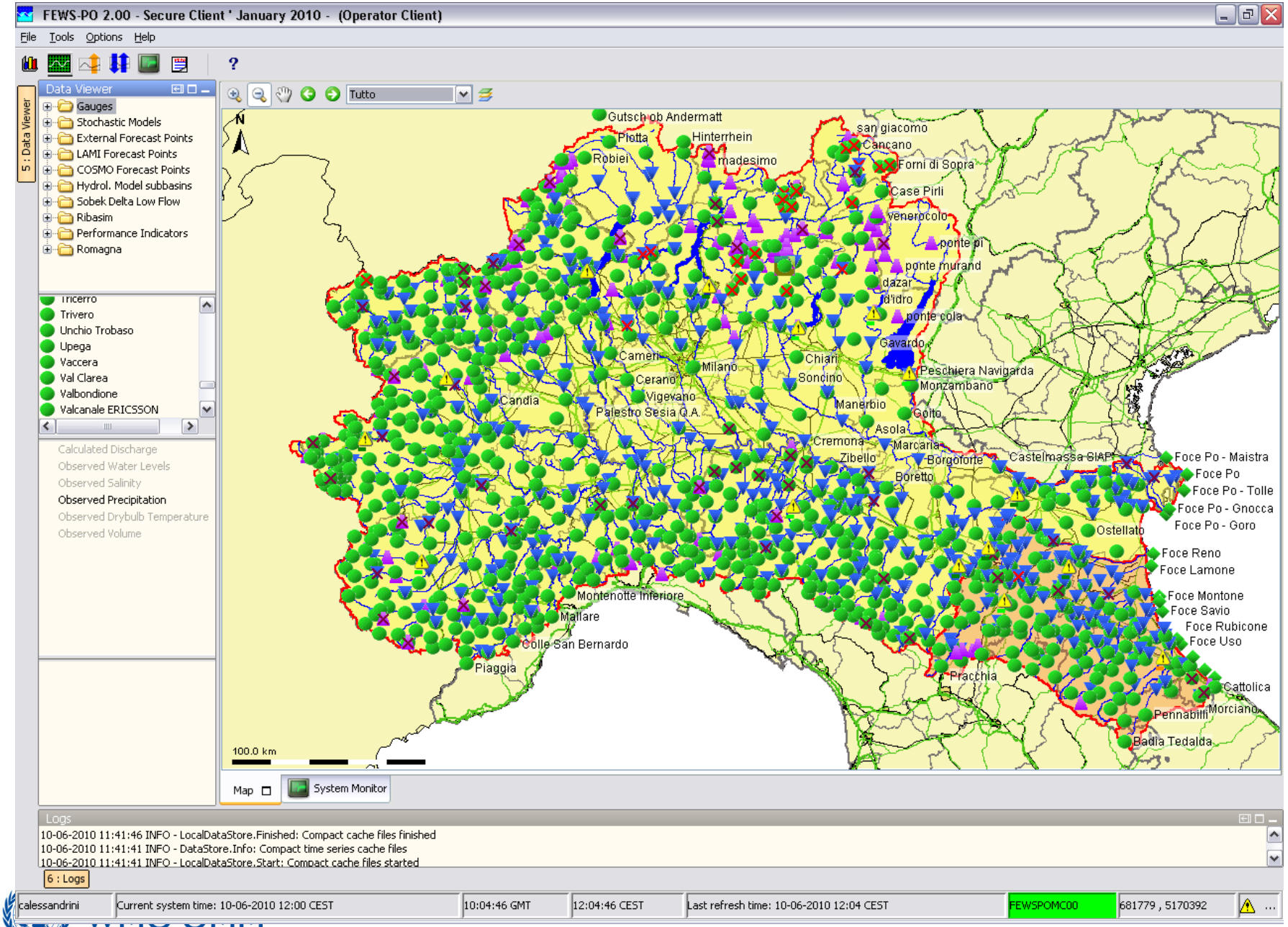



Helgoland
Diagramm
Karte
Favoriten
Anbieter
Listenauswahl
Einstellungen
suche Addresse ...
Legende
hsl-laz:577200@1602109545
hsl-laz:Tmax
hsl-laz:Tmax-Maximum
Tmax
hsl-laz:577200@1602109545
hsl-laz:Precipitation
hsl-laz:Precipitation-Cumulative
Precipitation
hsl-laz:577200@1602109545
hsl-laz:Tmin
hsl-laz:Tmin-Minimum
Tmin
hsl-laz:Tmin
hsl-laz:Precipitation
hsl-laz:Tmax
Daten ohne Gewähr!
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
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
Grottammare
Pomezia
Velletri
Ardea
Aprilia
Cisterna di Latina
Ferentino
Veroli
Giglio
Isola del Liri
Frosinone

WMO OMM


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
Sulmona
Avezzano
Guidonia Montecelio
Parco Naturale dei Monti Lucretili
Parco Naturale Monti Simbruini
Parco Suburbano Castelli Romani
Fiumicino
Frosinone
Cassino
Parco Nazionale d'Abruzzo
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
Add collections to browse with optional filters
Browse
Mappa
Satellite
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
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
Slovenia
Zagabria
Timişoara
Novi Sad
Croazia
Bosnia ed Erzegovina
Zara
Sarajevo
Spalato
Ragusa
Podgorica
Mare Adriatico
Mar Ionio
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
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
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
Peschiera Navigarda
Monzambano
Golto
Asola
Marcaria
Borgoforte
Castelmassa SIAP
Boretto
Zibello
Cremona
Manerbio
Soncino
Chiari
Cameri
Milano
Cerano
Vigevano
Palestro Sesia Q.A.
Candia
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
Cattolica
Morciano
Pennabilli
Badia Tedalda
Pracchia
Montenotte Inferiore
Mallare
Colle San Bernardo
Piaggia
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

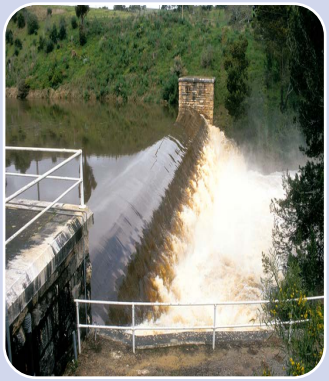
```
<?xml version="1.0" encoding="UTF-8"?>
<timeSeriesImportRun xmlns="http://www.wldelft.nl/fews"
                     xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
                     xsi:schemaLocation="http://www.wldelft.nl/fews http://fews.wldelft.nl/schemas/version1.0/timeSeriesImportRun.xsd">
    <!-- 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>

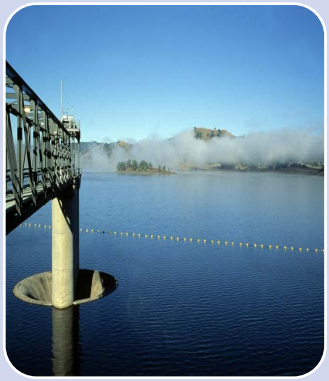
            <!-- Directory from which CSV files are to be imported -->
        <folder>$IMPORT_FOLDER_WATERML$</folder>
            <idMapId>IdImportWaterML2_usgs</idMapId>
            <importTimeZone>
                <timeZoneOffset>-06:00</timeZoneOffset>
            </importTimeZone>
        </general>
        <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>
```

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)

WMO OMM

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">
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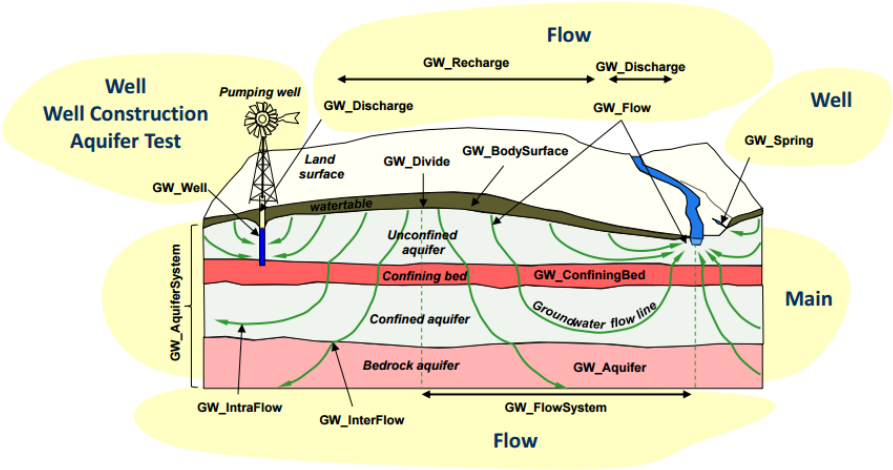
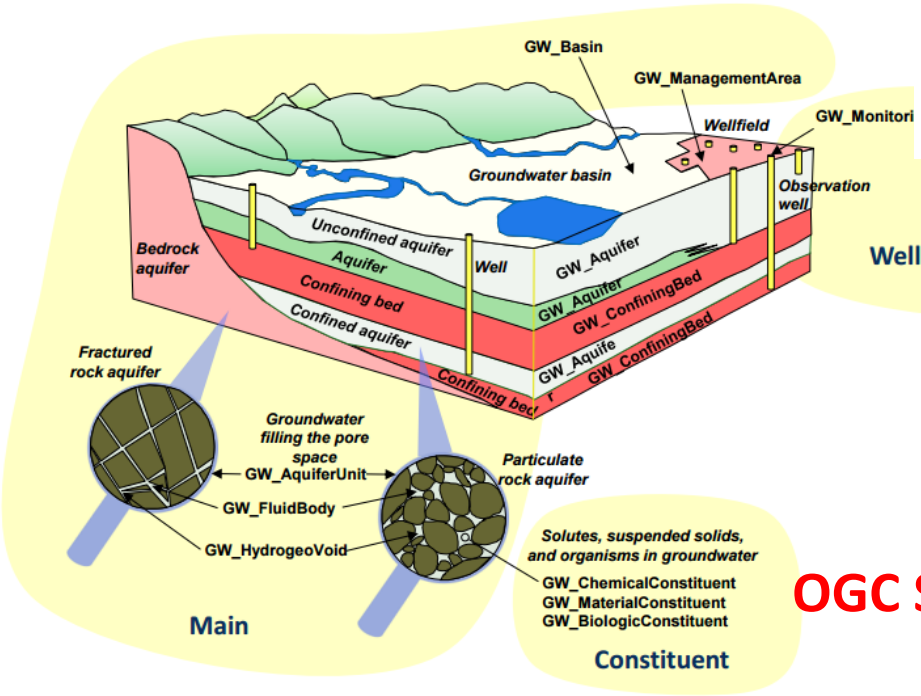




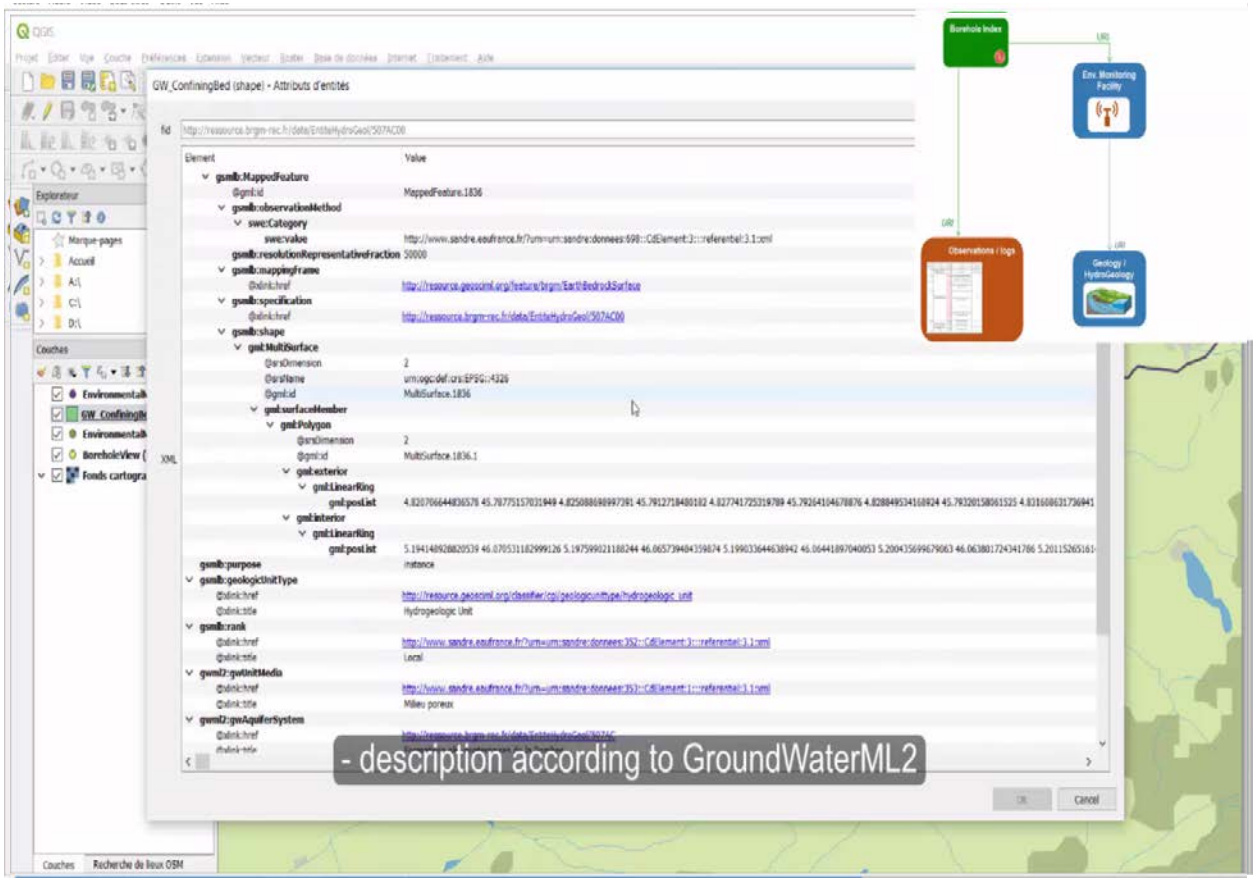
GroundWaterML2 (GWML2)

WaterML2 Part4

OGC Standard today -> WMO Standard soon

Implementation

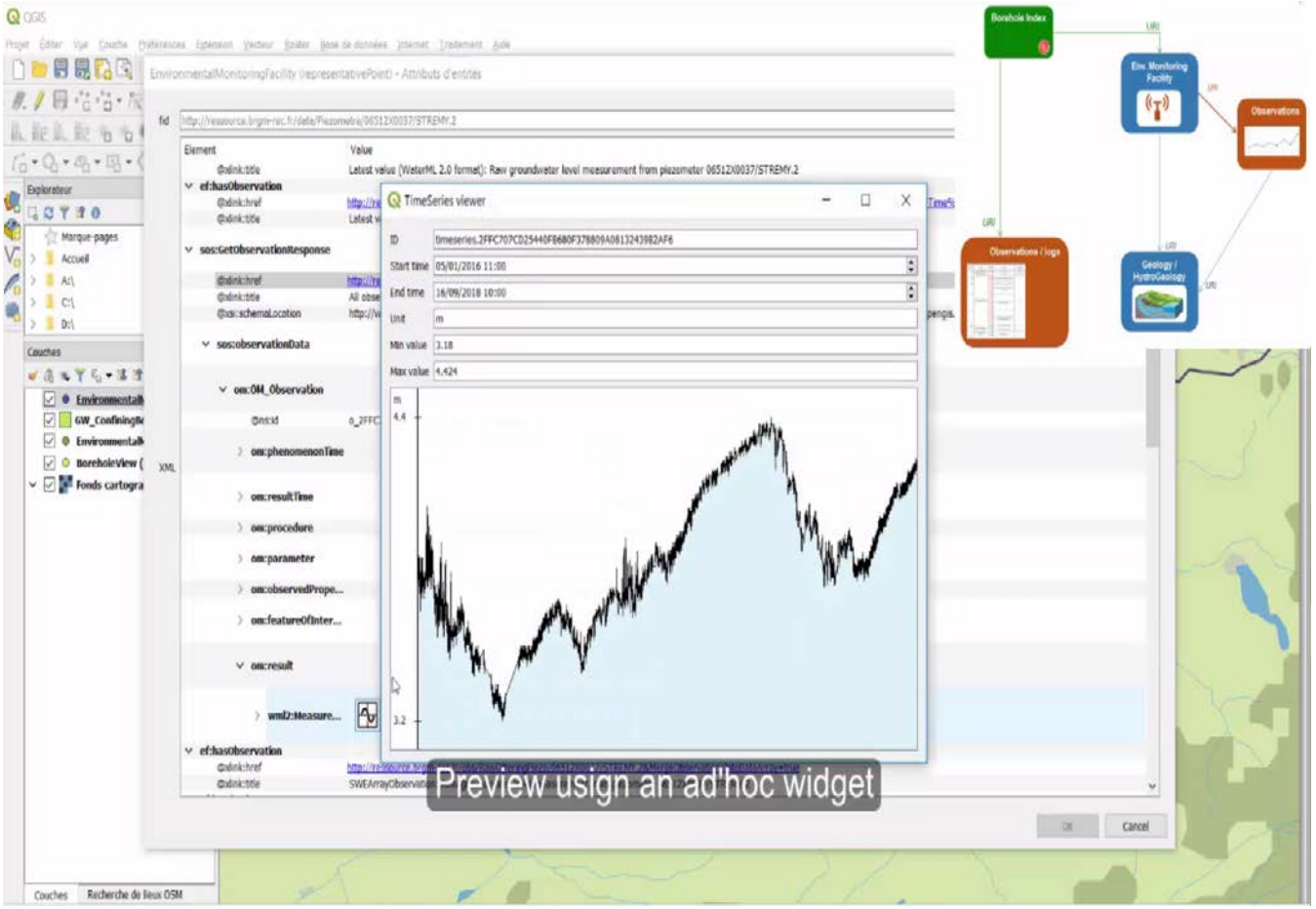
Technical scenario: GWML2 data used in QGIS



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

Implementation

Technical scenario: GWML2 data used in QGIS



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

WMO

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

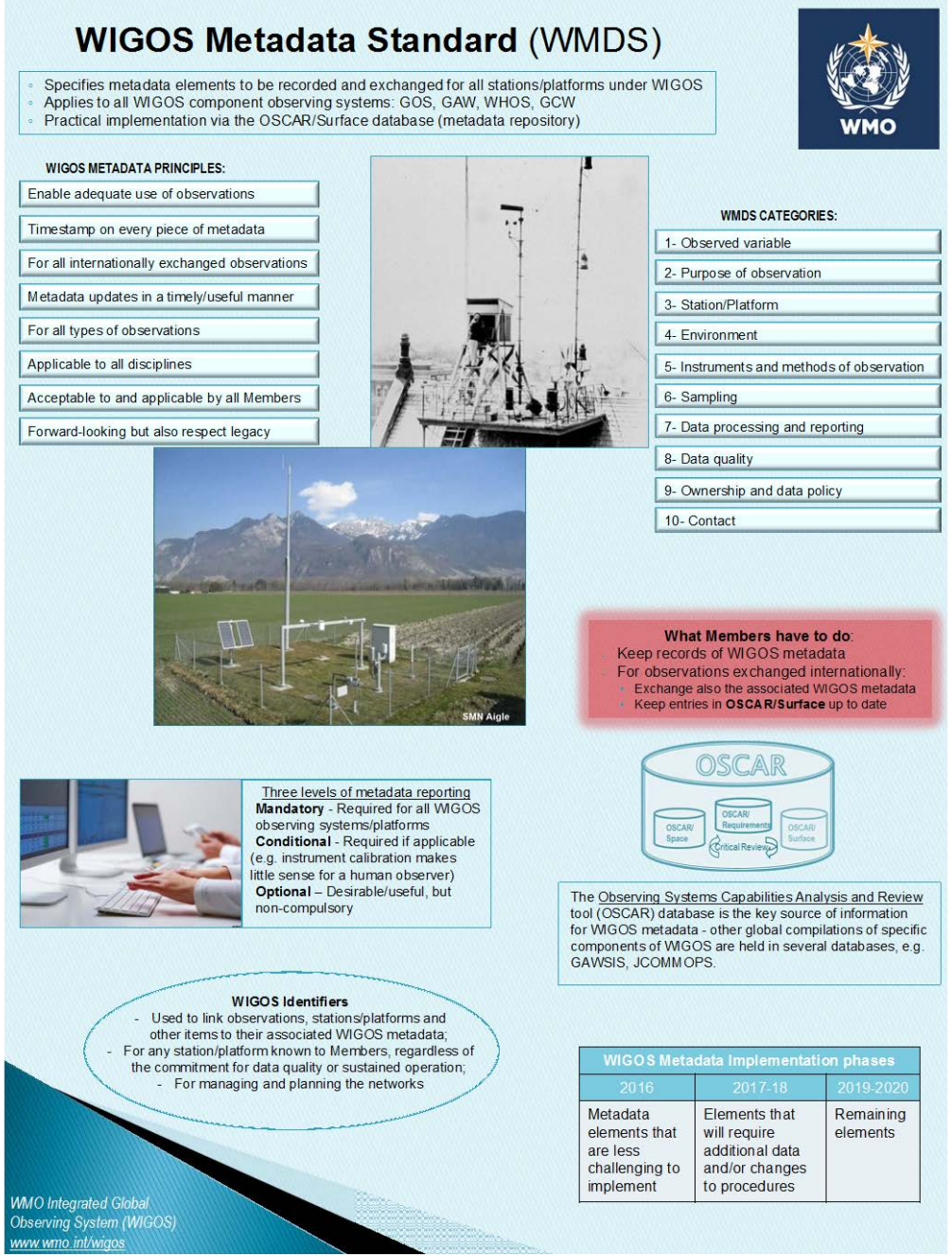
[3] https://link.springer.com/article/10.1186%2Fs40965-018-0058-3

WMO OMM

WIGOS Metadata Standard

- Approved at Cg-17 June 2015

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

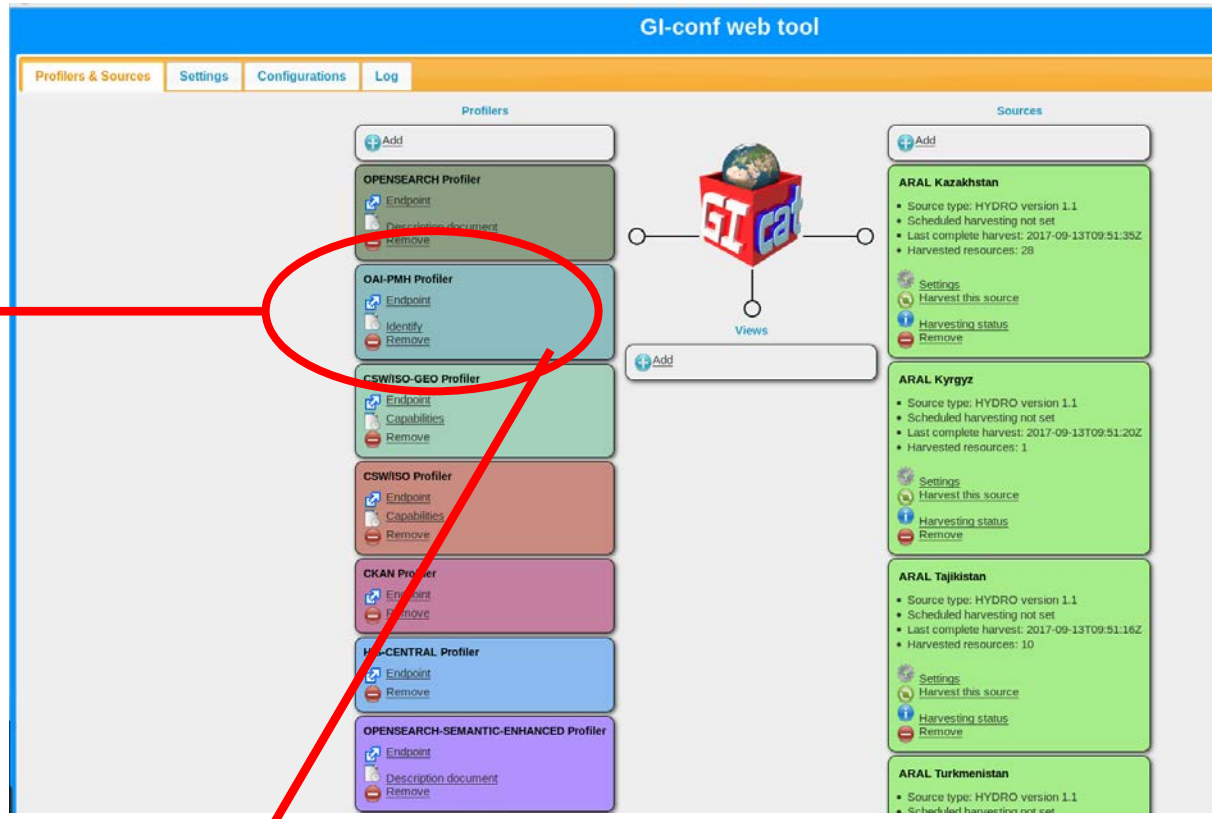


WMO OMM

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

jOAI Harvester – the result

A folder containing about 80.000 records encoded according to **Wigos metadata standard**

E.g.

```
<?xml version="1.0" encoding="UTF-8"?>
- <ns9:WIGOSMetadataRecord xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:ns9="http://def.wmo.int/wmdr/2016" xmlns:ns8="http://www.isotc211.org/2005/gts"
xmlns:ns7="http://www.opengis.net/om/2.0" xmlns:ns6="http://www.isotc211.org/2005/gmd"
xmlns:ns5="http://www.isotc211.org/2005/gco" xmlns:ns4="http://def.wmo.int/metce/2013"
xmlns:ns3="http://def.wmo.int/opm/2013" xmlns:ns2="http://www.w3.org/1999/xlink"
xmlns:ns11="http://www.opengis.net/samplingSpatial/2.0" xmlns:ns10="http://www.opengis.net/sampling/2.0"
xmlns:ns1="http://www.opengis.net/gml/3.2" ns1:id="hsl-lig:Tmin@hsl-lig:ROCNE@1377724686">
    <ns1:description ns2:type="simple">Liguria</ns1:description>
    <ns1:identifier codeSpace="itaLig">hsl-lig:Tmin@hsl-lig:ROCNE@1377724686</ns1:identifier>
    <ns1:name>Acquisitions at Rocchetta Nervina - Temperature</ns1:name>
    <ns1:boundedBy xsi:nil="true"/>
  - <ns9:facilityDefinition>
    - <ns9:ObservingFacility>
        <ns1:description ns2:type="simple">Rocchetta Nervina</ns1:description>
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        <ns1:name>Rocchetta Nervina</ns1:name>
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        - <ns9:TimestampedLocation>
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          - <ns9:location ns2:type="simple">
              <ns1:Point srsName="EPSG:4326"/>
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          </ns9:TimestampedLocation>
        </ns9:geospatialLocation>
      - <ns9:responsibleParty>
        - <ns6:CI_ResponsibleParty>
            <ns6:role/>
          </ns6:CI_ResponsibleParty>
        </ns9:responsibleParty>
      </ns9:ObservingFacility>
    </ns9:facilityDefinition>
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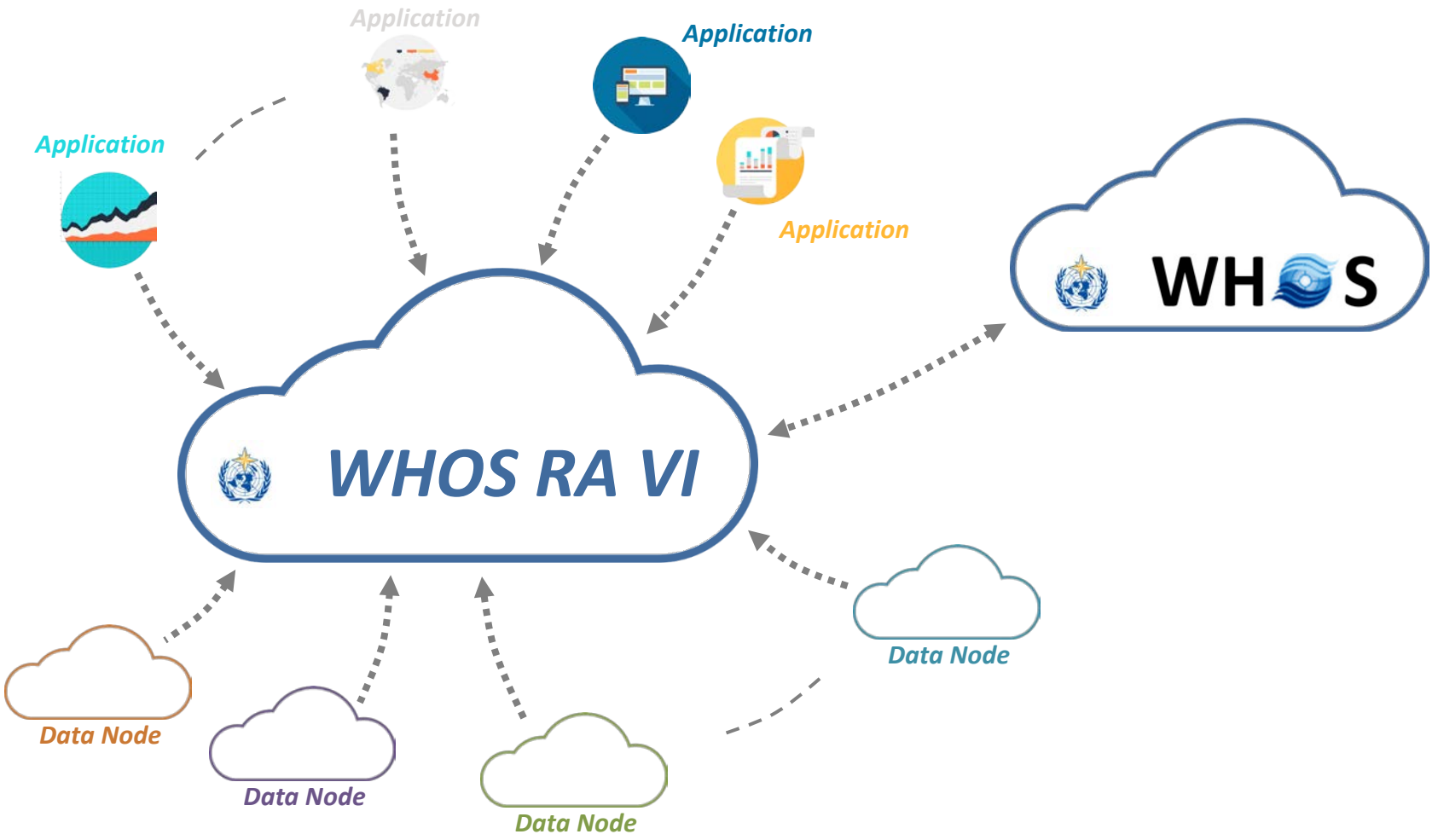
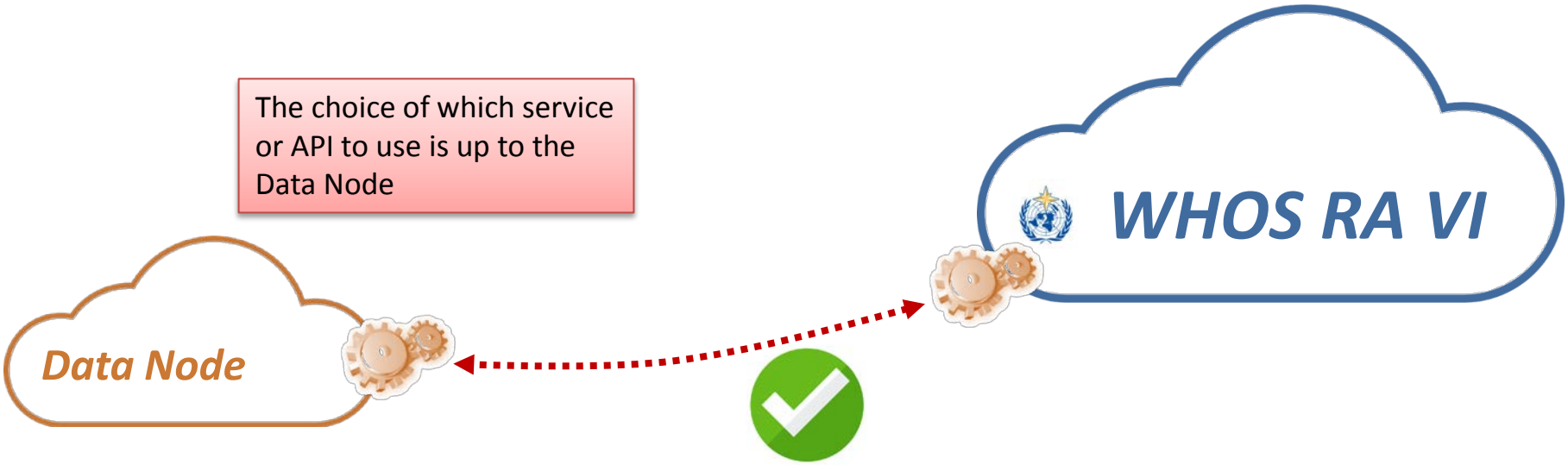
WMO OMM

WHOS RA VI System Overview



Brokering a Data Node

The choice of which service or API to use is up to the Data Node



Connectivity	The Data Node is reachable on the Web
Data Discoverability	It is possible to discover data
Data Accessibility	It is possible to download discovered data

If needed, one or more cycles of tuning/tests can take place

Publishes data → Interoperability Tests → Data Node becomes part of the System of Systems

Connecting an Application

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

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

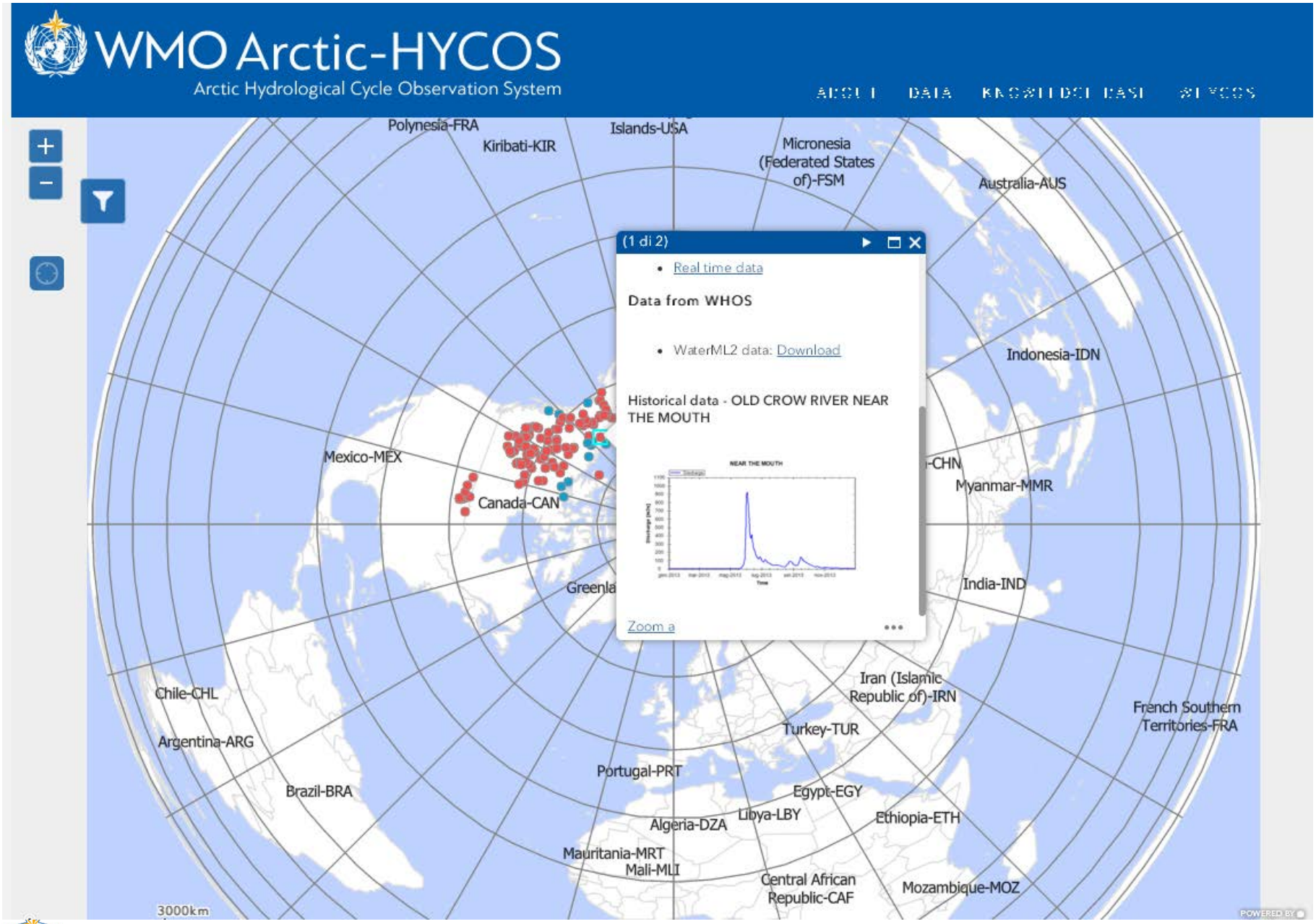
Publishes a set of web services/APIs

Can use any service/API to connect to the System

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

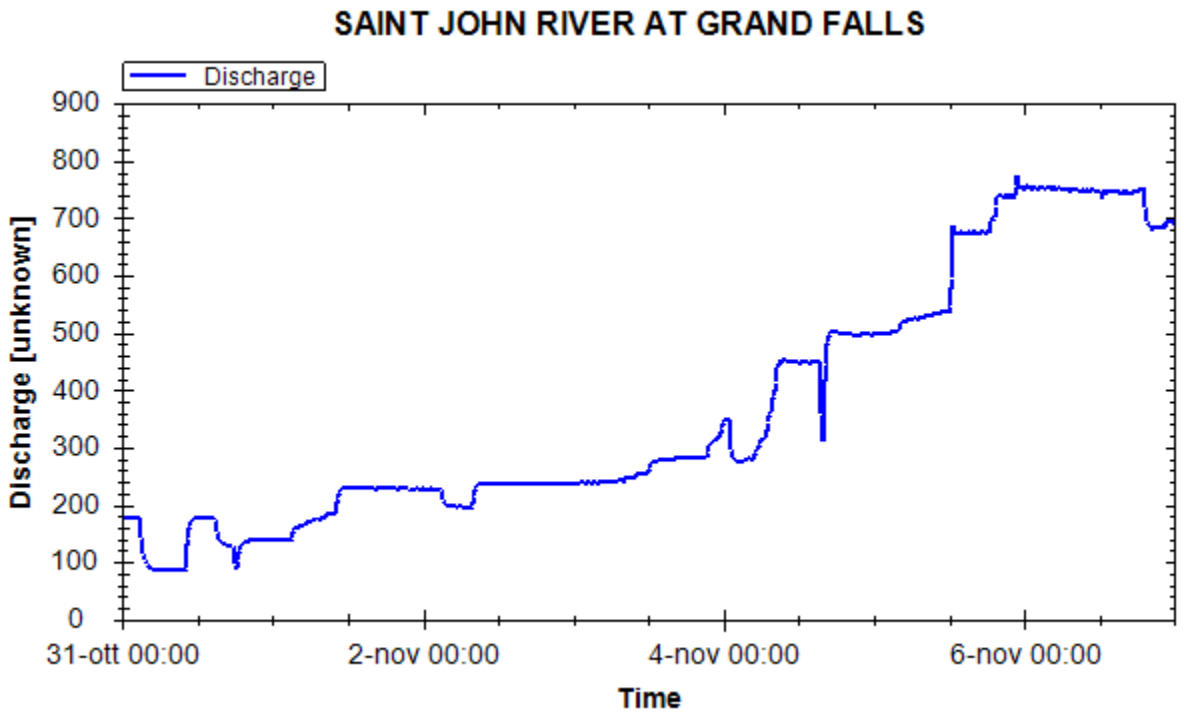
WHOS INITIAL IMPLEMENTATION IN RA VI

1. Sava river basin (lead by Mirza Sarač)
2. Danube river basin (lead by Jan Danhelka)
3. Rhine river basin (lead by Eric Sprokkereef)
4. Aral Sea basin (lead by Artem Shevchenko)
5. Arctic-Hycos



WMO OMM

http://www.whycos.org/WMO/arctichycos/index.html



http://hiscentral.ddns.net/graph/handler2.ashx?height=375&width=645&serviceUrl=http%3A%2F%2Farpa-er-axe.geodab.eu%2Fgi-axe-arpa%2Fservices%2Fhis&siteCode=EC%3A01AF002%40794943551&variableCode=Discharge&startDate=2018-10-31&endDate=2018-11-07

WMO OMM

This XML file does not appear to have any style information associated with it. The document tree is shown below.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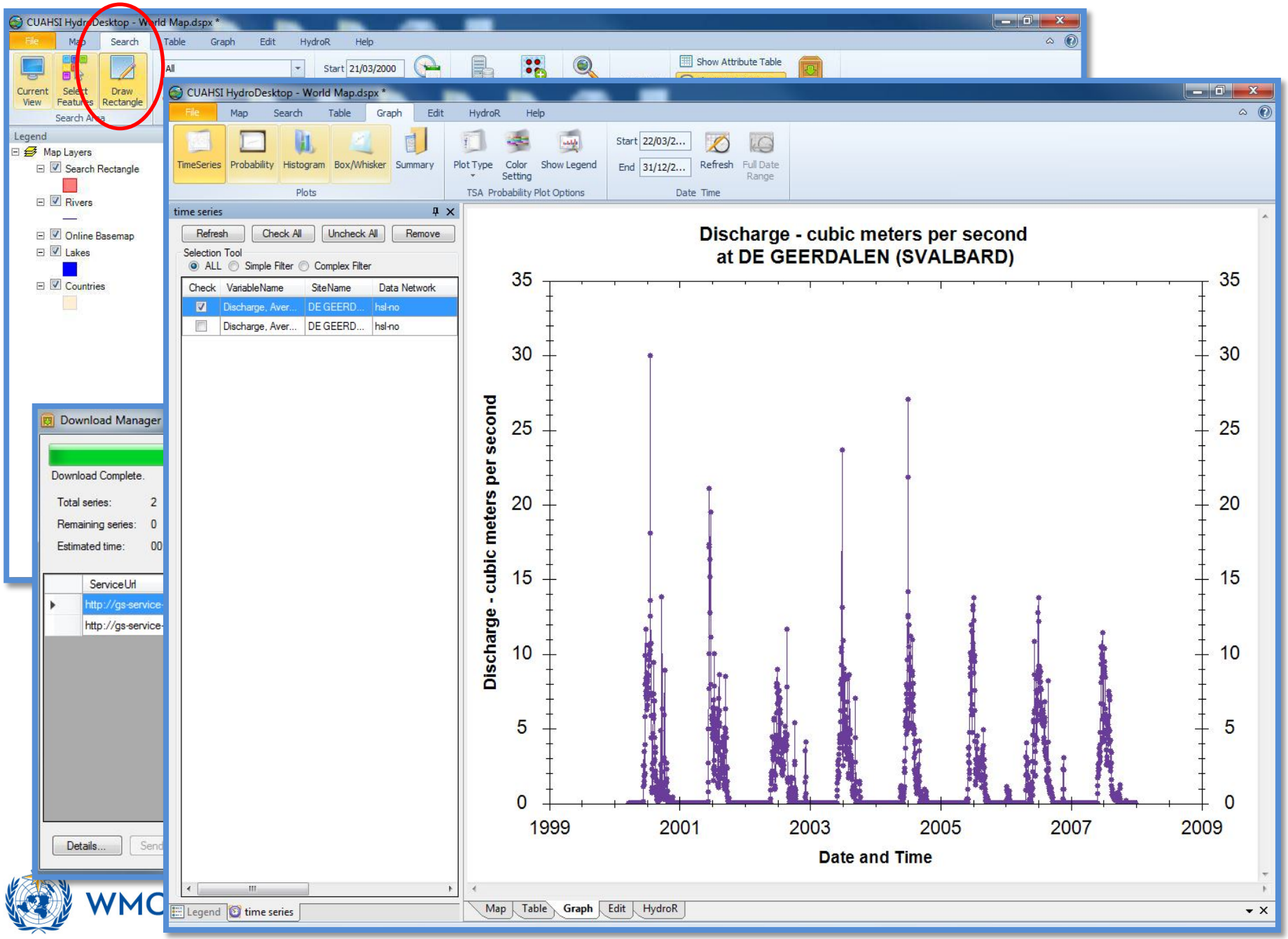
```


http://arpa-er-axe.geodab.eu/gi-axe-arpa/services/http-get?request=execute&service=WPS&identifier=gi-axe-transform&DataInputs=descriptor=;outputFormat=WML_2_0;outputTemporalBegin=2018-10-31T00%3A00%3A00Z;outputTemporalEnd=2018-11-07T00%3A00%3A00Z&RawDataOutput=resource&protocol=HYDRO&linkage=http%3A%2F%2Farpa-er-axe.geodab.eu%2Fgi-axe-arpa%2Fservices%2Fhis&name=Discharge%40EC%3A01AF002%40794943551

WMO OMM


CUAHSI HydroDesktop - World Map.dspx *
File
Map
Search
Table
Graph
Edit
HydroR
Help
Current View
Select Features
Draw Rectangle
Search Area
Start 21/03/2000
Show Attribute Table
Legend
Map Layers
Search Rectangle
Rivers
Online Basemap
Lakes
Countries
Download Manager
Download Complete.
Total series: 2
Remaining series: 0
Estimated time: 00
ServiceUrl
http://gs-service-
http://gs-service-
Details...
CUAHSI HydroDesktop - World Map.dspx *
File
Map
Search
Table
Graph
Edit
HydroR
Help
TimeSeries
Probability
Histogram
Box/Whisker
Summary
Plots
Plot Type
Color Setting
Show Legend
TSA Probability Plot Options
Start 22/03/2...
End 31/12/2...
Refresh
Full Date Range
Date Time
time series
Refresh
Check All
Uncheck All
Remove
Selection Tool
ALL
Simple Filter
Complex Filter
Check
VariableName
SiteName
Data Network
Discharge, Aver...
DE GEERD...
hsl-no
Discharge, Aver...
DE GEERD...
hsl-no
Legend
time series
Discharge - cubic meters per second
at DE GEERDALEN (SVALBARD)
Discharge - cubic meters per second
Date and Time
0
5
10
15
20
25
30
35
1999
2001
2003
2005
2007
2009
Map
Table
Graph
Edit
HydroR

jupyter WMO-Arctic-HYCOS_8.0 Last Checkpoint: 8 minuti fa (autosaved)

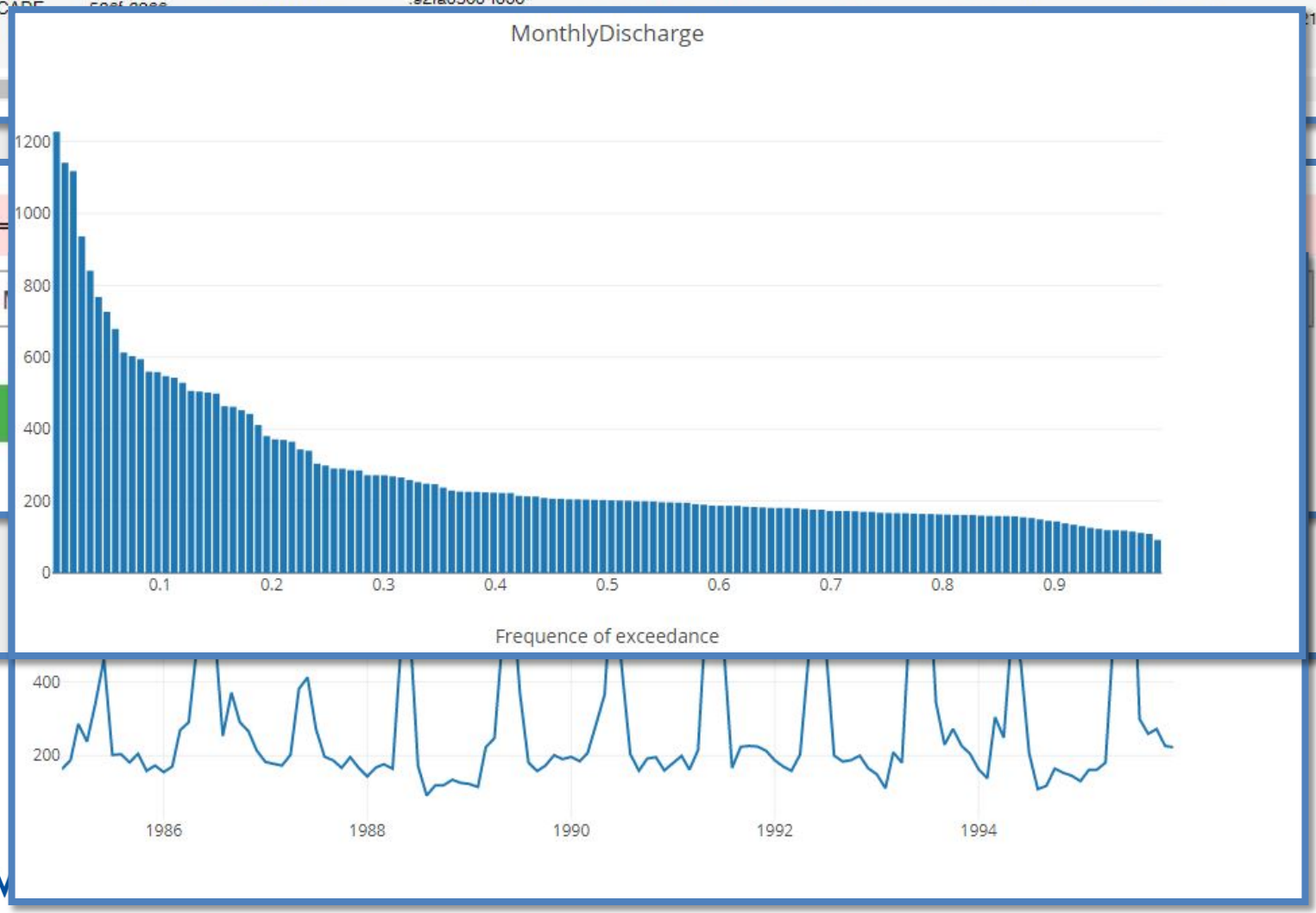
Logout

File Edit View Insert Cell Kernel Widgets Help

Trusted Python 3

Run Code

	Site.name	Full.site.code	Available.parameters	Full.variable.code	Unit.of.measure	Latitude	Longitude	Start.recording.data	End.recording.data	Quality.of.the
1	CASCADE	:01c7e38e-		:92fa0500-f000-						



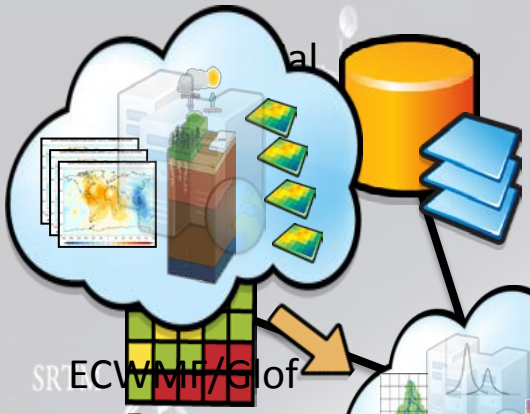
NASA SERVIR PORTAL

ICIMOD NEPAL PORTAL

WMO RA VI PORTAL

APP WAREHOUSE

Stakeholders – They Make the Decisions



ECWMF/GlofasForecasts Model Files

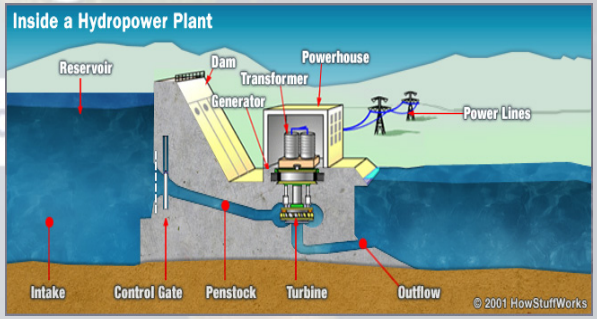
Custom Python Scripts

Streamflow Forecast Services

Bangladesh Flood Inundation Transboundary Flows Web App Tool

ICIMOD, DFM, FFWC, BWDB, Pakistan, Mercy Corps, Practical Action, Others

Engineers, Decision Makers, Advocacy Groups, Public



WMO OMM

WEATHER CLIMATE WATER
TEMPS CLIMAT EAU

Thank you
Merci

WMO OMM

World Meteorological Organization
Organisation météorologique mondiale