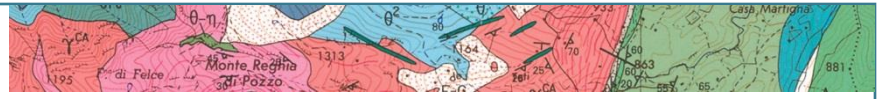

Towards a comprehensive subsurface information system

Mickaël Beaufils, Christelle Loiselet, Sylvain Grellet, François Robida

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Underground Infrastructure Mapping and Modeling Workshop

New York, Tuesday April 25th

BRGM in one slide

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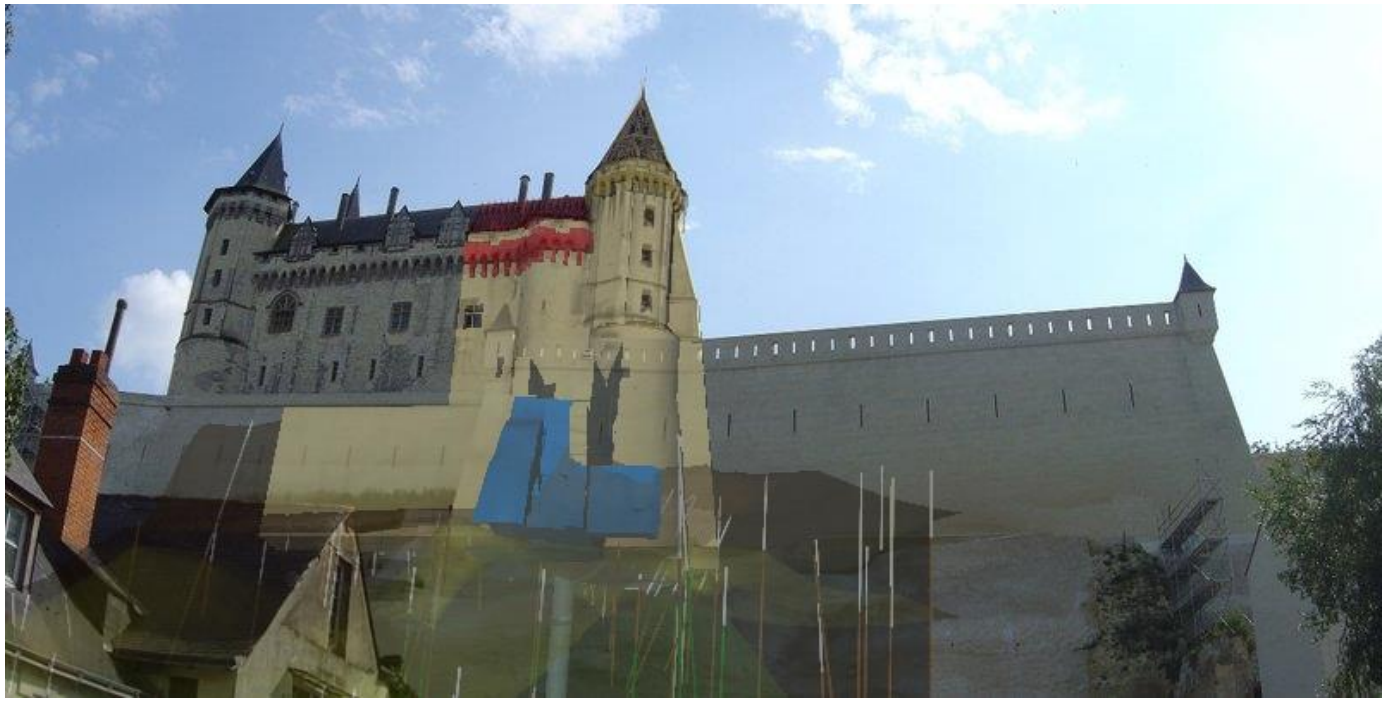
- French Geological Survey
- 5 main departments: groundwater, geology/ressources, geohazards, laboratories & IT
- An active contributor for interoperability in geosciences and geospatial

OGC®
Making location count.

INSPIRE Infrastructure for Spatial Information in Europe

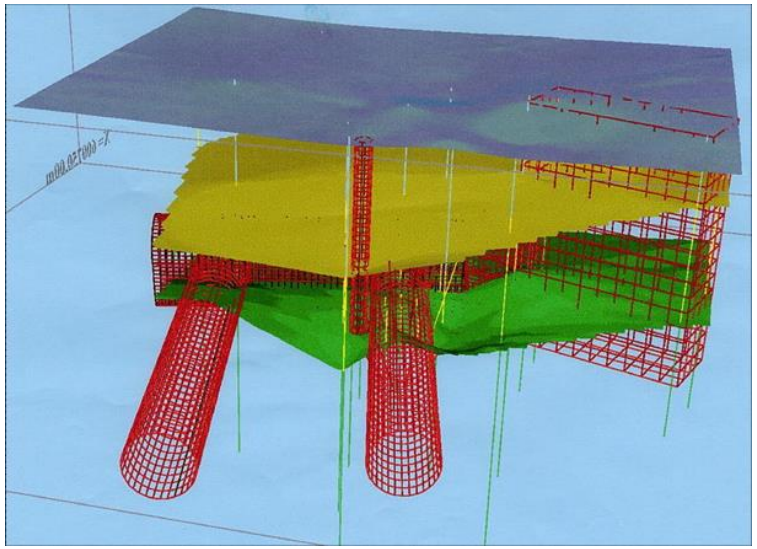
Linking geological and urban modeling, a long story in BRGM

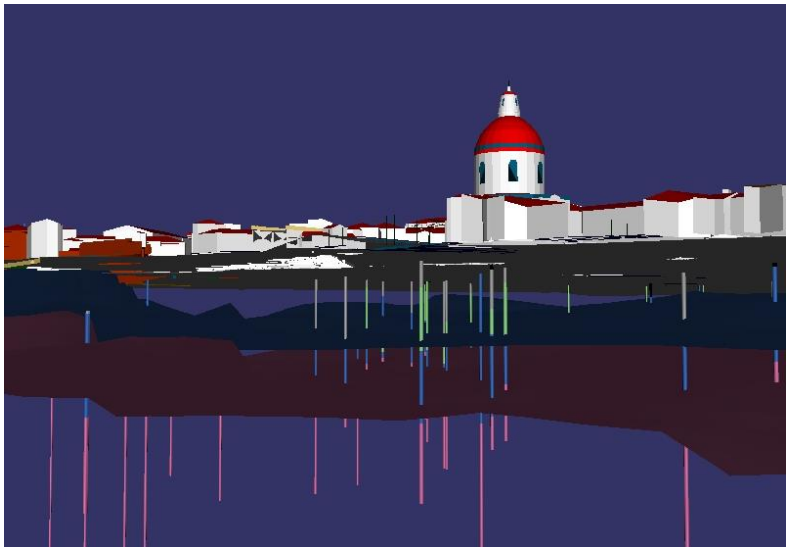
RAXENV 2006-2008



Linking geological and urban modeling, a long story in BRGM

DeepCity3D 2009-2012





Fraunhofer IGD

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What did we learn / get from those projects?

> **Proof of concepts**

> **But**

- Disconnections in the raw data > visualization chain process
- Some technological maturity issues (GPRS localization, big data volumes management, …)

$\Rightarrow$ difficult to replicate to other use cases

$\Rightarrow$ isolated initiatives

> **We decided to focus more on data structure**

- Do more than proof of concepts

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Combining built and natural environment modeling: map of the problematique

> **Environmental modeling is (mostly) based on mathematical functions / algorithms**

> ***« All models are wrong: some models are useful »***

George E.P. Box (statistician)

- No perfect match with reality
- Environmental models have conditions of validity
- Environment is always changing

⇒ Necessity of communicating the conditions of validity of the model

⇒ Be cautious with representations

⇒ Models have to be updated / refined with new observations

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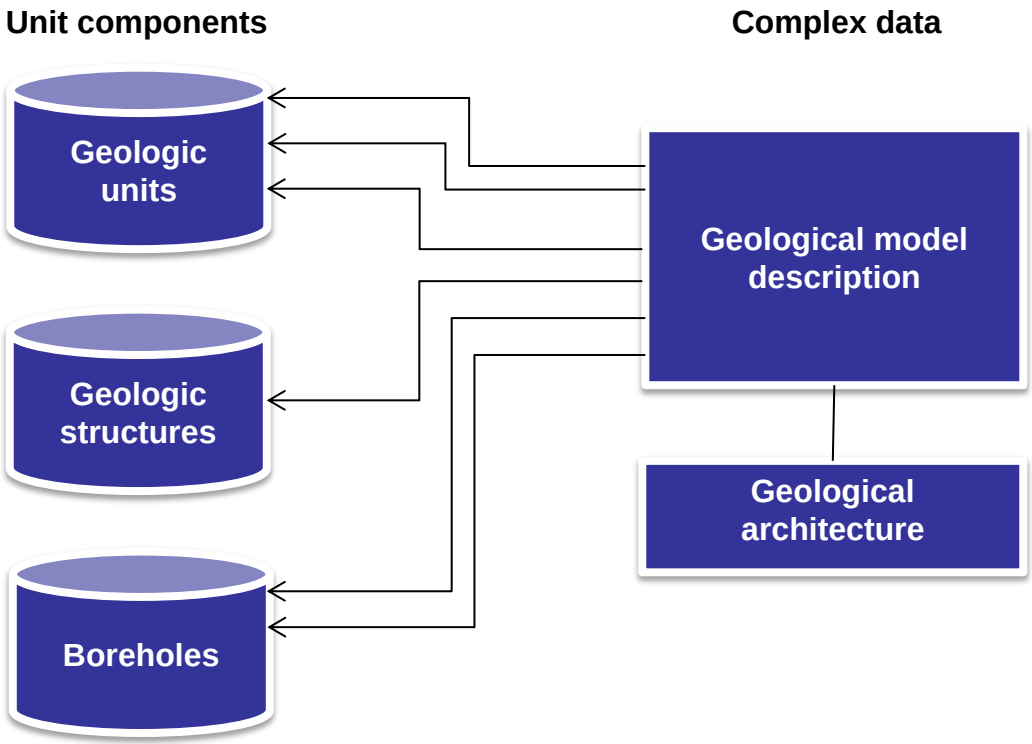
How to be aware of data uncertainty?

> Providing sources: linked data



- Better knowledge of the model building process
- Thus better assessment of uncertainty
  - Being able to reprocess modeling if data changed?

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Some current French / European / global initiatives to mention

> All share the same main objectives

- Standardizing data description
- Standardizing vocabularies / semantics
- Simplifying data access
- Providing sustainable data and service infrastructures

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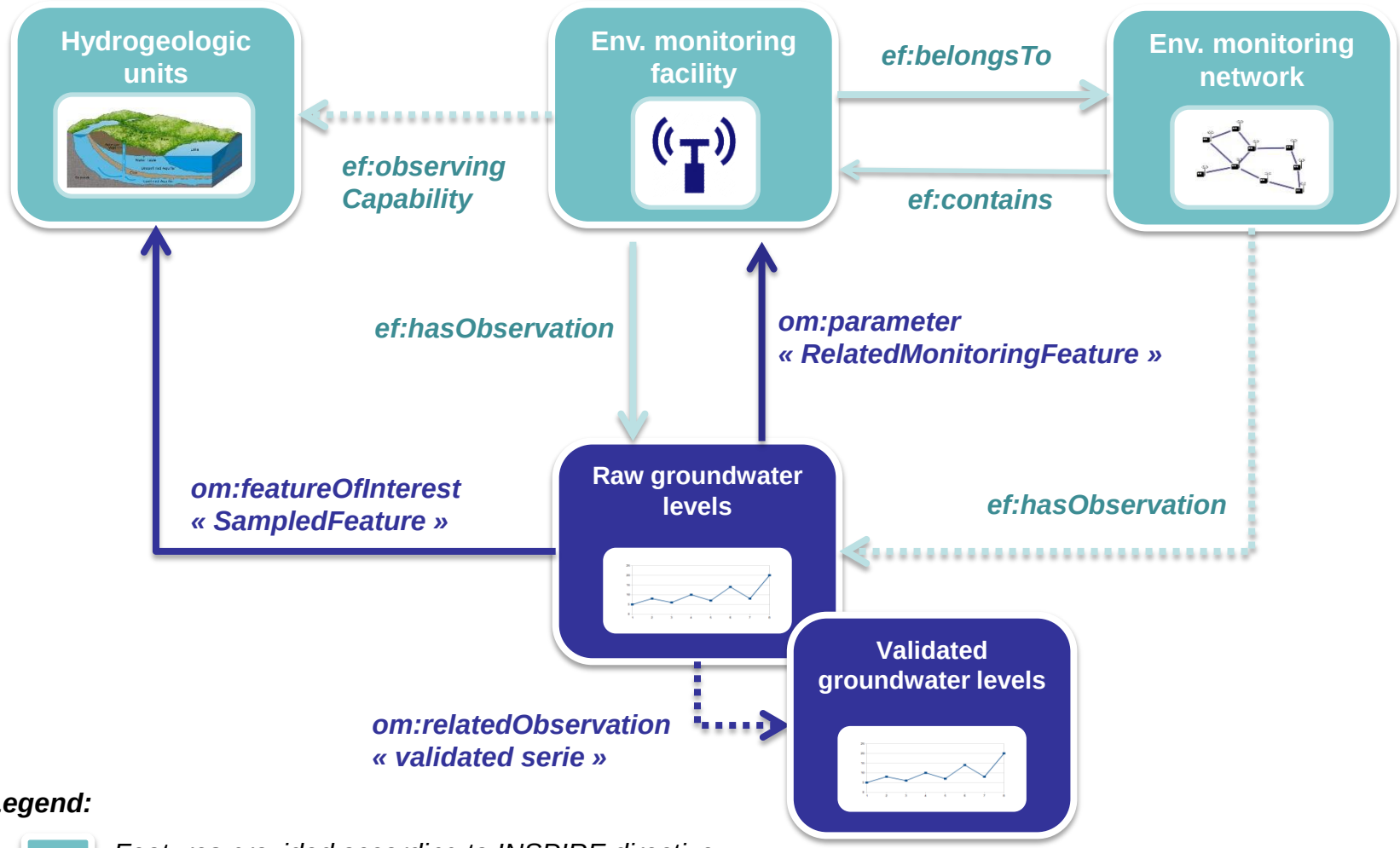
Linked data: applicated to groundwater monitoring



Legend:

- *Features provided according to INSPIRE directive*
- *Observation(s) provided according to WaterML 2.0*

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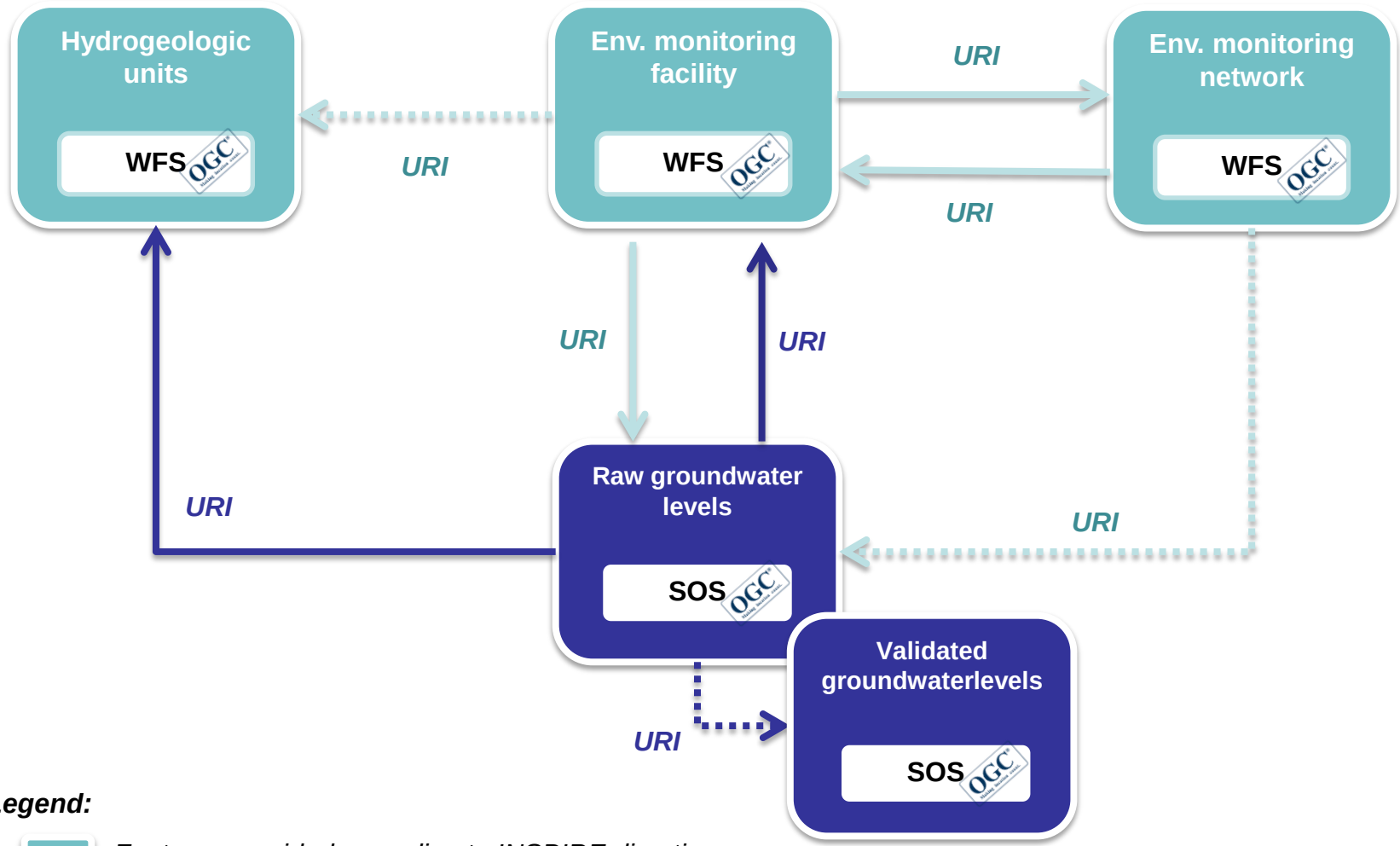
Linked data: applicated to groundwater monitoring



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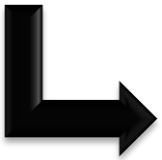
Linked data: applicated to groundwater monitoring

http://ressource.brgm-rec.fr/data/Piezometre/00634X0147/PZ1.2



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How to combine built environment and geological models?

> BRGM SCUDDD project approach

P (x, y, z)

What geology is there at this point?

Native directory of geological model

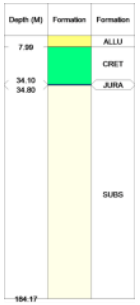
Lithology(x,y,z)

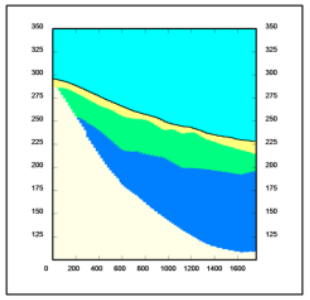
Stratigraphy(x,y,z)

> Samples of results for n points

- Virtual geologic « borehole logs »
- Cross sections

⇒ *Provided through WPS*





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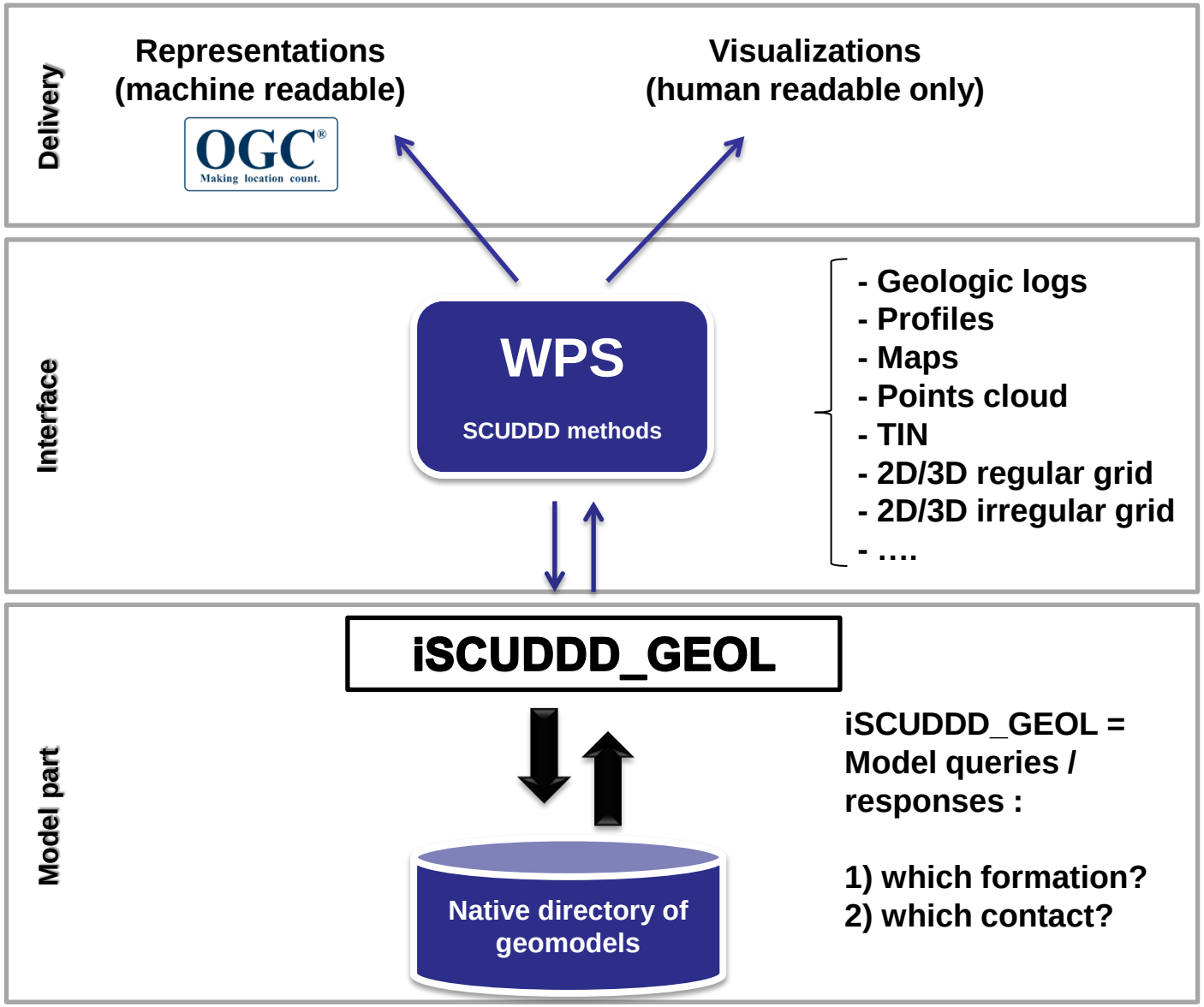
SCUDDD architecture (adapted from Loiselet & al., 2016)



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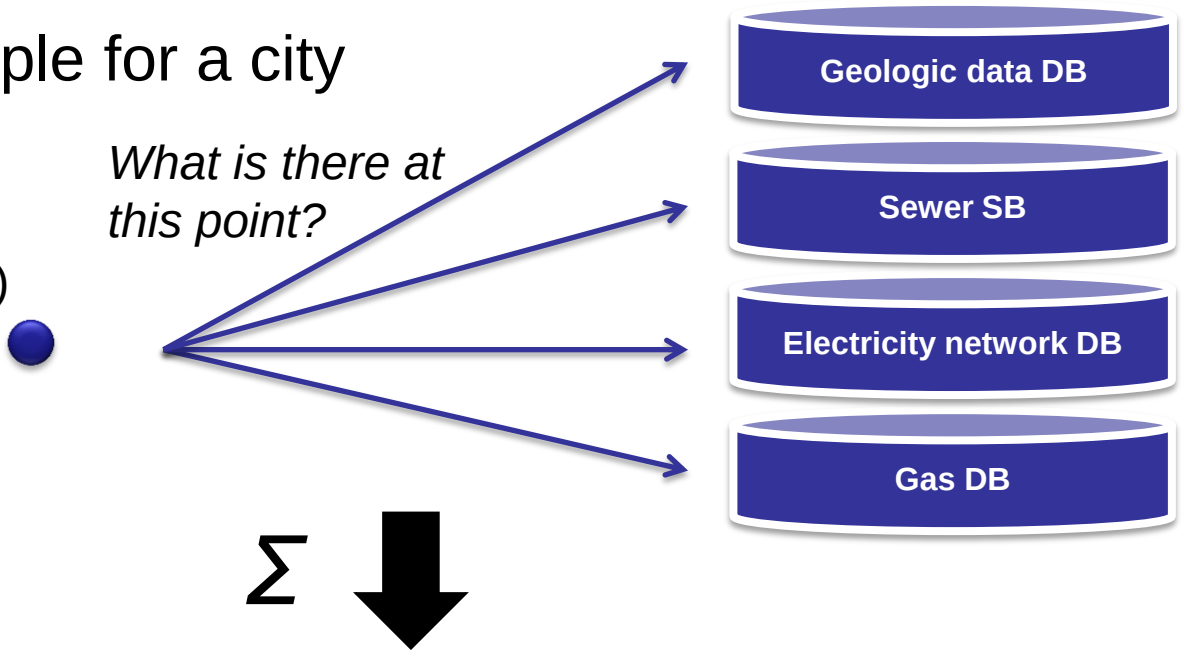
An approach that can be generalized!

> Example for a city

What is there at this point?

P (x, y, z)



Σ

Report from DB requests for

P (x, y, z)

SewerDB : nothing
Electricity DB: Part of NRT network **Precision: 0.5m**
Gas DB: Part of R27 network **Precision: 0.1m**
Geologic data DB: Clay

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MINnD http://www.minnd.fr/en/

Modélisation des INformations INteropérables pour les INfrastructures Durables

- Interoperable Information Model for Sustainable Infrastructures
- A French consortium of 60 partners
- 1 goal : enhancing BIM capabilities for infrastructure modeling and management

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MINnD

> 8 uses cases

1 **Standardised uses cases extended to infrastructure**

2 **Roadway lifecycles**

3 **Bridges**

4 **Project review**

5 **Cost control through modeling**

6 **Environment**

7 **Infrastructure lifecycle and exploitation**

8 **Underground infrastructures**

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UC8: Underground Infrastructure

- Scope: standardizing underground infrastructure description process

- One main sponsor
  - Importance of building and environment relationship
- Two main topics and working groups
  - Built environement (tunnels…) description
  - Relationship with its natural environment
- Actions planned
  - Identify exchange requirements (ER)
  - Process description (IDM)
  - Study of digital workflows (services + profiles)
  - Enabling data structure (OGC + BSI standards)

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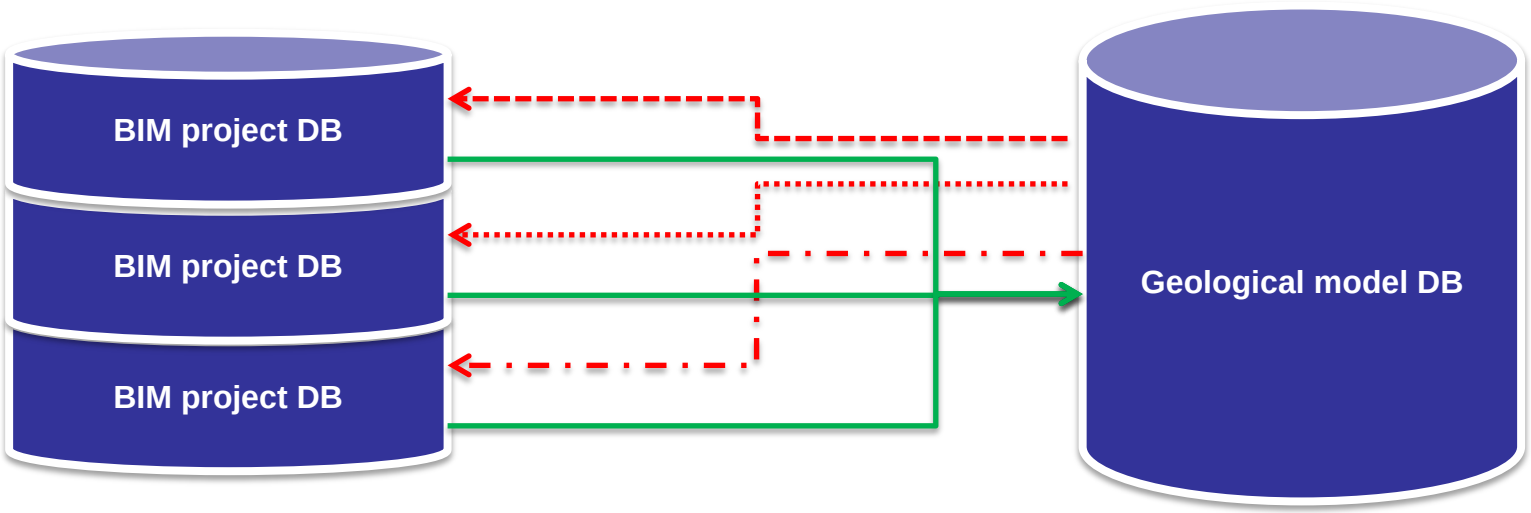
Perspective for geological data



Services to query geological models

Services to feed geological models

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(Upcoming) Geoscience Domain Working Group

> **Initiated by**

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Natural Resources Canada / Ressources naturelles Canada

Canada

British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

> **Following adoption of GeoSciML, proposal to create a Geoscience Domain Working Group under the umbrella of the Earth Systems Science DWG**

> **With primary focus on**

- Borehole standards / best practices
- 3D geological modelling
- Seismology

1. **Review the draft charter**
2. **Submit an electronic vote in the coming weeks > We are there!**
3. **1st meeting of DWG in St-John June 2017, with election of co-chairs**

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Conclusion

- Environmental models <> building models
- Necessity of communicating uncertainty
- Linked data between instances offer soft and flexible linkage
- Many existing OGC formats / protocols can (must !) be reused
- Do we (always) need 3d representations?

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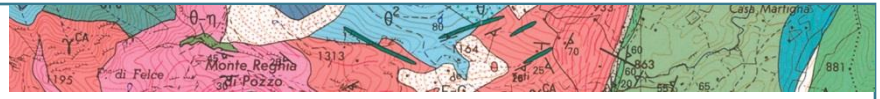
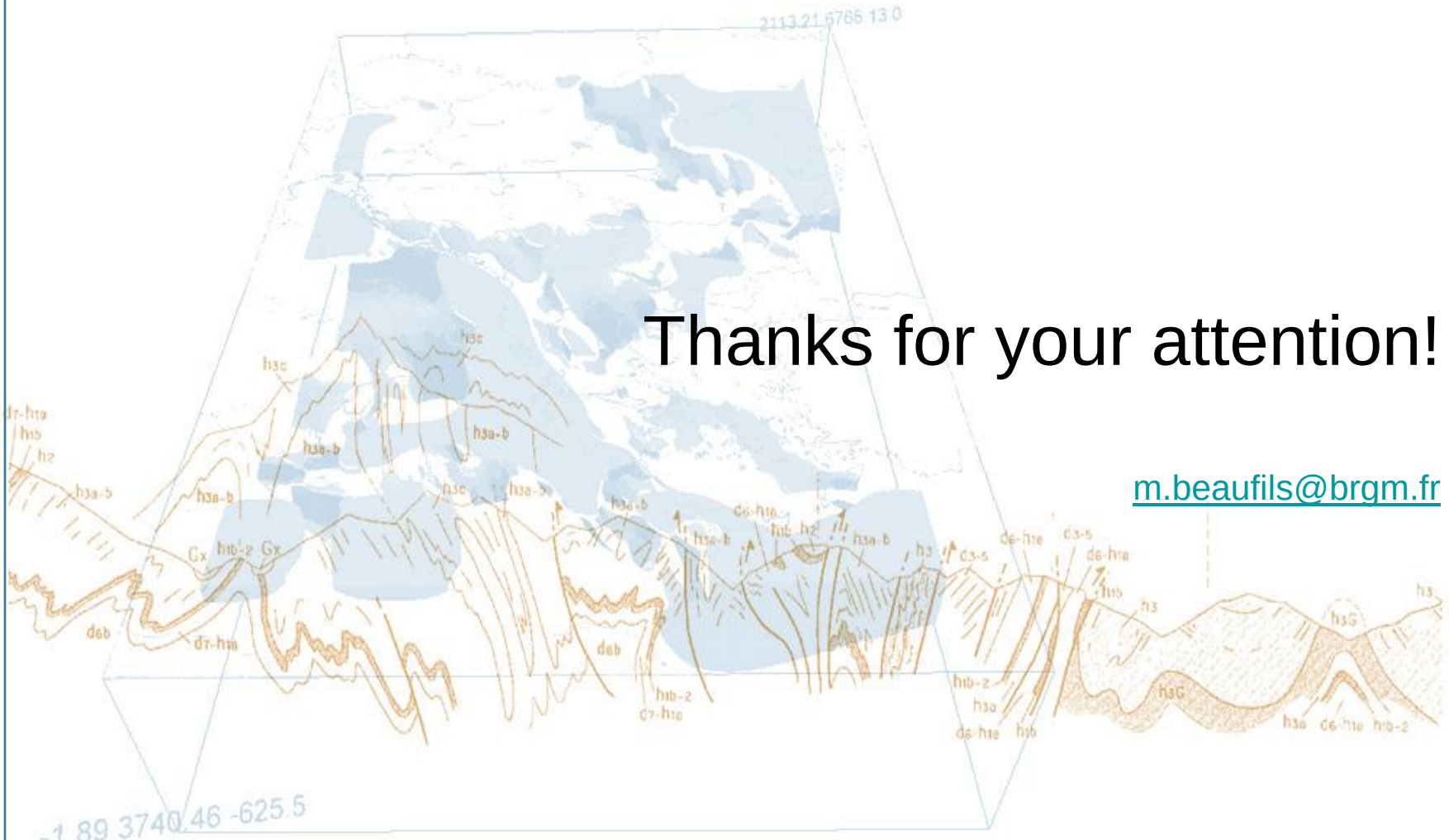


Thanks for your attention!

m.beaufils@brgm.fr



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