



QGIS / GDAL GML application schema support update : use case on French Groundwater Information Network (GIN)

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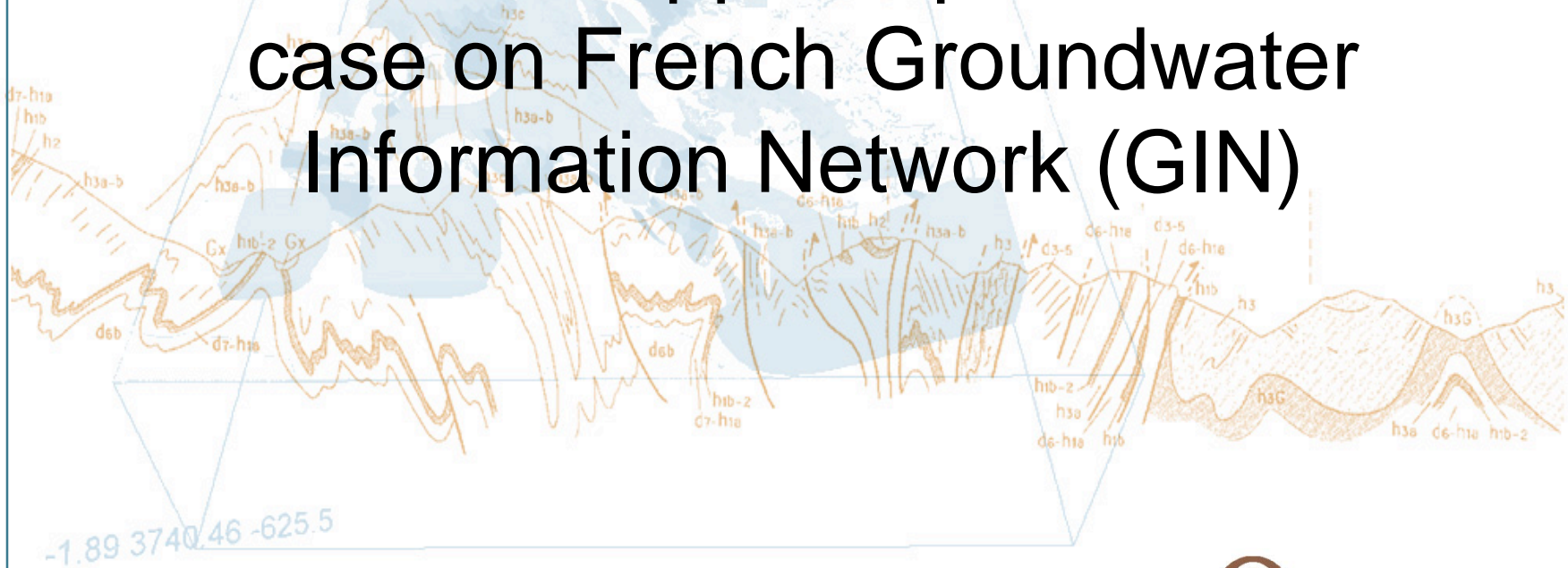
<https://brgm.hal.science/hal-02003227>

Submitted on 1 Feb 2019

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A detailed geological map of the area around Monte Reggina. The map shows various geological units in different colors: red for the main mountain area, green for the surrounding hills, and blue for the river. Topographic features include Monte Reggina (1313m), Monte di Felce (195m), and Monte Pozzo (881m). The map also shows the course of the river and several small settlements like Felce and Casale Mattino.



OGC Hydro DWG Workshop 2017 – Tuscaloosa – 2017-06-20

French GIN – linked data use case

> Objectives

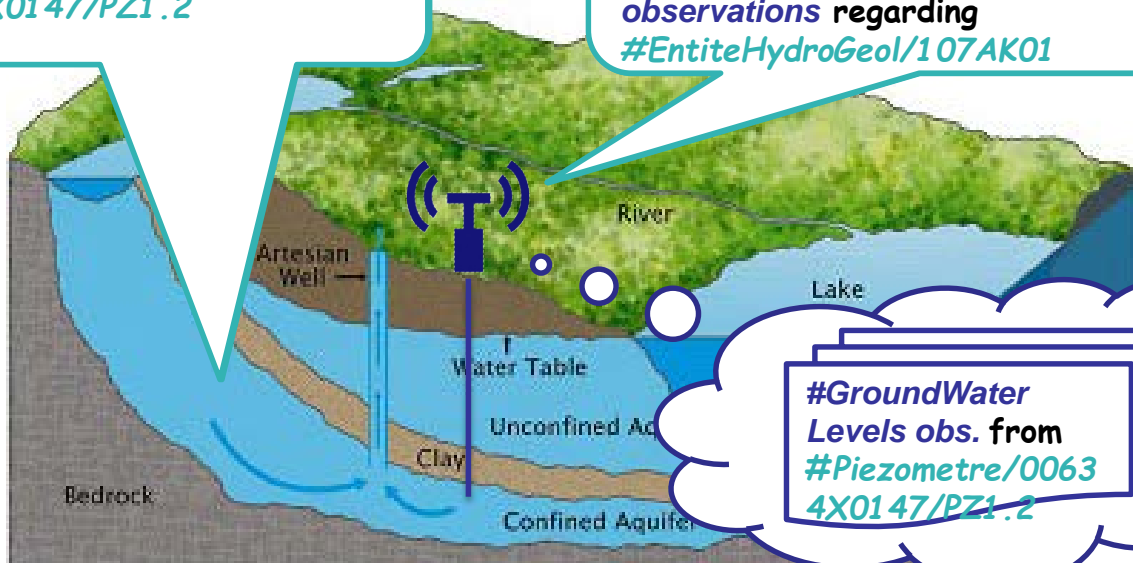
- To provide stable and resolvable links to resources
- To allow reference / data citation
- Independent from underlying technologies used to provide data

I am [#EntiteHydroGeol/107AK01](#)

I am monitored by
[#Piezometre/00634X0147/PZ1.2](#)

I am [#Piezometre/00634X0147/PZ1.2](#)
attached to [#Borehole/00634X0147/PZ1.2](#)

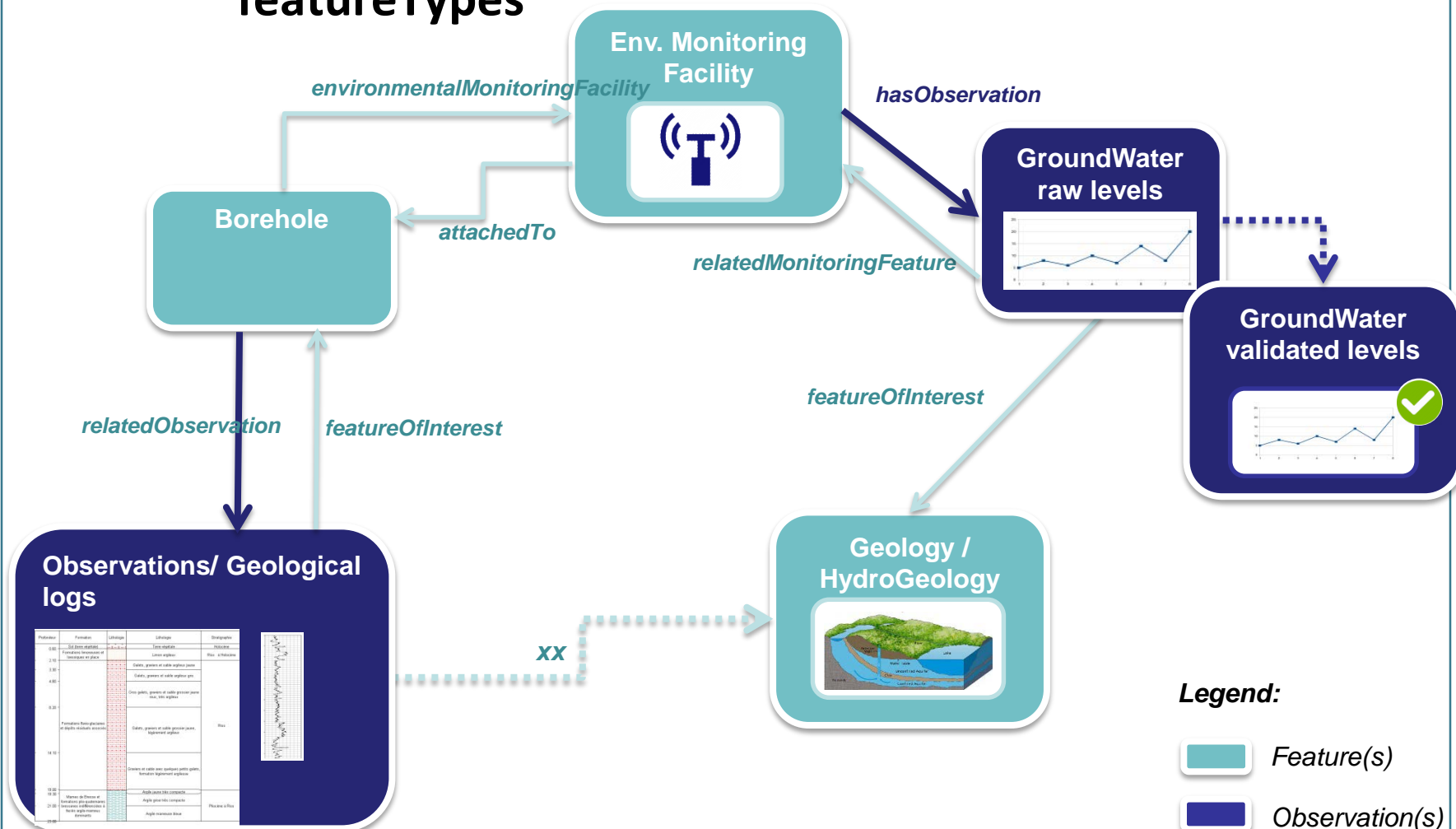
I have a lot of [#GroundWater Levels](#)
[observations](#) regarding
[#EntiteHydroGeol/107AK01](#)



[#GroundWater Levels obs. from #Piezometre/00634X0147/PZ1.2](#)

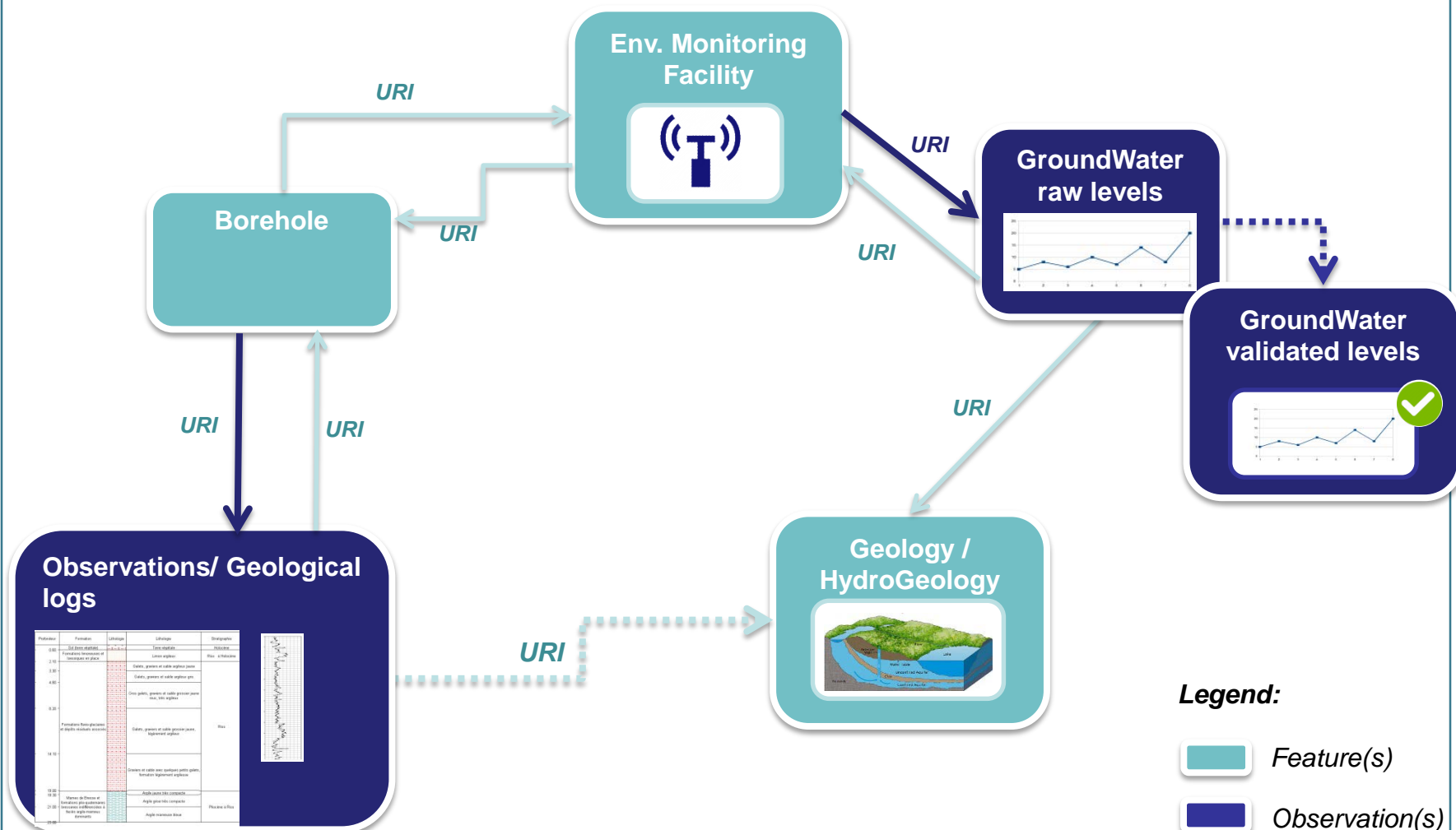
French GIN – linked data use case

> Flows based on OGC and INSPIRE defined featureTypes



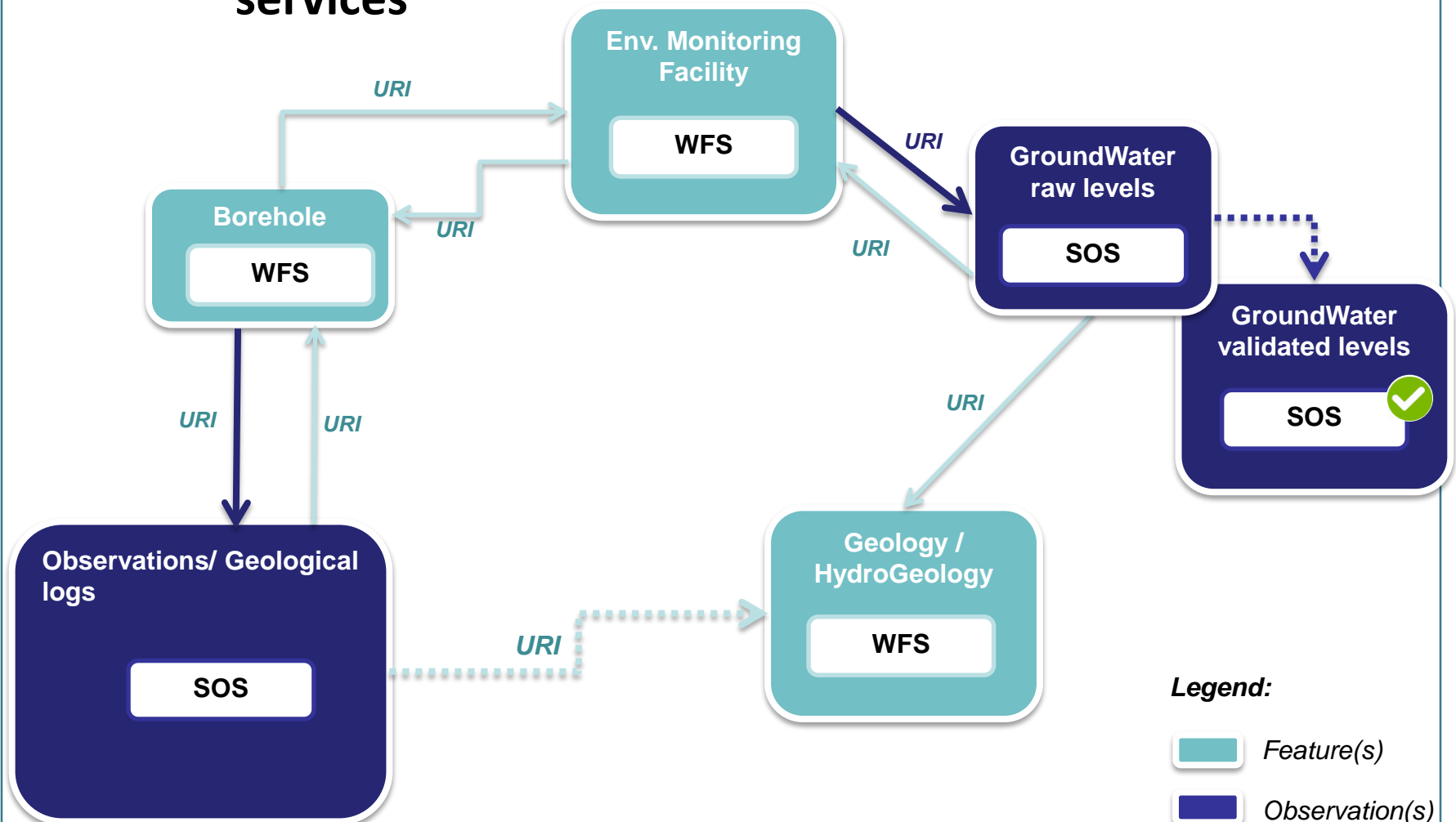
French GIN – linked data use case

> Object instances are associated by their URI



French GIN – linked data use case

- URI allowing to dereference content exposed by OGC services



GML application schema toolbox - overall context

> Initial idea

- Reuse information available in XML compliant to xsd(s) to handle this content with no hardcoded configuration -> enriched XML and database generation on the fly.

> Retrieve objects of interest described according to a standard

- = semantic and geographical representation
- interacts with the content (XML and Database). Database -> plug other tools

> Resolve XLinks to add more content

- vocabulary registry definitions (multilinguism is handled)
- linked domain features / observation

GML application schema toolbox - overall context

- > **Trigger custom widgets based on standards**
 - working: Waterml 2 timeseries, Inspire PointTimeSeries
 - drafty: GW_GeologyLogCoverage
 - on-going EU AirqualityDirective timeseries

- > **Writes content (file not WFS-T)**

- > **Standalone OGR/GDAL driver -> reuse**

- > **Previously presented during last year workshop**
 - Koblenz 2016 Hydro DWG Workshop [presentation](#) of the Proof Of Concept QGIS plugin

GML application schema toolbox use – QGIS 3

GML App Schema Toolbox

Download Convert Export Help

Input file or URL

Method

Source GML file

GMLAS config

Edit or create custom configuration files based on [GMLAS config file schema](#) for more advanced options.

☒ Remove unused layers

☒ Remove unused fields

13 layer(s) found:

- category (100)
- category_extension_extension (100)
- extension (100)
- geologicevent (100)

☐ **Filter by extent**

xmin,ymin,xmax,ymax,EPSG:srs_id

☒ Create OGR metadata tables

☐ Create null constraints

☒ Convert to linear geometry

Swap coordinates

☐ Skip failures

Language

Target database

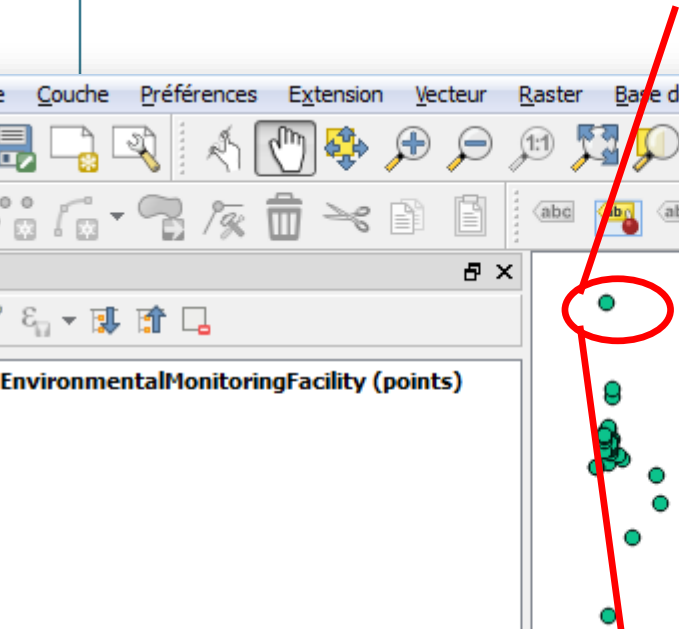
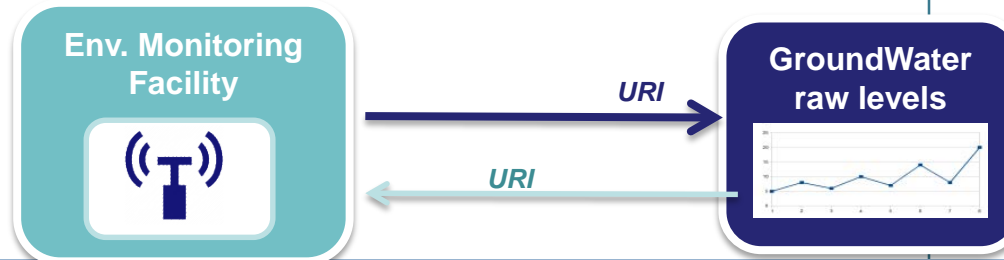
☒ SQLite ☐ PostgreSQL

Path

SRS

Access Mode ☒ Create ☐ Update ☐ Append ☐ Overwrite

GML application schema toolbox use – XML



EnvironmentalMonitoringFacility (points) - Attributs d'entités

fid <http://ressource.brgm-rec.fr/data/Piezometre/06988C0281/F.2>

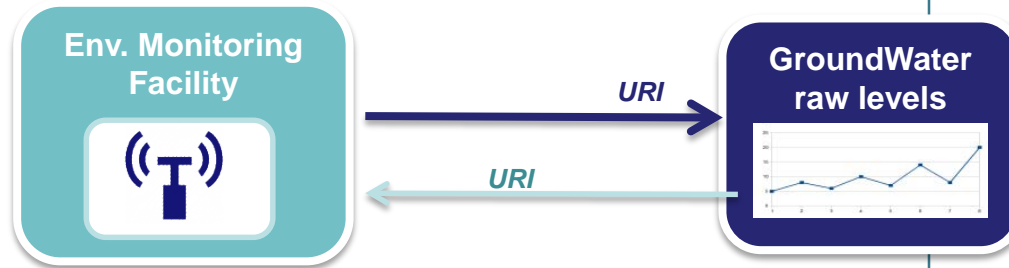
| Element | Value |
|-------------------------------|---|
| @gml:id | Piezometre.06988C0281.F.2 |
| gml:description | Water well from national BSS (Banque du Sous-Sol) Data database. Piezometer monitoring ground water level |
| gml:identifier | |
| @codeSpace | http://ressource.brgm-rec.fr/data/Piezometre/06988C0281/F.2 http://www.ietf.org/rfc/rfc2616 |
| ef:inspireId | |
| ef:name | Piezomètre molasse piscine Chassieu - 69 |
| ef:additionalDescription | |
| ef:mediaMonitored | |
| @xlink:href | http://inspire.ec.europa.eu/codelist/MediaValue/water |
| @xlink:title | water |
| ef:legalBackground | |
| ef:geometry | |
| gml:Point | |
| @srsName | urn:ogc:def:crs:EPSG::4326 |
| @gml:id | Piezometre.geom.2.06988C0281-F |
| @srsDimension | 2 |
| gml:pos | 45.7423745780909 4.96918640527985 |
| ef:onlineResource | http://fichebssseau.brgm.fr/bss_eau/fiche.jsf?code=06988C0281/F |
| ef:purpose | |
| @xlink:href | http://www.sandre.eaufrance.fr/?urn=urn:sandre:donnees:148::CdElement:2::referentiel:3.1:xml |
| @xlink:title | Ground water level measurement |
| ef:broader | |
| ef:supersedes | |
| ef:supersededBy | |
| ef:reportedTo | |
| ef:hasObservation | |
| @xlink:href | http://ressource.brgm-rec.fr/obs/RawOfferingPiezo/06988C0281/F.2&responseFormat=http://www.opengis.net/waterml/2.0&temporalFilter=om%3Aphenomenon |
| @xlink:title | Latest value (WaterML 2.0 format): Raw groundwater level measurement from piezometer 06988C0281/F.2 |
| ef:hasObservation | |
| @xlink:href | http://ressource.brgm-rec.fr/obs/RawOfferingPiezo/06988C0281/F.2&responseFormat=application/json&temporalFilter=om%3Aphenomenon |
| @xlink:title | Latest value (JSON format): Raw groundwater level measurement from piezometer 06988C0281/F.2 |
| ef:hasObservation | |
| @xlink:href | http://ressource.brgm-rec.fr/obs/RawOfferingPiezo/06988C0281/F.2&responseFormat=http://www.opengis.net/waterml/2.0 |
| @xlink:title | All observations (WaterML 2.0 format): Raw groundwater level measurement from piezometer 06988C0281/F.2 |
| ef:hasObservation | |
| @xlink:href | http://ressource.brgm-rec.fr/obs/RawOfferingPiezo/06988C0281/F.2&MergeObservationsIntoDataArray=true |
| @xlink:title | Raw groundwater level measurement from piezometer 06988C0281/F.2 |
| ef:involvedIn | |
| ef:representativePoint | |

XML


2

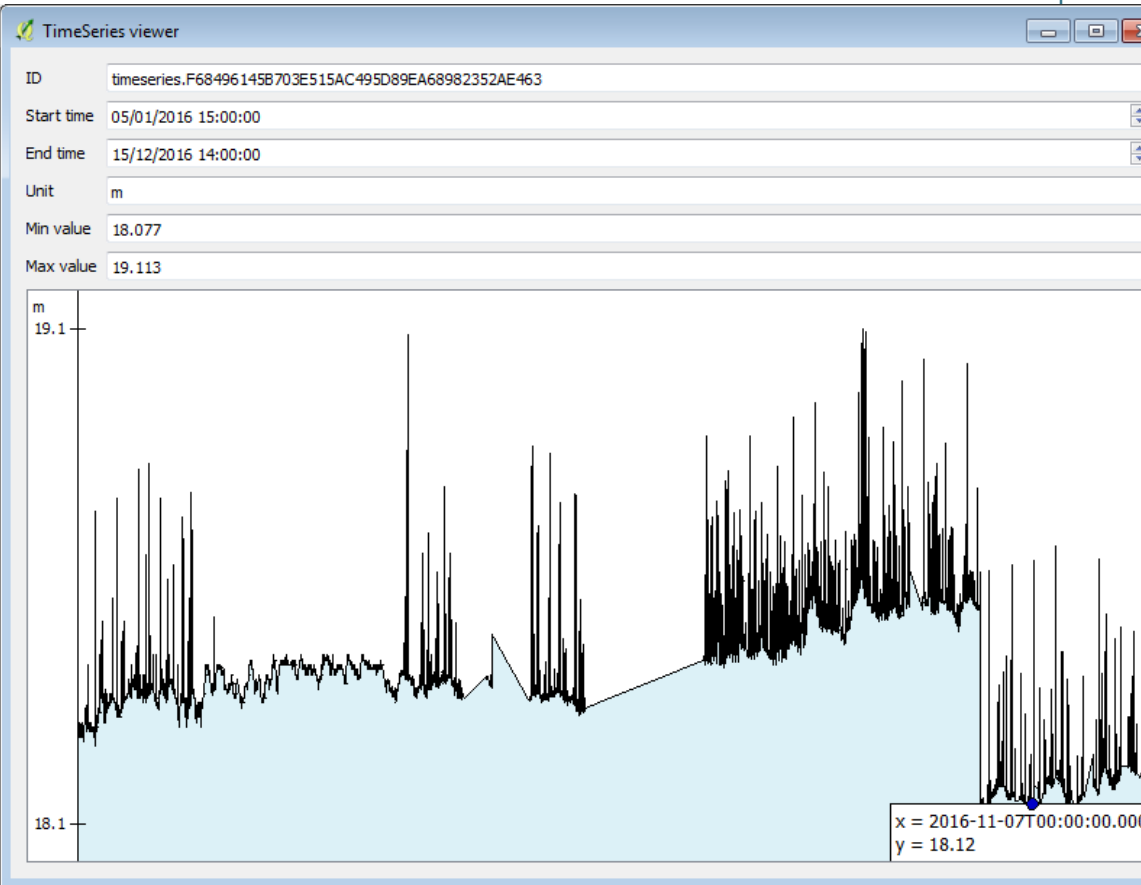
Copy value
Copy XPath
Resolve external
Embedded
As a new layer
Add to layer

GML application schema toolbox use – XML



XML Schema Tree:

- om:resultTime
 - gml:TimeInstant
 - @gml:id: ti_A5B605235028277DAC699731065C39B5E0F1
 - gml:timePo...: 2016-12-15T14:00:00.000Z
 - om:procedure
 - @xlink:href: <http://id.eaufrance.fr/met/403.xml>
 - @xlink:title: Electronic piezometric probe
 - om:parameter
 - om:observedPrope...
 - @xlink:href: <http://id.eaufrance.fr/par/1689.xml>
 - @xlink:title: GroundWaterLevel
 - om:featureOfInter...
 - wml2:Monitori...
 - @gml:id: mp_4C6129829F7C1C2DE4A2FB853F56C5B1A
 - gml:identifier: <http://ressources.brgm-rec.fr/data/Piezometre>
 - gml:name: Piezo 06988C0281/F.2
 - sf:sampledF...
 - sams:shape
 - om:result
 - wml2:Measure...  **3**



GML application schema toolbox use – XML

Borehole

The screenshot displays a GIS application interface. On the left, a map shows a geographical area with a point labeled 'A' circled in red. A red line connects this point to the XML data view on the right. The XML view, titled 'BoreholeView (points) - Attributs d'entités', shows the following data:

| Element | Value |
|--|---|
| @gml:id | BSS001REWW |
| gml:description | Borehole description |
| ▸ gml:identifier | http://ressource.brgm-rec.fr/data/BoreholeView/BSS001REWW |
| @codeSpace | http://www.ietf.org/rfc/rfc2616 |
| gml:name | Forage BSS001REWW |
| gsmlp:identifier | http://ressource.brgm-rec.fr/data/Borehole/BSS001REWW |
| ▸ gsmlp:purpose | |
| @xlink:href | http://inspire.ec.europa.eu/codelist/BoreholePurposeValue/hydrogeologicalSurvey |
| @xlink:title | levÃ© hydrogÃ©ologique, gestion de lâ€™eau |
| ▸ gsmlp:status | |
| @xlink:href | http://resource.europe-geology.eu/vocabs/BoreholeStatus/drillingCompleted |
| @xlink:title | drilling completed |
| ▸ gsmlp:drillingMethod | |
| @xlink:href | http://resource.europe-geology.eu/vocabs/DrillingMethod/hydraulic_rotary_drilling |
| @xlink:title | hydraulic rotary drilling |
| gsmlp:operator | BRGM (PIEZOMETRIE) |
| gsmlp:driller | INTRA FOR-COFOR |
| gsmlp:drillEndDate | 1974-11-30Z |
| ▸ gsmlp:startPoint | |
| @xlink:href | http://resource.europe-geology.eu/vocabs/BoreholeStartPoint/naturalLandSurface |
| @xlink:title | natural land surface |
| ▸ gsmlp:inclinationType | |
| @xlink:href | http://resource.europe-geology.eu/vocabs/BoreholeInclinationType/vertical |
| @xlink:title | vertical |
| gsmlp:boreholeMaterialCustodian | unknown |
| ▸ gsmlp:boreholeLength_m | |
| @uom | http://qudt.org/vocab/unit/M |

GML application schema toolbox use – XML

<http://resource.europe-geology.eu/vocabs/BoreholeStartPoint/1REWW>

| Element | Value |
|--|---|
| gsmlp:drillEndDate | 1974-11-30Z |
| ▴ gsmlp:startPoint | |
| @xlink:href | http://resource.europe-geology.eu/vocabs/BoreholeStartPoint/naturalLandSurface |
| @xlink:title | natural land surface |
| ▴ gsmlp:inclinationType | |
| @xlink:href | http://resource.europe-geology.eu/vocabs/BoreholeInclinationType/vertical |
| @xlink:title | vertical |
| gsmlp:boreholeMaterialCustodian | unknown |
| ▴ gsmlp:boreholeLength_m | |
| @uom | http://qudt.org/vocab/unit/M |
| ▴ gsmlp:elevation_m | |
| @uom | http://qudt.org/vocab/unit/M |
| gsmlp:elevation_srs | http://www.opengis.net/def/crs/EPSSG/0/5720 |
| gsmlp:source | http://ficheinfoterre.brgm.fr/InfoterreFiche/ficheBss.action?id=06512X0037/STREMY |
| gsmlp:metadata_uri | http://www.geocatalogue.fr/Detail.do?fileIdentifier=BR_BSS_BAA |
| gsmlp:genericSymbolizer | Not provided |
| ▴ gsmlp:shape | |
| ▴ gml:Point | |
| @srsDimension | 2 |
| @srsName | urn:ogc:def:crs:EPSG::4326 |
| @gml:id | gsmlp.shape.BSS001REWW |
| gml:pos | 46.1909541655103 5.18713262971692 |
| gsmlp:cored | false |
| gsmlp:accessToPhysicalDrillCore | false |
| ▴ gsmlp:boreholeUse | |
| @xlink:href | http://inspire.ec.europa.eu/codelist/BoreholePurposeValue/groundwaterLevelMonitoring |
| @xlink:title | surveillance du niveau de la nappe phrÃ©atique |
| ▴ gsmlp:detailedDescription | |
| @xlink:href | http://www.opengis.net/def/nil/OGC/0/template |
| @xlink:title | template |
| ▴ gsmlp:geophysicalLogs | |
| @xlink:href | http://www.opengis.net/def/nil/OGC/0/unknown |
| @xlink:title | unknown |
| ▴ gsmlp:geologicalDescription | |
| @xlink:href | http://ressource.brgm-rec.fr/obs/RawGeologicLogs/BSS001REWW |
| @xlink:title | Borehole BSS001REWW geologic log available. |
| ▴ gsmlp:groundWaterLevel | |
| @xlink:href | http://ressource.brgm-rec.fr/data/Piezometre/06512X0037/STREMY.2 |
| @xlink:title | Description of Piezometer attached to BSS001REWW. Provides link to SensorObservationService offering |

Borehole

GML application schema toolbox use – XML

gsmlp:shape

gml:Point

@srsDimension 2
 @srsName urn:ogc:def:crs:EPSG::4326
 @gml:id gsmlp.shape.BSS001REWW
 gml:pos 46.1909541655103 5.18713262971692

gsmlp:cored false
 gsmlp:accessToPhysicalDrillCore false

gsmlp:boreholeUse

@xlink:href <http://inspire.ec.europa.eu/codelist/BoreholePurposeValue/groundwaterLevelMonitoring>
 @xlink:title surveillance du niveau de la nappe phrÃ©atique

gsmlp:detailedDescription

@xlink:href <http://www.opengis.net/def/nil/OGC/0/template>
 @xlink:title template

gsmlp:geophysicalLogs

@xlink:href <http://www.opengis.net/def/nil/OGC/0/unknown>
 @xlink:title unknown

gsmlp:geolo

@xlink:href <http://ressource.brgm-rec.fr/obs/RawGeologicLogs/BSS001REWW>
 @xlink:title Borehole BSS001REWW geologic log available.

gsmlp:grou

@xlink:href <http://data.piezometre/06512X0037/STREMY.2>
 @xlink:title Described to BSS001REWW. Provides link to SensorObservationService offering

gsmlp:groundWaterChemistry

@xlink:href <http://www.opengis.net/def/nil/OGC/0/unknown>
 @xlink:title unknown

gsmlp:rockGeochemistry

@xlink:href <http://www.opengis.net/def/nil/OGC/0/unknown>
 @xlink:title unknown

gsmlp:poreGasChemistry

@xlink:href <http://www.opengis.net/def/nil/OGC/0/inapplicable>
 @xlink:title inapplicable

gsmlp:geoTechnicalInfo

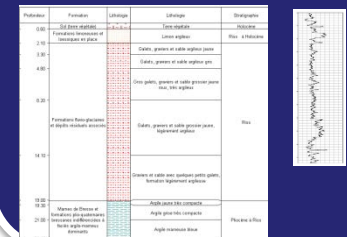
@xlink:href <http://www.opengis.net/def/nil/OGC/0/unknown>
 @xlink:title unknown

Borehole

URI

URI

Observations/ Geological logs



B

GML application schema toolbox use – XML

Geology log viewer

Description Lithologic observation for this level of borehole BSS001REWW

0.0 SUPERF: TERRE
0.6 LIMON, ARGILEUX

2.1
MEL/GALET/GRAVIER/SABLE, ARGILEUX

19.0 ARGILE, JAUNE COMPACT
19.3 ARGILE, GRIS COMPACT

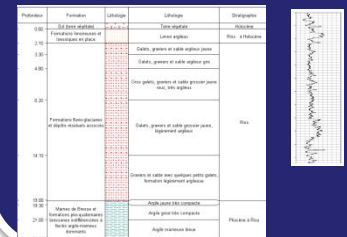
21.0 ARGILE, BLEU
23.0

Borehole

URI

URI

Observations/ Geological logs



http://ressource.brgm-rec.fr/data/BoreholeView/BSS001REWW

| Element | Value |
|--|---|
| gsmlp:drillEndDate | 1974-11-30Z |
| ▴ gsmlp:startPoint | |
| @xlink:href | http://resource.europe-geology.eu/vocabs/BoreholeStartPoint/naturalLandSurface |
| @xlink:title | natural land surface |
| ▴ gsmlp:inclinationType | |
| @xlink:href | http://resource.europe-geology.eu/vocabs/BoreholeInclinationType/vertical |
| @xlink:title | vertical |
| gsmlp:boreholeMaterialCustodian | unknown |
| ▴ gsmlp:boreholeLength_m | |
| @uom | http://qudt.org/vocab/unit/M |
| ▴ gsmlp:elevation_m | |
| @uom | http://qudt.org/vocab/unit/M |
| gsmlp:elevation_srs | http://www.opengis.net/def/crs/EPSSG/0/5720 |
| gsmlp:source | http://ficheinfoterre.brgm.fr/InfoterreFiche/ficheBss.action?id=06512X0037/STREMY |
| gsmlp:metadata_uri | http://www.geocatalogue.fr/Detail.do?fileIdentifier=BR_BSS_BAA |
| gsmlp:genericSymbolizer | Not provided |
| ▴ gsmlp:shape | |
| ▴ gml:Point | |
| @srsDimension | 2 |
| @srsName | urn:ogc:def:crs:EPSG::4326 |
| @gml:id | gsmlp.shape.BSS001REWW |
| gml:pos | 46.1909541655103 5.18713262971692 |
| gsmlp:cored | false |
| gsmlp:accessToPhysicalDrillCore | false |
| ▴ gsmlp:boreholeUse | |
| @xlink:href | http://inspire.ec.europa.eu/codelist/BoreholePurposeValue/groundwaterLevelMonitoring |
| @xlink:title | surveillance du niveau de la nappe phrÃ©atique |
| ▴ gsmlp:detailedDescription | |
| @xlink:href | http://www.opengis.net/def/nil/OGC/0/template |
| @xlink:title | template |
| ▴ gsmlp:geophysicalLogs | |
| @xlink:href | http://www.opengis.net/def/nil/OGC/0/unknown |
| @xlink:title | unknown |
| ▴ gsmlp:geologicalDescription | |
| @xlink:href | http://ressource.brgm-rec.fr/obs/RawGeologicLogs/BSS001REWW |
| @xlink:title | Borehole BSS001REWW geologic log available. |
| ▴ gsmlp:groundWaterLevel | |
| @xlink:href | http://ressource.brgm-rec.fr/data/Piezometre/06512X0037/STREMY |
| @xlink:title | Description of Piezometer attached to BSS001REWW. Provides link to SensorObservationService offering |

back to slides 9, 10

Borehole

URI

URI

Env. Monitoring
Facility



GML application schema toolbox use – Database

- WaterML2 flow (see slide 10, Timeseries viewer) but client in database mode

The screenshot displays the QGIS application interface. The top toolbar includes various editing and data management tools. The left sidebar shows the 'Couches' (Layers) panel with a list of layers including 'EnvironmentalMonitoringFacility representativePoint Point' and 'EnvironmentalMonitoringFacility geometry Point'. The main canvas shows a GML application schema diagram with several entities: 'MonitoringPointType_sampledFeature', 'MonitoringPointType_name', 'MeasurementTimeseriesType_point', 'MeasurementTimeseriesType', 'OM_Observation', and 'MonitoringPointType'. A red box highlights the 'MeasurementTimeseriesType_point' entity, and a red arrow points from it to a data table window. The table window is titled 'Table attributaire - MeasurementTimeseriesType_point :: Total des entités: 5000, filtrées: 5000, sélectionnées:'. It contains a table with the following columns: 'MeasurementTVP_value', 'MeasurementTVP_time', 'id', and 'MeasurementTimeseriesType'. The table lists 20 rows of data, showing values for each column.

| MeasurementTVP_value | MeasurementTVP_time | id | MeasurementTimeseriesType |
|----------------------|--------------------------|-----|---------------------------|
| 45.41 | 2016-01-10T02:00:00.000Z | 234 | timeseries.927B7... |
| 45.41 | 2016-01-10T03:00:00.000Z | 235 | timeseries.927B7... |
| 45.41 | 2016-01-10T04:00:00.000Z | 236 | timeseries.927B7... |
| 45.41 | 2016-01-10T05:00:00.000Z | 237 | timeseries.927B7... |
| 45.41 | 2016-01-10T06:00:00.000Z | 238 | timeseries.927B7... |
| 45.41 | 2016-01-10T07:00:00.000Z | 239 | timeseries.927B7... |
| 45.4 | 2016-01-10T08:00:00.000Z | 240 | timeseries.927B7... |
| 45.4 | 2016-01-10T09:00:00.000Z | 241 | timeseries.927B7... |
| 45.4 | 2016-01-10T10:00:00.000Z | 242 | timeseries.927B7... |
| 45.4 | 2016-01-10T11:00:00.000Z | 243 | timeseries.927B7... |
| 45.4 | 2016-01-10T12:00:00.000Z | 244 | timeseries.927B7... |
| 45.4 | 2016-01-10T13:00:00.000Z | 245 | timeseries.927B7... |
| 45.4 | 2016-01-10T14:00:00.000Z | 246 | timeseries.927B7... |

GML application schema toolbox use – ogrinfo

> Ex: direct driver access to GroundWaterML2 GW_Well

```
qgis@qgis-VirtualBox:~/qgisgmlas/data/geology: ogrinfo -q GMLAS:GW_Well_BRGM-uc1.xml gw_well

Layer name: gw_well
OGRFeature(gw_well):1
  id (String) = PointEau.01846X0361.P1
  description_href (String) = (null)
  description_title (String) = (null)
  description_nilreason (String) = (null)
  description (String) = Water well from national BSS (Banque du Sous-Sol) Data database
  descriptionreference_href (String) = (null)
  descriptionreference_title (String) = (null)
  descriptionreference_nilreason (String) = (null)
  identifier_codespace (String) = http://www.ietf.org/rfc/rfc2616
  identifier (String) = http://ressource.brgm.fr/data/PointEau/01846X0361/P1
  location_location_pkid (String) = (null)
  type_owns (Integer(Boolean)) = 0
  type_href (String) = (null)
  type_title (String) = (null)
  type_nilreason (String) = (null)
  lineage_pkid (String) = (null)
  shape_href (String) = (null)
  shape_title (String) = (null)
  shape_nilreason (String) = (null)
  gwwellconstructeddepth_href (String) = (null)
  gwwellconstructeddepth_title (String) = (null)
  gwwellconstructeddepth_nilreason (String) = (null)
  gwwellconstructeddepth_om_observation_om_observation_pkid (String) = OM_Observation.1
  gwwellconstructeddepth_om_observation_gw_geologylog_pkid (String) = (null)
  gwwellconstruction_href (String) = (null)
  gwwellconstruction_title (String) = (null)
  gwwellconstruction_nilreason (String) = (null)
  gwwellconstruction_owns (Integer(Boolean)) = 0
  gwwellconstruction_borehole_pkid (String) = Borehole.1
  gwwellstatus_owns (Integer(Boolean)) = 0
  gwwellstatus_href (String) = http://www.sandre.eaufrance.fr/?urn=urn:sandre:donnees:79::CdElement:3::referentiel:3.1.xml
  gwwellstatus_title (String) = OpA@rationnel
  gwwellstatus_nilreason (String) = (null)
  gwwelltotallength_nilreason (String) = (null)
  gwwelltotallength_href (String) = (null)
  gwwelltotallength_title (String) = (null)
```

Overall – development story



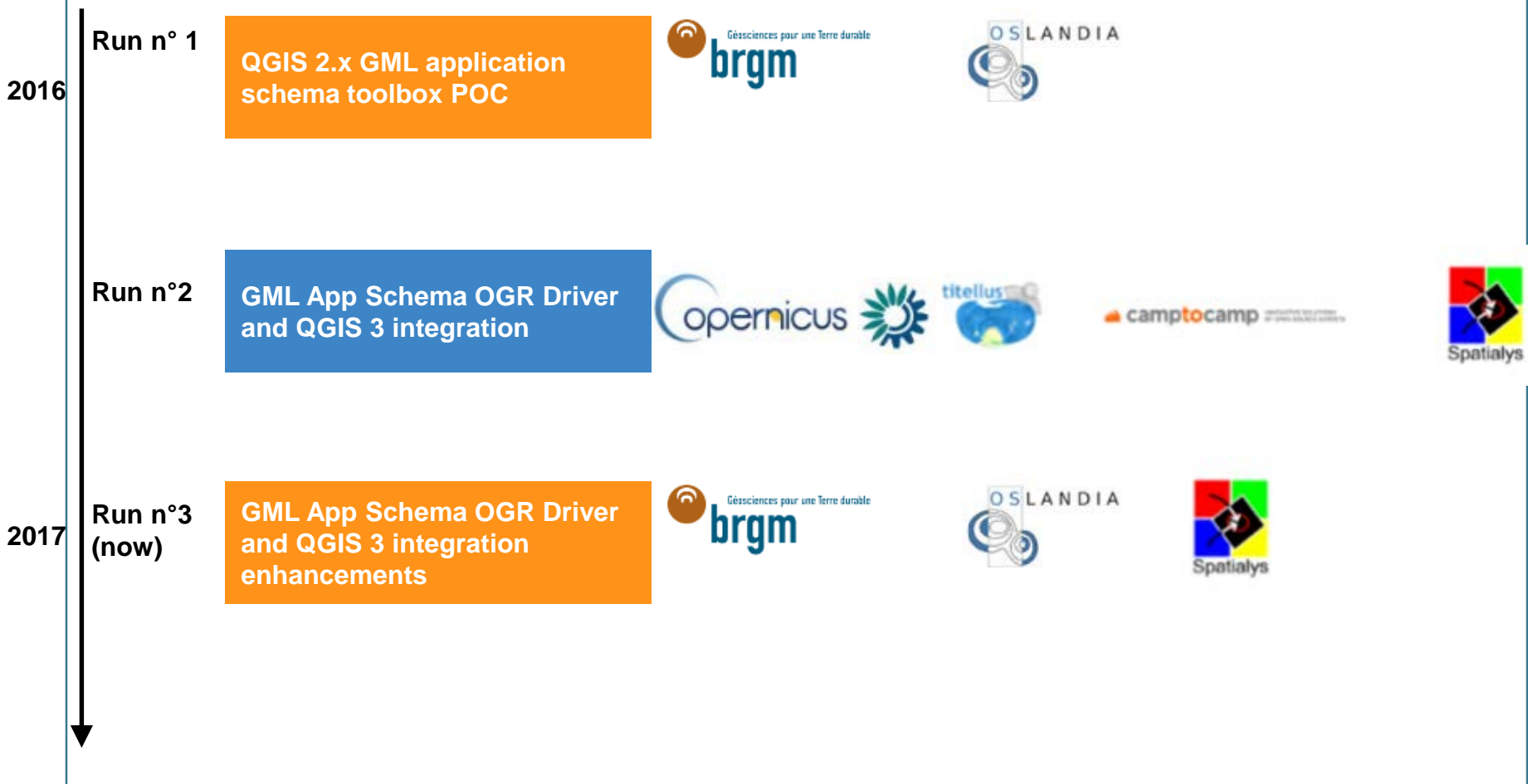
***« another approach to demonstrate
the usefulness of interoperable standards »***

or

***« having something to show to those
who consider XML is not sexy »***

Overall – development story

> From the ProofOfConcept to an enhanced approach



Overall – development story

> From the ProofOfConcept to an enhanced approach

Run n° 1

QGIS 2.x GML application
schema toolbox POC


Run n°2

GML App Schema OGR Driver
and QGIS 3 integration

PyXB -> specific [OGR/GDAL GMLAS driver](#) (targetting
GDAL 2.2), handling both reading and writing
Integration within QGIS 3

Run n°3
(now)

GML App Schema OGR Driver
and QGIS 3 integration
enhancements

- GDAL GMLAS : addition handling specific SWE types
based on GWML2 GW_GeologyLogCoverage and EU Air  GDAL 2.2
Quality Reportings (dataArray, dataRecord, ...)

- QGIS 3 : enhanced widgets for timeseries, and borehole
logs + some commit to the trunk



Useful links

- > https://plugins.qgis.org/plugins/gml_application_schema_toolbox/
- > https://github.com/BRGM/gml_application_schema_toolbox
 - Documentation, GUI presentation
- > **Multilinguism handling**
 - on INSPIRE registry: same flow asking for English then Greek definitions
<https://www.youtube.com/watch?v=EeAyyUOykVE>
- > **How to test under QGIS3 until its official release**
 - Use [OSGeo4W](#) installer
 - Advanced install \ Desktop -> add qgis-dev
 - Then install the plugin from QGIS repository

Conclusion

> **Generic work successfully tested on**

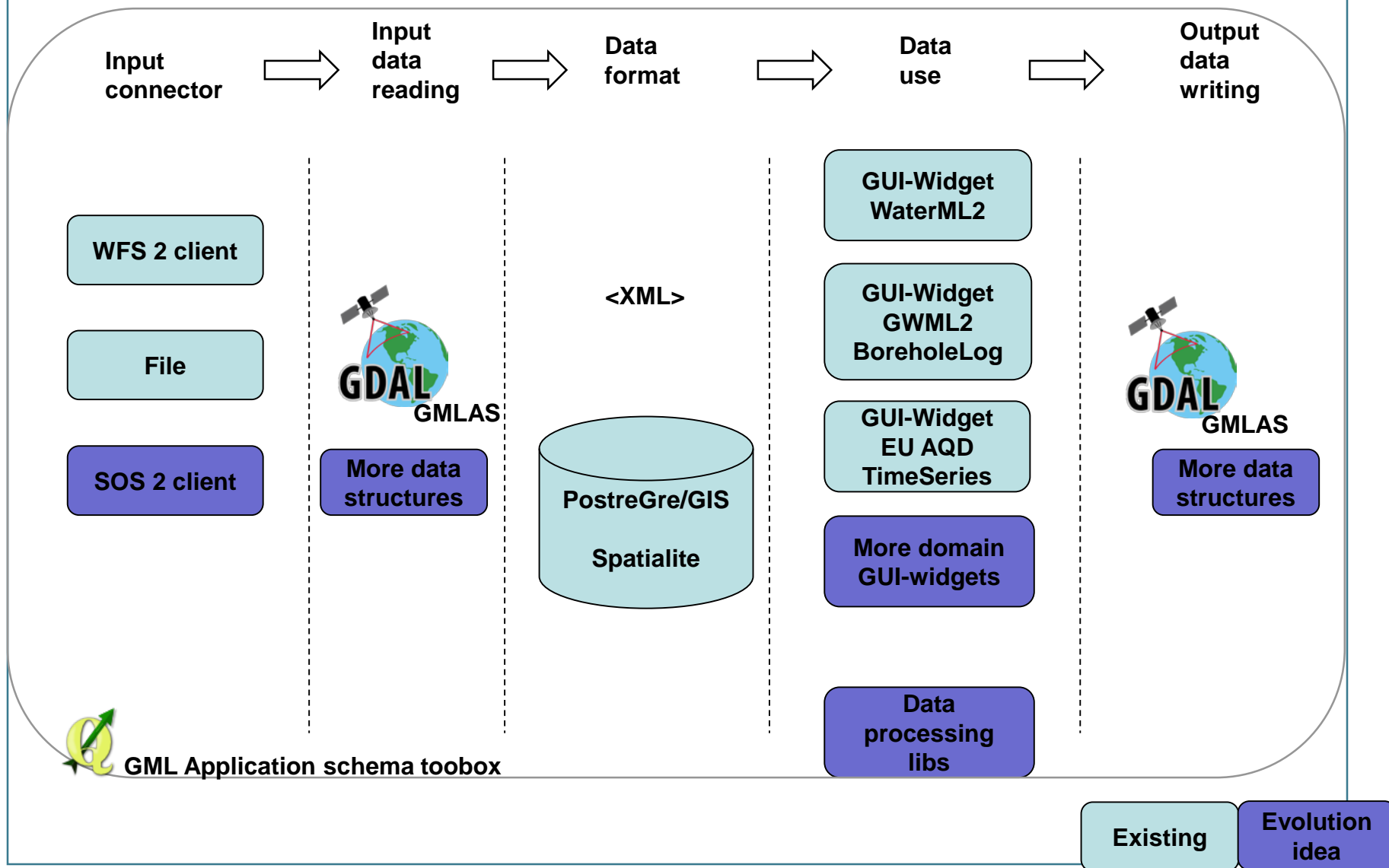
- OGC : GroundWaterML2, GeoSciML4, WaterML2
- INSPIRE : EnvironmentalMonitoringFacilities, BioGeographicalRegions, LandCover, ProtectedSites, MineralResources, PointTimeSeriesObservation

> **Our domain colleagues can now finally make use of standardized content 😊**

> **Next steps**

- Address (some) SWE specificities
- Have more domain widgets
- Handle other content type (JSON-LD ?)
- Workshop at Foss4G-E : [github ticket](#) to gather content to play with
- Feel free to use, test, enhance it, propose evolutions

Conclusion - wishlist



Thank you

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