

2113.21 6766 13 0

-1.89 3740.46 -625.5

QGIS GML application schema toolbox guided tour – use case on French Groundwater Information Network (GIN)



S.Grellet – BRGM / H.Mercier – Oslandia

French GIN – linked data use case

> Objectives

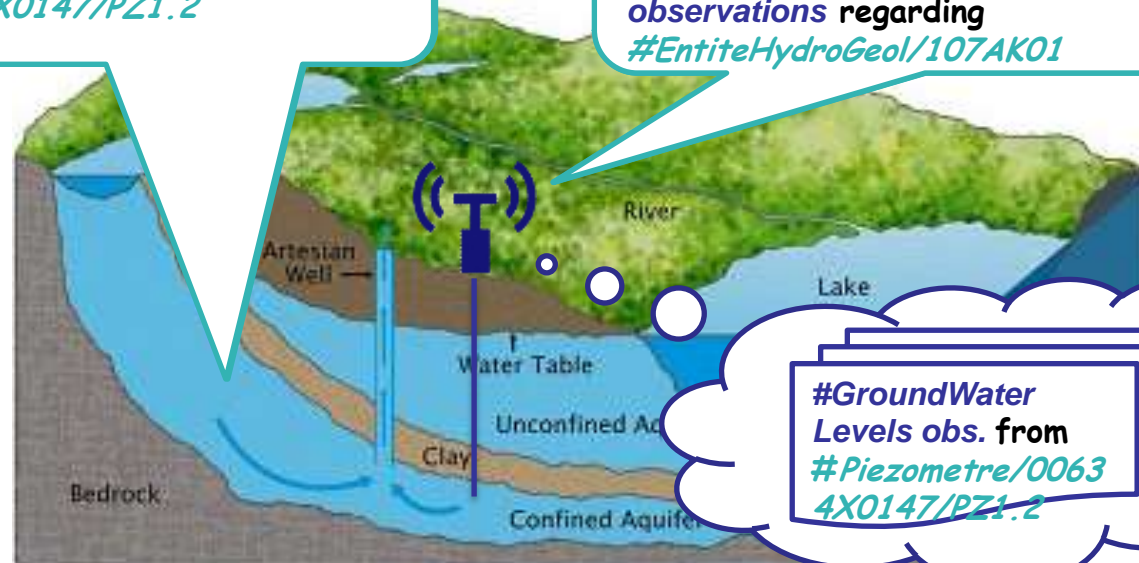
- To provide stable and resolvable links to resources
- To allow reference / data citation
- Independant from underlying technologies used to provide data

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

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

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

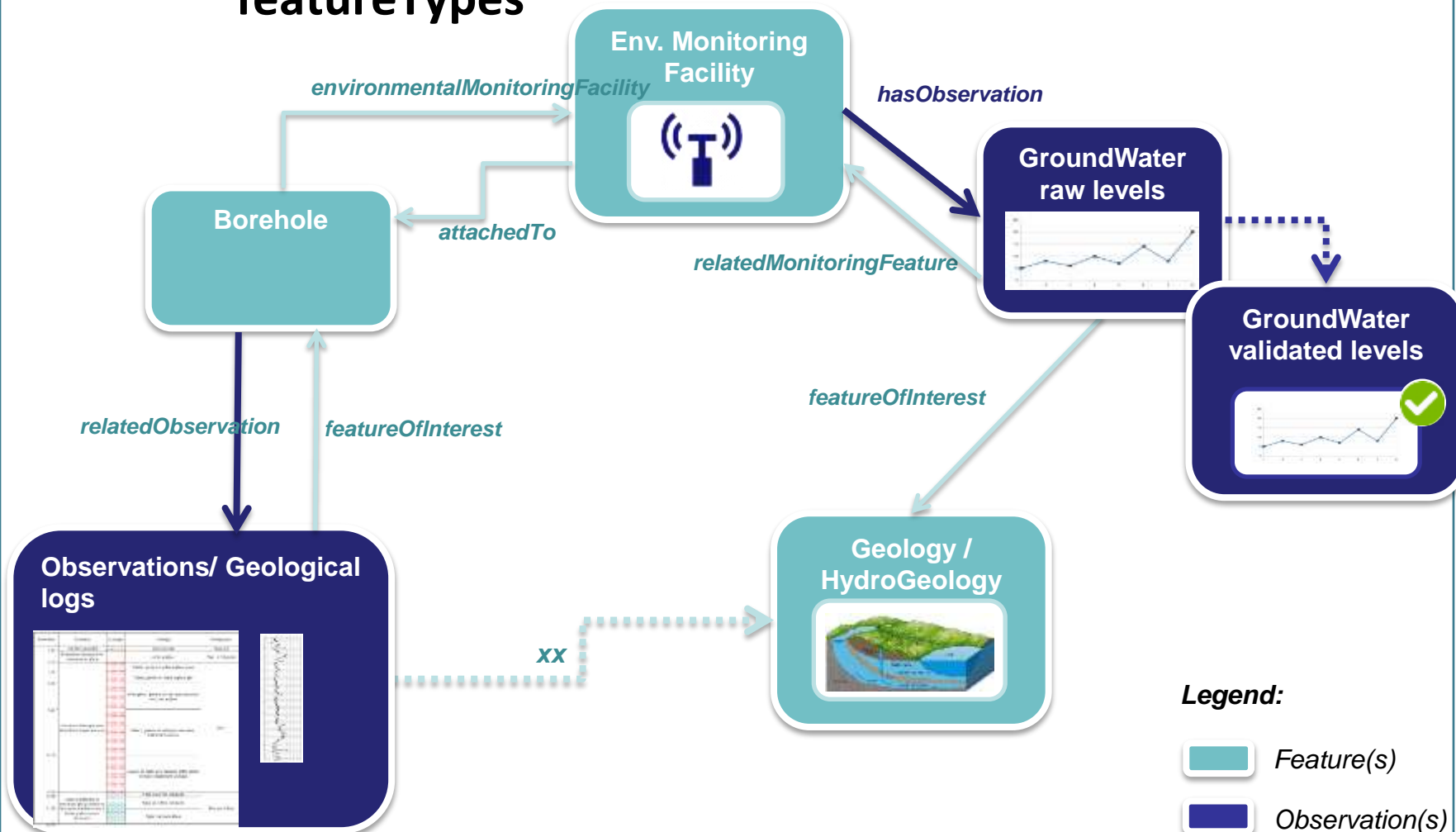
I have a lot of [#GroundWater Levels](#)
[observations](#) regarding
[#EntiteHydroGeol/107AK01](#)



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

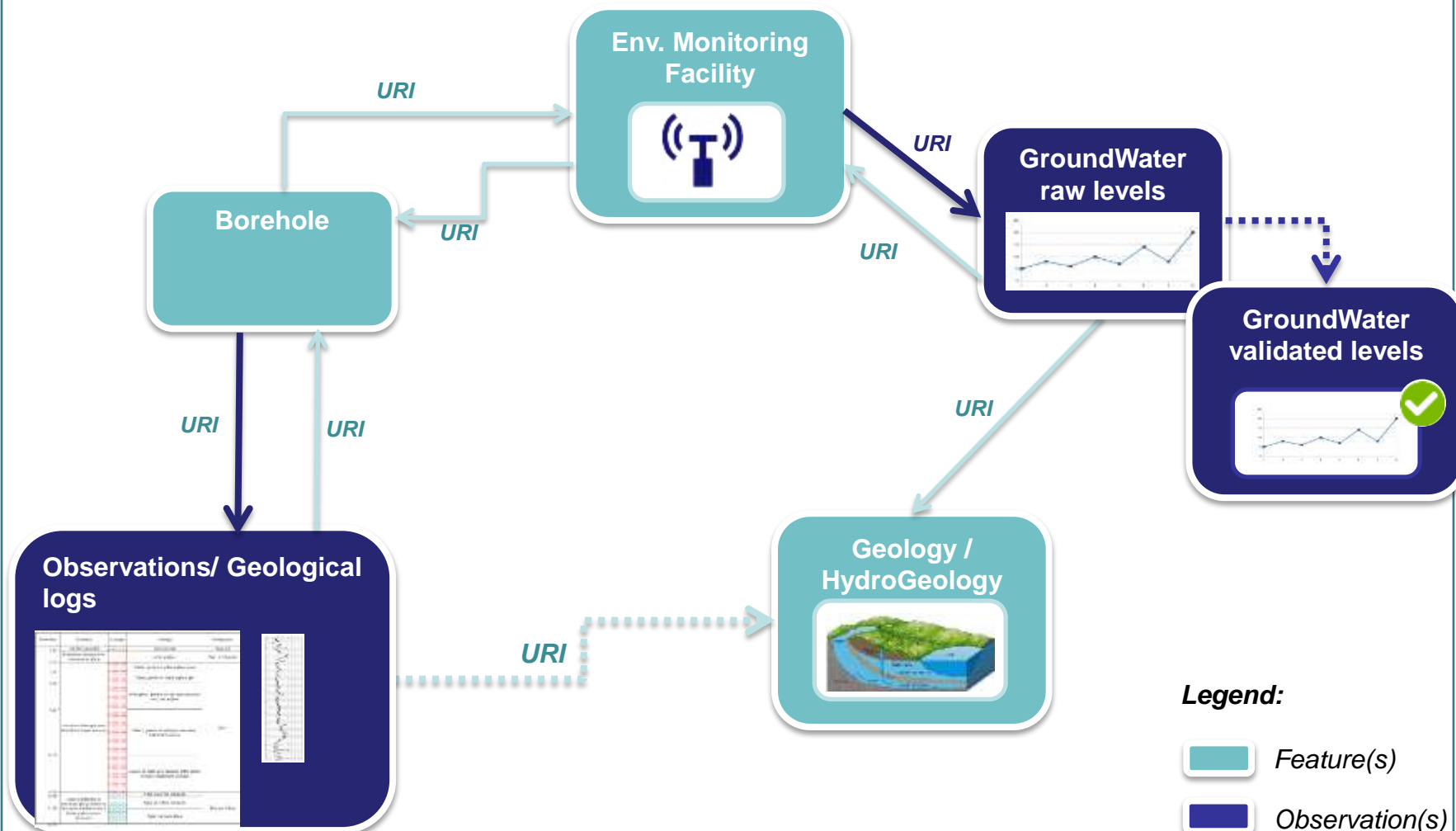
French GIN – linked data use case

> Flows based on OGC and INSPIRE defined featureTypes



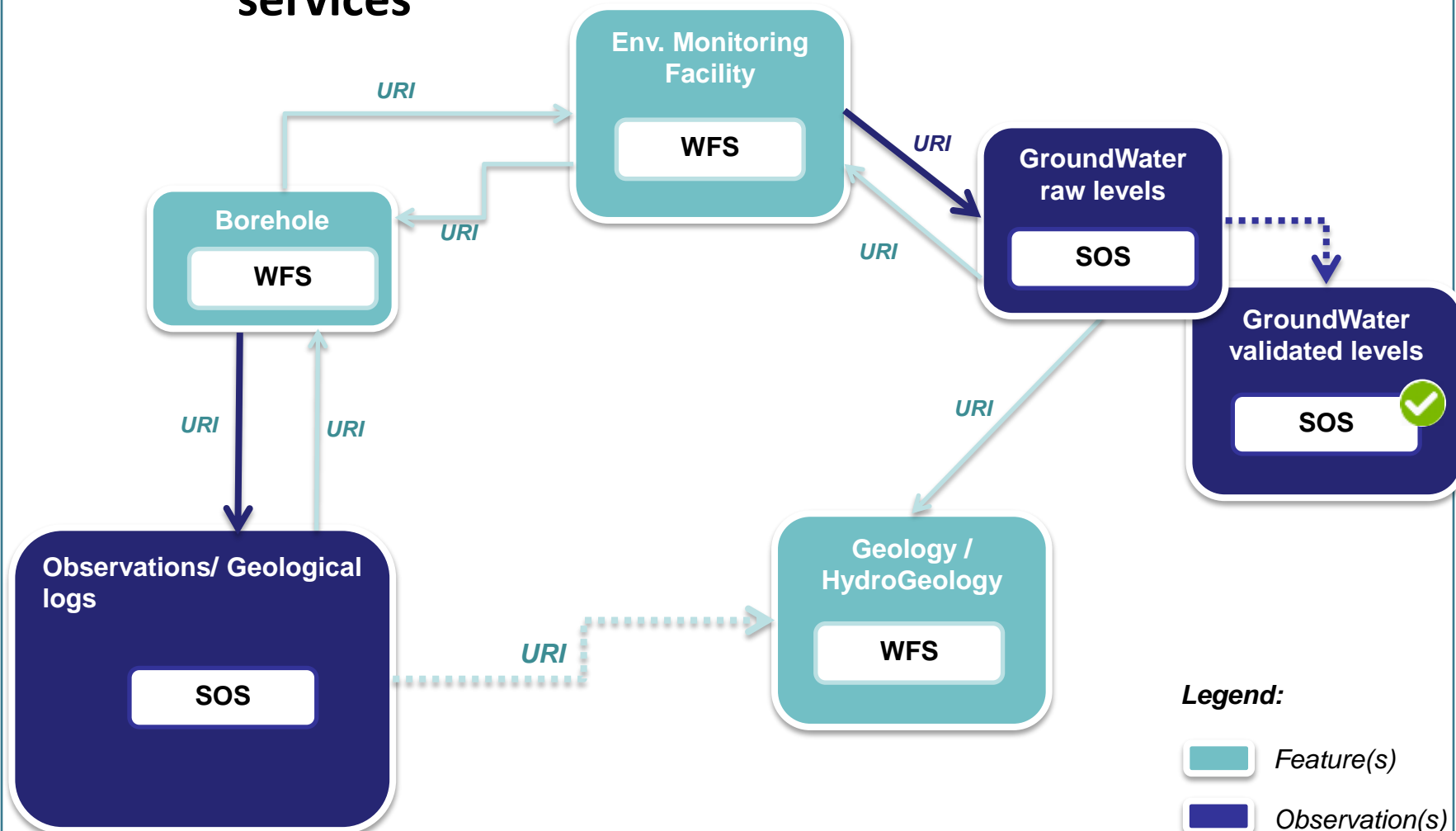
French GIN – linked data use case

> 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 - overview

> Initial idea

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

> Retrieve objects of interest described according to an interoperable 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 - overview

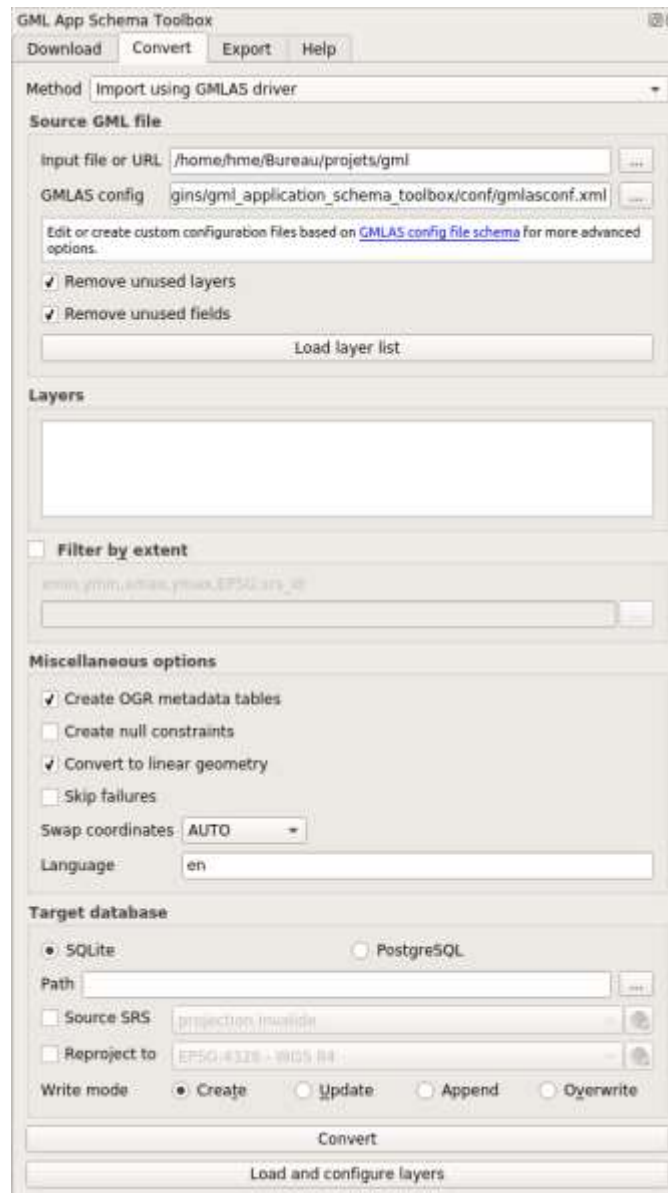
> **Trigger custom widgets based on interoperability standards**

- 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**

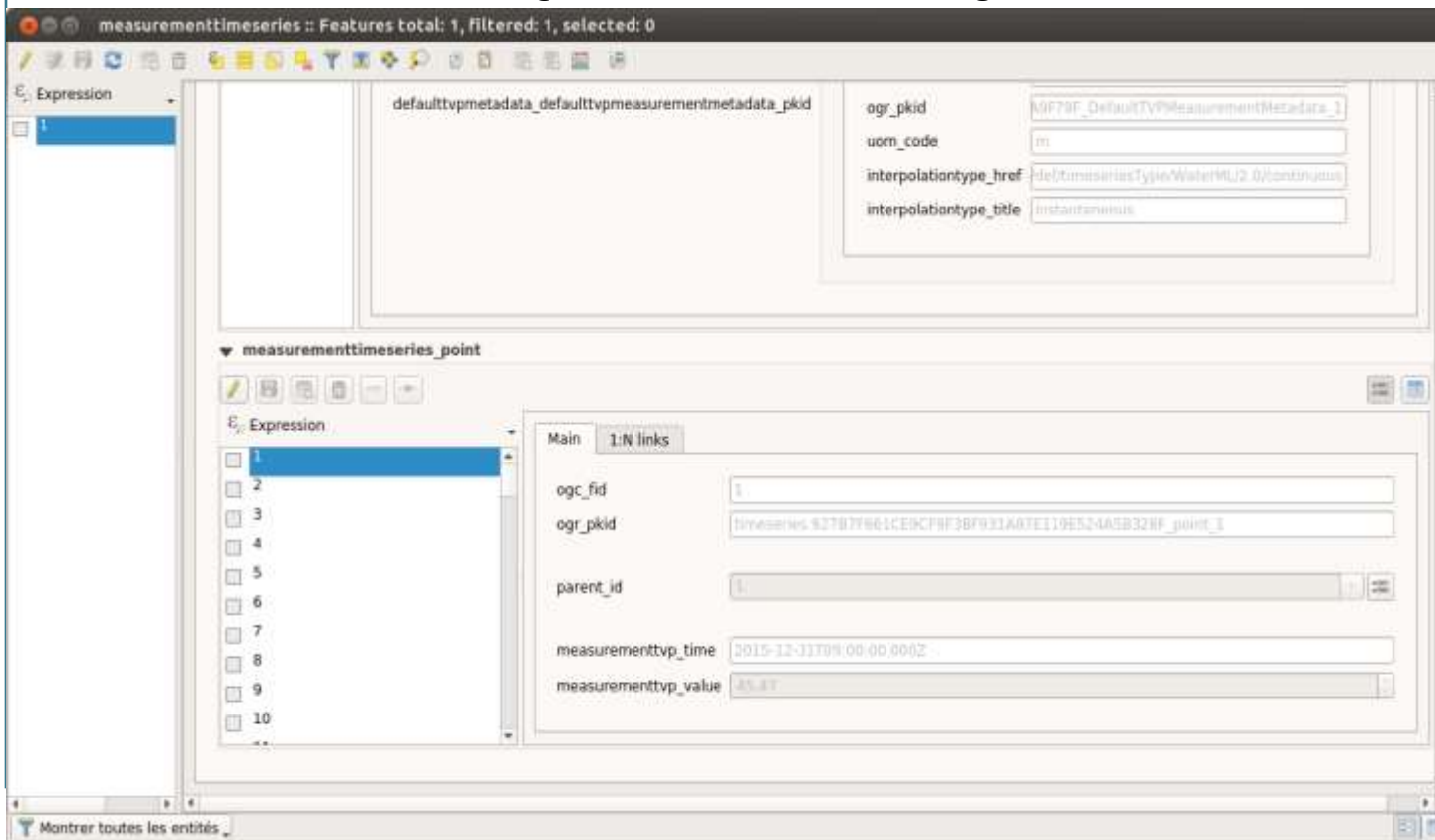
GML application schema toolbox use – QGIS 3



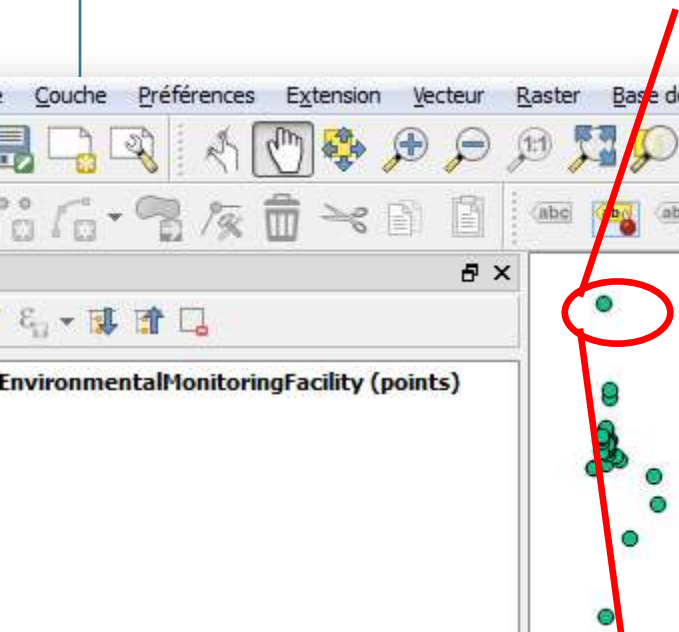
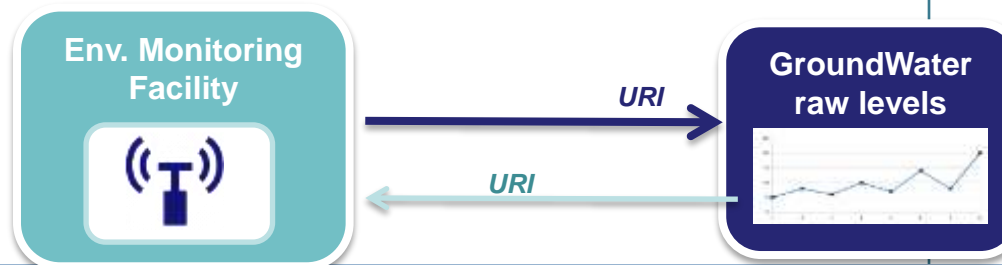
GML application schema toolbox - overview

> Two modes

- XML mode
- “relational” mode, thanks to GMLAS GDAL driver
 - QGIS project automatic configuration (layers / relations / editor widgets)
 - navigation in the model through standard QGIS forms



GML application schema toolbox use – XML



EnvironmentalMonitoringFacility (points) - Attributs d'entités

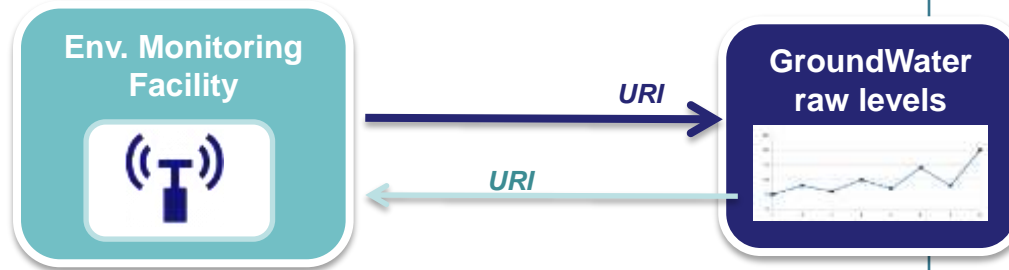
fid <http://ressource.brgm-rec.fr/data/Piezometre/06988C0281/F.2>


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	http://ressource.brgm-rec.fr/data/Piezometre/06988C0281/F.2
@codeSpace	http://www.ietf.org/rfc/rfc2616
ef:inspireId	
ef:name	Piézomètre 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.openqgis.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.openqgis.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	All observations (WaterML 2.0 format): Raw groundwater level measurement from piezometer 06988C0281/F.2
ef:involvedIn	
ef:representativePoint	

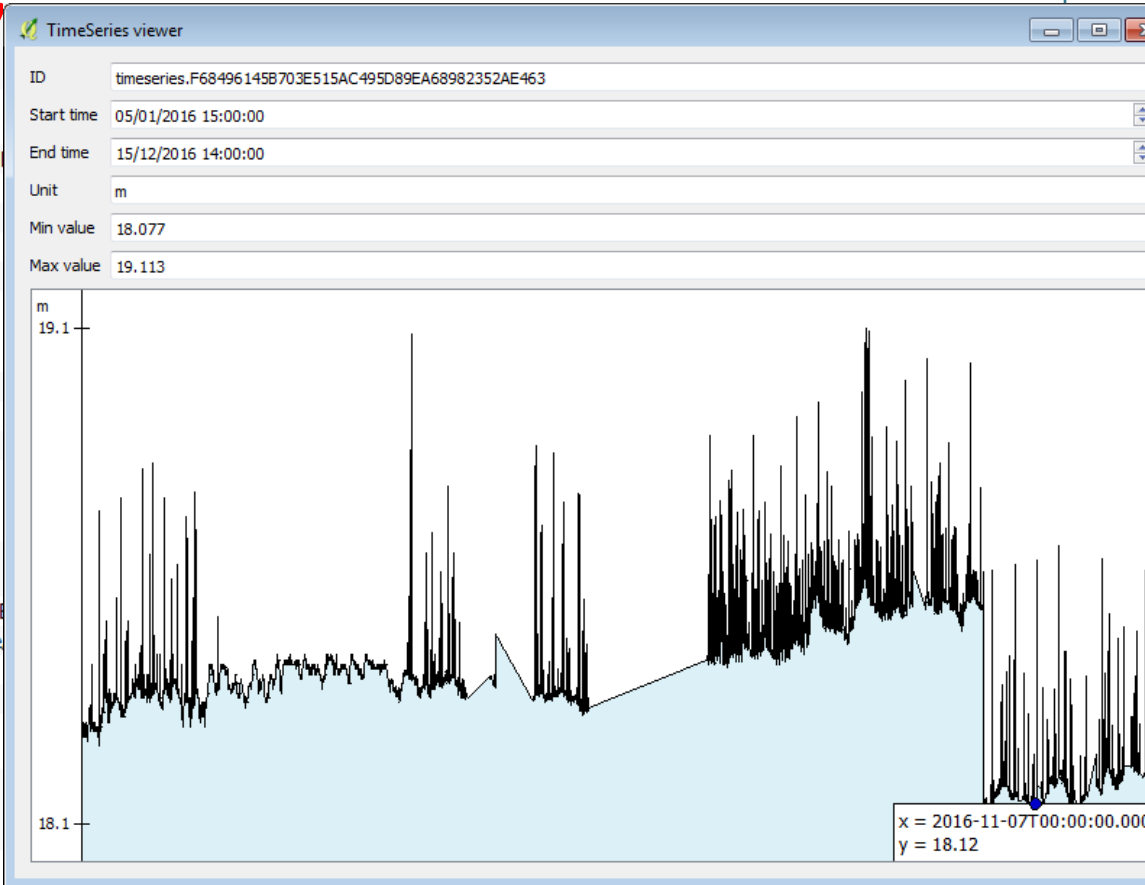
XML

2

GML application schema toolbox use – XML

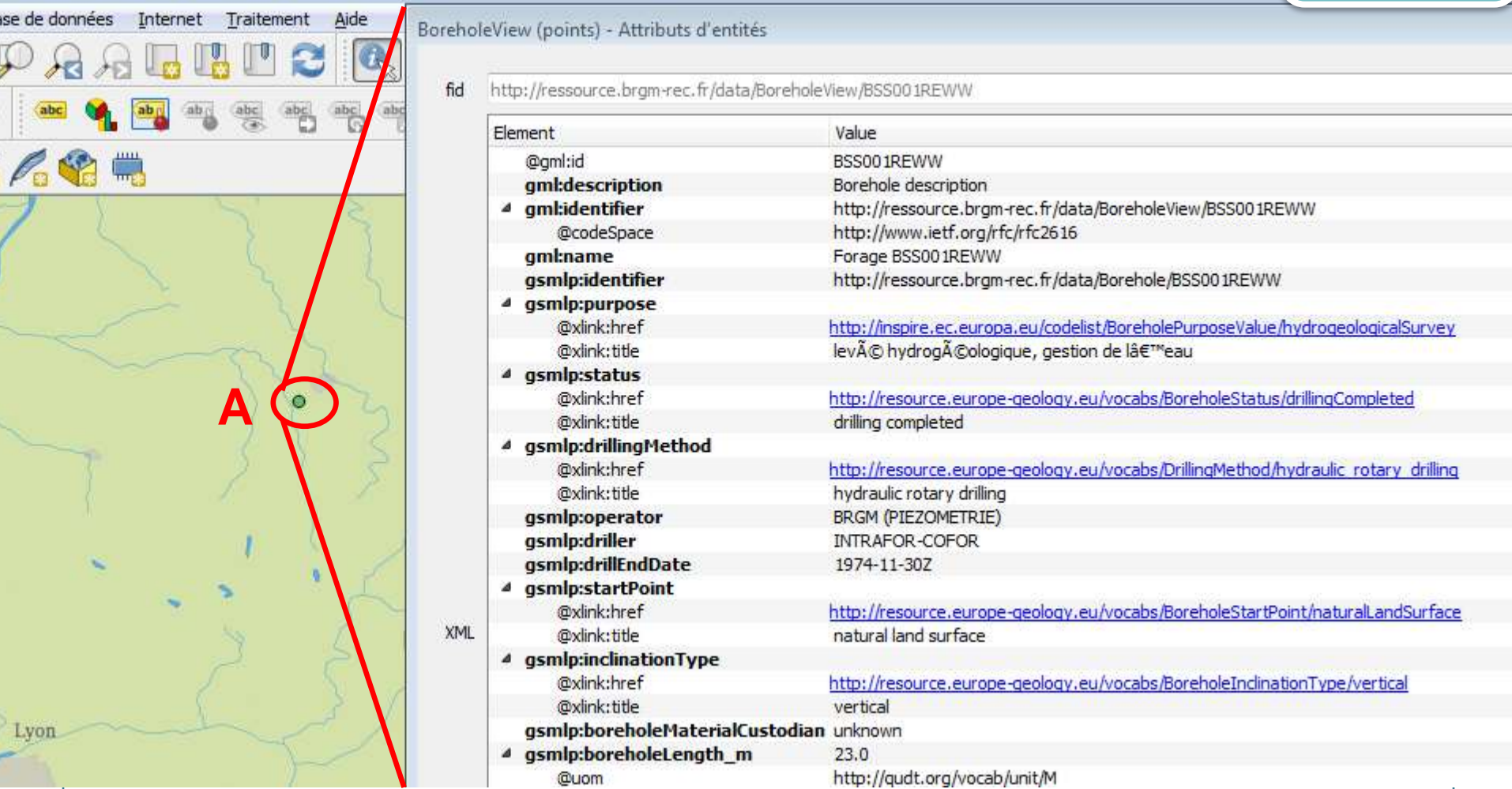


- om:resultTime
 - gml:TimeInstant
 - @gml:id ti_A5B605235028277DAC699731065C3985E0F1
 - gml:timePo... 2016-12-15T14:00:00.000Z
 - om:procedure
 - @xlink:href <http://id.eaufrance.fr/met/403.xml>
 - @xlink:title Electronic piezometric probe
 - om:parameter
 - om:observedPrope...
 - @xlink:href <http://id.eaufrance.fr/par/1659.xml>
 - @xlink:title GroundWaterLevel
 - om:featureOfInter...
 - wml2:Monitori...
 - @gml:id mp_4C6129829FFC1C2DE4A2FB853F56C5B1A
 - 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 green area with a red circle around a point labeled 'A'. A red line connects this point to the XML metadata table on the right. The table, titled 'BoreholeView (points) - Attributs d'entités', lists various GML elements and their values for the borehole identified by the URL 'http://ressource.brgm-rec.fr/data/BoreholeView/BSS001REWW'.

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	INTRAFOR-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	23.0
@uom	http://qudt.org/vocab/unit/M

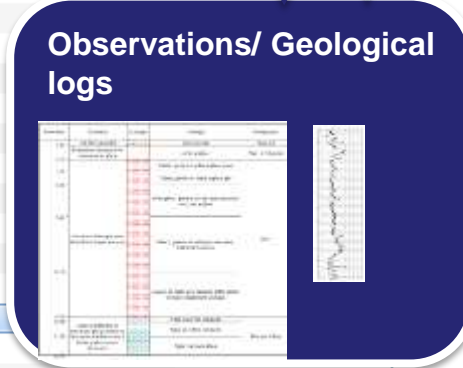
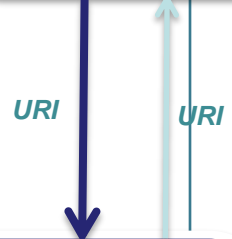
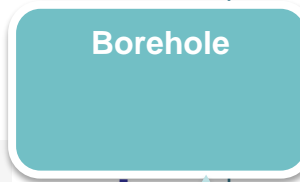
GML application schema toolbox use – XML

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	23.0
@uom	http://qudt.org/vocab/unit/M
▾ gsmlp:elevation_m	223.87
@uom	http://qudt.org/vocab/unit/M
gsmlp:elevation_srs	http://www.opengis.net/def/crs/EPSG/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 phrÀ@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.openqis.net/def/nil/OGC/0/template
@xlink:title	template
gsmlp:geophysicalLogs	
@xlink:href	http://www.openqis.net/def/nil/OGC/0/unknown
@xlink:title	unknown
gsmlp:geologicLogs	
@xlink:href	http://ressource.brgm-rec.fr/obs/RawGeologicLogs/BSS001REWW
@xlink:title	Borehole BSS001REWW geologic log available.
gsmlp:groundWaterChemistry	
@xlink:href	http://www.openqis.net/def/nil/OGC/0/unknown
@xlink:title	unknown
gsmlp:rockGeochemistry	
@xlink:href	http://www.openqis.net/def/nil/OGC/0/unknown
@xlink:title	unknown
gsmlp:poreGasChemistry	
@xlink:href	http://www.openqis.net/def/nil/OGC/0/inapplicable
@xlink:title	inapplicable
gsmlp:geoTechnicalInfo	
@xlink:href	http://www.openqis.net/def/nil/OGC/0/unknown
@xlink:title	unknown



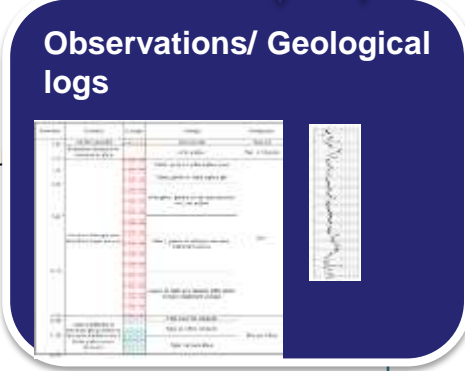
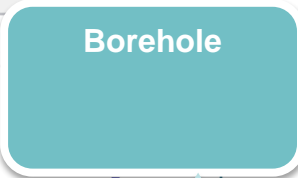
B

A green rectangular box highlights a context menu for the 'gsmlp:geologicLogs' entry. The menu options are: Copy value, Copy XPath, Resolve external (with a sub-menu), Embedded, As a new layer, and Add to layer (with a sub-menu). The 'Resolve external' sub-menu is open, showing options like 'Embedded', 'As a new layer', and 'Add to layer'. A blue arrow points from the selected 'Embedded' option to the 'Observations/ Geological logs' image.

GML application schema toolbox use – XML

Geology log viewer

Description Lithologic observation for this level of borehole BSS00



URI

URI

sos:GetObservationResponse

@xlink:href <http://ressource.brgm-rec.fr/obs/RawGeologicLogs/>
 @xlink:title Borehole BSS001REWW geologic log available.
 @xsi:schemaLocation <http://www.opengis.net/sos/2.0> <http://schemas.op>

sos:observationData

om:OM_Observation



@gml:id o_B8A57E0D13F439A702FBAD713F09AA17FC951E
 gml:description Lithologic observation for this level of borehole BSS00
 gml:identifier <http://ressource.brgm-rec.fr/obs/RawEarthMaterial>
 gml:name RawEarthMaterialLogObservation BSS001REWW
 om:type
 om:phenomenonTime
 om:resultTime
 om:procedure
 om:parameter
 om:parameter
 om:parameter
 om:observedProperty
 @xlink:href <http://www.opengis.net/def/gwml/2.0/observedProp>
 @xlink:title Earth Material
 om:featureOfInterest
 om:result

sos:observationData

om:OM_Observation



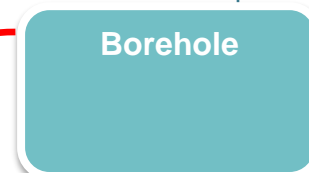
gsmlp:groundWaterLevel

@xlink:href <http://ressource.brgm-rec.fr/data/Piezometre/0651>
 @xlink:title Description of Piezometer attached to BSS001REWW

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	23.0
@uom	http://qudt.org/vocab/unit/M
▾ gsmlp:elevation_m	223.87
@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



GML application schema toolbox use – Database

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

The screenshot displays a GIS application interface. On the left, a 'Couches' (Layers) panel lists various environmental monitoring layers. The main workspace shows a GML schema toolbox with several classes, including 'MonitoringPointType_sampledFeature', 'MonitoringPointType_name', 'OH_Observation', and 'MeasurementTimeseriesType_point'. A red box highlights the 'MeasurementTimeseriesType_point' class, with a red arrow pointing to a data table window.

The data table window, titled 'Table attributaire - MeasurementTimeseriesType_point :: Total des entités: 5000, filtrées: 5000, sélectionnées:', displays the following data:

MeasurementTVP_val	MeasurementTVP_time	id	MeasurementTimeseriesT...
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...

At the bottom of the interface, a legend identifies the layers: 'EnvironmentalMonitoringFacility representativePoint Point' and 'EnvironmentalMonitoringFacility_geometry_Point'.

GML application schema toolbox - Custom viewers API

> Custom viewer?

- a piece of code able to present some data in a visually appealing way
e.g. : timeseries as plot rather than list of (x,y) values

> Main ideas

- a simple and common way to express access to data: **XPath** on the xsd
- a common graphical API: **PyQT**
- a simple way to add new viewers for specific application schemas (targeted to Python dev audience for now)
 - Just create a new .py file in a given directory
 - With a common base Python class

GML application schema toolbox - Custom viewers API

example.py

Raw

```
1 class GeologyLogViewer(QWidget):
2     @classmethod
3     def name(cls):
4         return "GW Geology log"
5
6     @classmethod
7     def xml_tag(cls):
8         # the XML tag (with namespace) this widget is meant for
9         # the second element of the tuple is an XPath filter
10        return ("{http://www.opengis.net/om/2.0}OM_Observation",
11              ".:/om:type[@xlink:href='http://www.opengis.net/def/observationType/OGC-GWML/2.2/GW_GeologyLog']")
12
13    @classmethod
14    def icon(cls):
15        return QIcon(os.path.join(os.path.dirname(__file__), "drill.svg"))
16
17    @classmethod
18    def init_from_xml(cls, xml_tree):
19        # parse data
20        data = []
21        description = resolve_xpath(xml_tree, "description/text()")
22        logs = resolve_xpath(xml_tree, "result/GW_GeologyLogCoverage/element/LogValue")
23        data = []
24        for log in logs:
25            fromDepth = float(resolve_xpath(log, "fromDepth/Quantity/value/text()"))
26            toDepth = float(resolve_xpath(log, "toDepth/Quantity/value/text()"))
27            value_text = resolve_xpath(log, "value/DataRecord/field/Text/value/text()")
28            value_cat = resolve_xpath(log, "value/DataRecord/field/Category/value/text()")
29            value = value_text if value_text is not None else value_cat
30            data.append((fromDepth, toDepth, value))
31        return cls(description, data)
32
33    def __init__(self, title, data, parent = None):
34        QWidget.__init__(self, parent)
35        # ...
```

Useful links

- > https://plugins.qgis.org/plugins/gml_application_schema_toolbox/
- > https://github.com/BRGM/gml_application_schema_toolbox
 - Documentation, GUI presentation
- > **Multilinguism handling**
 - 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**
 - [OSGeo4W](#)
 - Use [OSGeo4W](#) installer
 - Advanced install \ Desktop -> add qgis-dev
 - Then install the plugin from QGIS repository
 - Virtualbox : http://hekla.oslandia.net/qgis_gmlas_box/

Conclusion

> **Generic work successfully tested on**

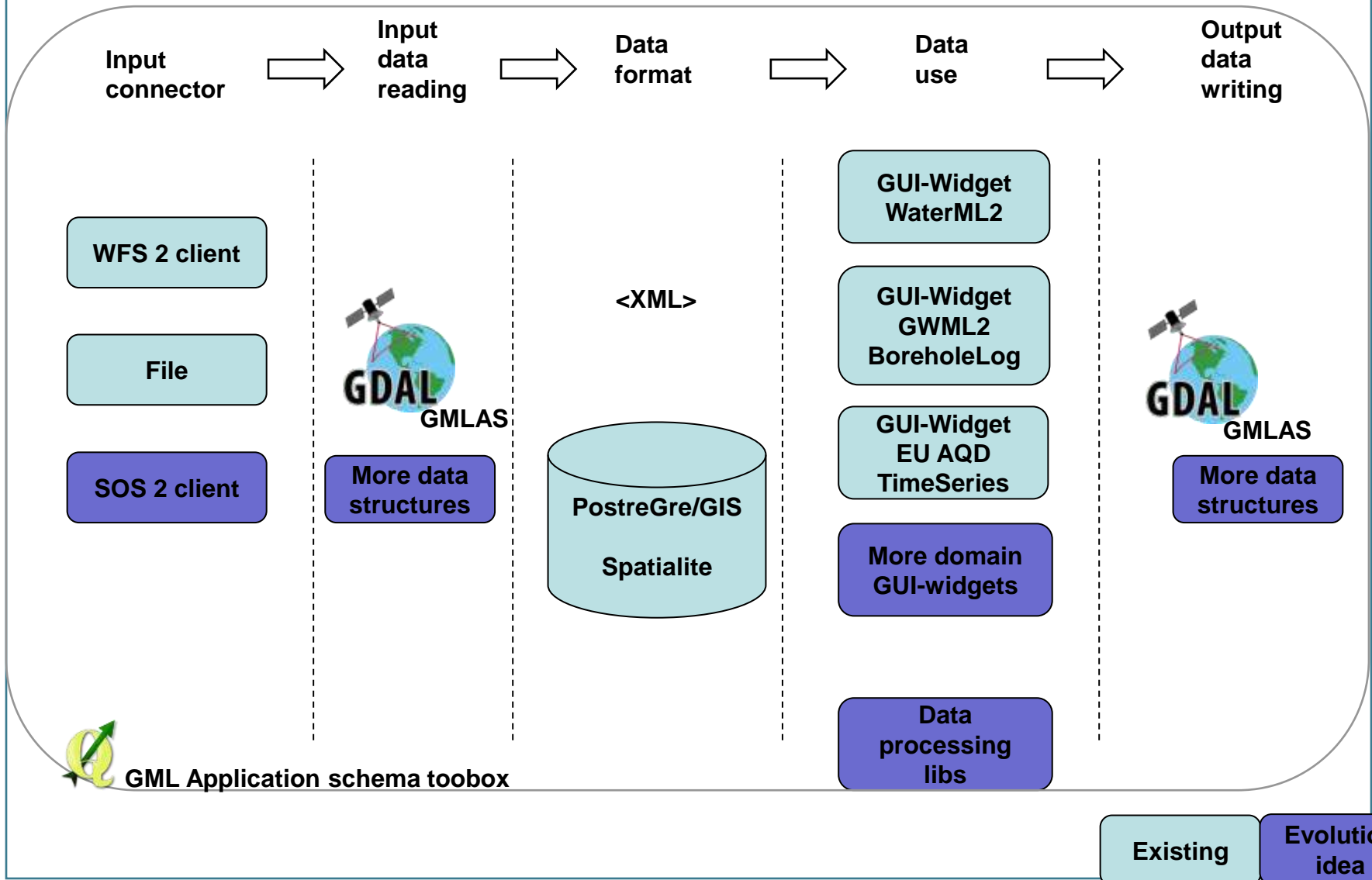
- OGC : GroundWaterML2, GeoSciML4, WaterML2
- INSPIRE : EnvironmentalMonitoringFacilities, BioGeographicalRegions, LandCover, ProtectedSites, MineralResources, PointTimeSeriesObservation

> **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

s.grellet@brgm.fr

m.beaufils@brgm.fr

hugo.mercier@oslandia.com