MIN^{n}D UC8 : Underground Infrastructures

Modélisation des INformations INteropérables
pour les INfrastructures Durables

Setting interoperability between BIM and Geological Modeling

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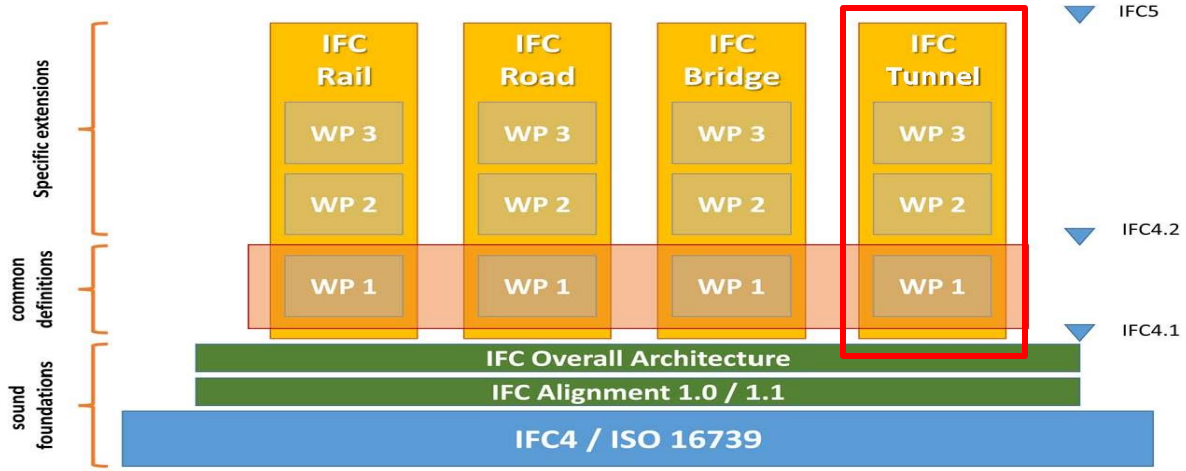
4th meeting of the European 3D Geomodelling Community - Orleans

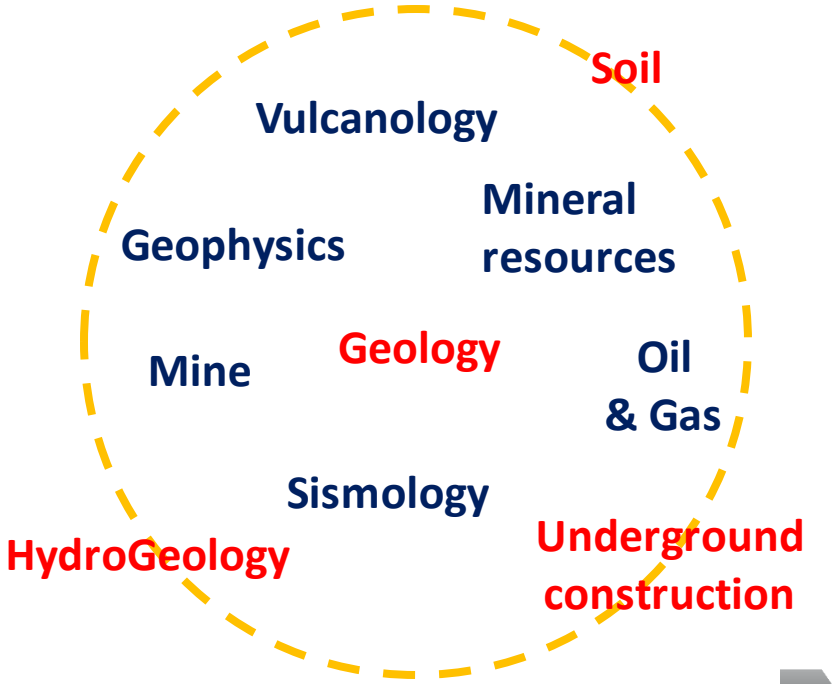
CONTEXT : THE MIN^{N}D PROJECT

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

- Interoperable Information Model for Sustainable Infrastructures
- A French collaborative program to extend BIM methods and standards from building to infrastructure modeling
  - 67 partners
  - Several use cases (type of infra) and themes (cross-domain)

- Objectives
  - Propose extensions to bSI and OGC standards
  - Set Memorandums of Understanding: MIN^{N}D-bSI / MIN^{N}D-OGC
  - ISO/CEN Normalization





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OGC Making location count. GeoScienceDWG

CONTEXT : MIN^{N}D UC8

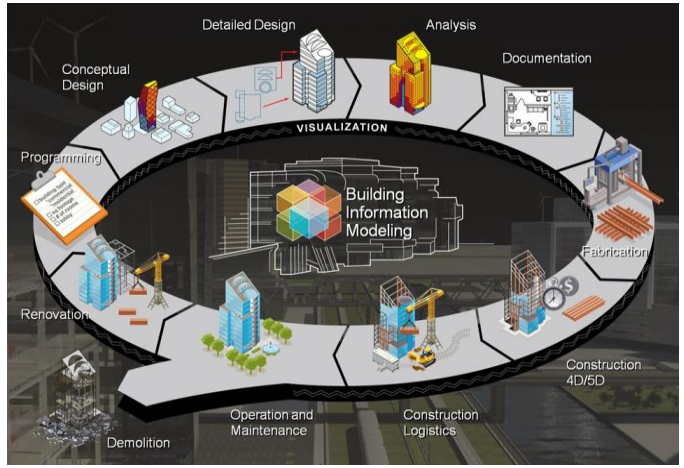
- Use Case dedicated to Underground Infrastructure modeling
- 18 month project: June 2017 – September 2018
- 14 partners :

- 2 groups :
  - **Group GC** : Building part modeling
  - **Group GT** : Environmental part modeling
- UC8-GT : First tentative in MIN^{N}D to study geomodelling connection with BIM

APPLICATION OF BIM TO GEOMODELLING ?

Building Information Modeling is a philosophy

- It is about having a model that mimic the real building infrastructure at each moment of its life



Applying BIM philosophy to geomodelling

- It is about building an interoperable information system able to store / provide / link geoscience data and results
- To indicate on which data and interpretation infrastructure are built

Key challenges are information description, lineage and update

WHAT DO WE HAVE IN MINᴺD?

- **Using standards**
  - To be able to reuse and aggregate projects data
  - To be able to build sustainable Integrated City Models

OGC® Making location count.

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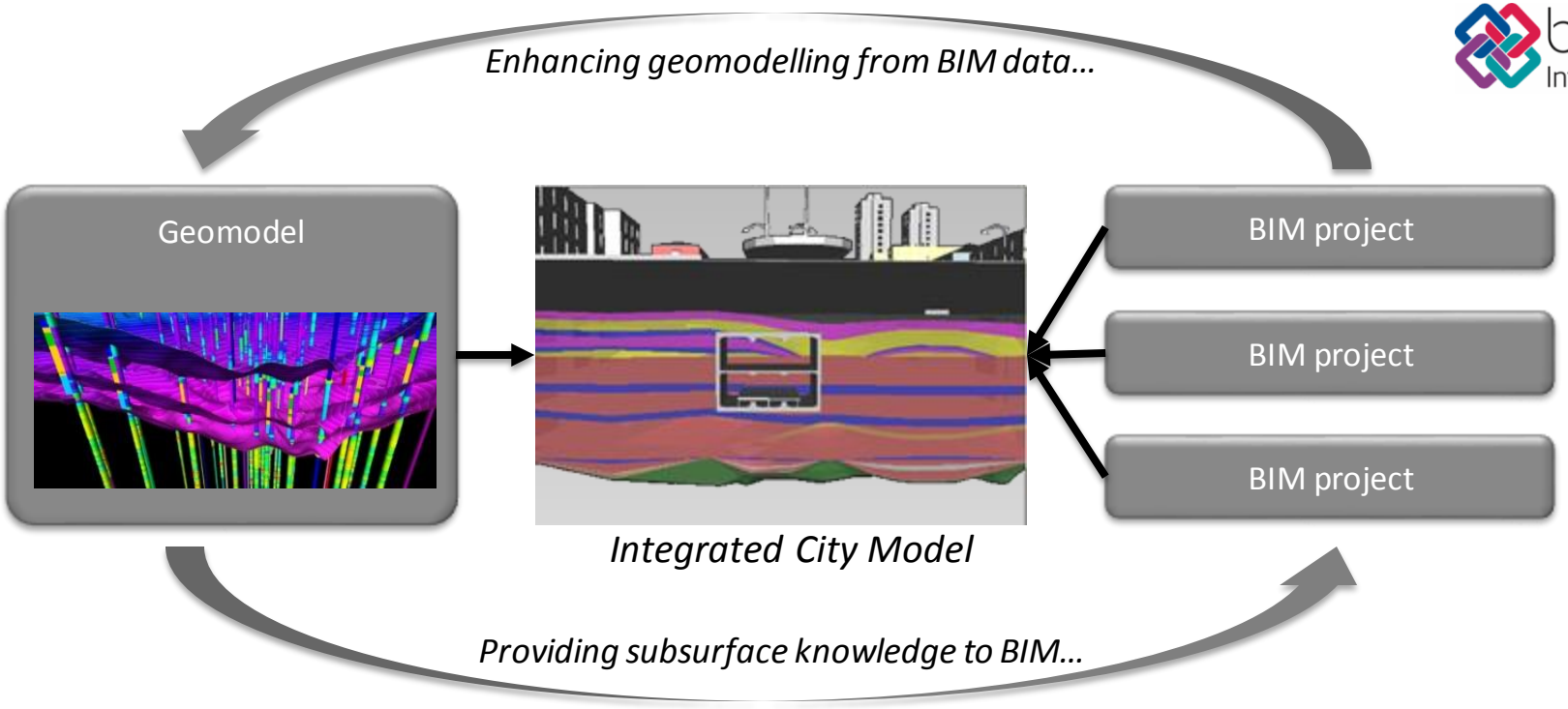
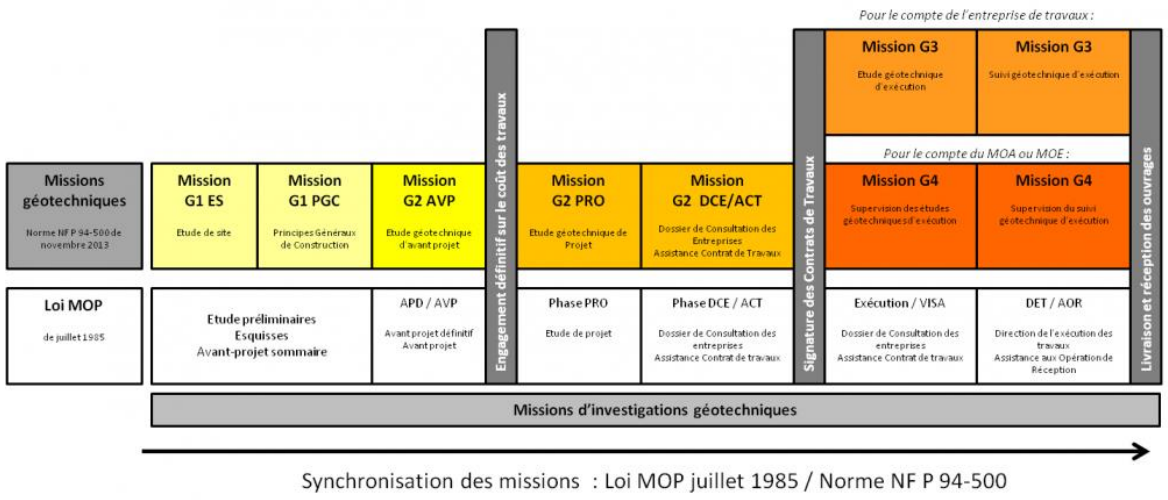


Bibliography

- AFNOR Standard: NF P 94-500:2013 on Standardization of Geotechnician Missions
- AFTES recommandations (GT43) on NF P 94-500:2013 application
- Partners experience

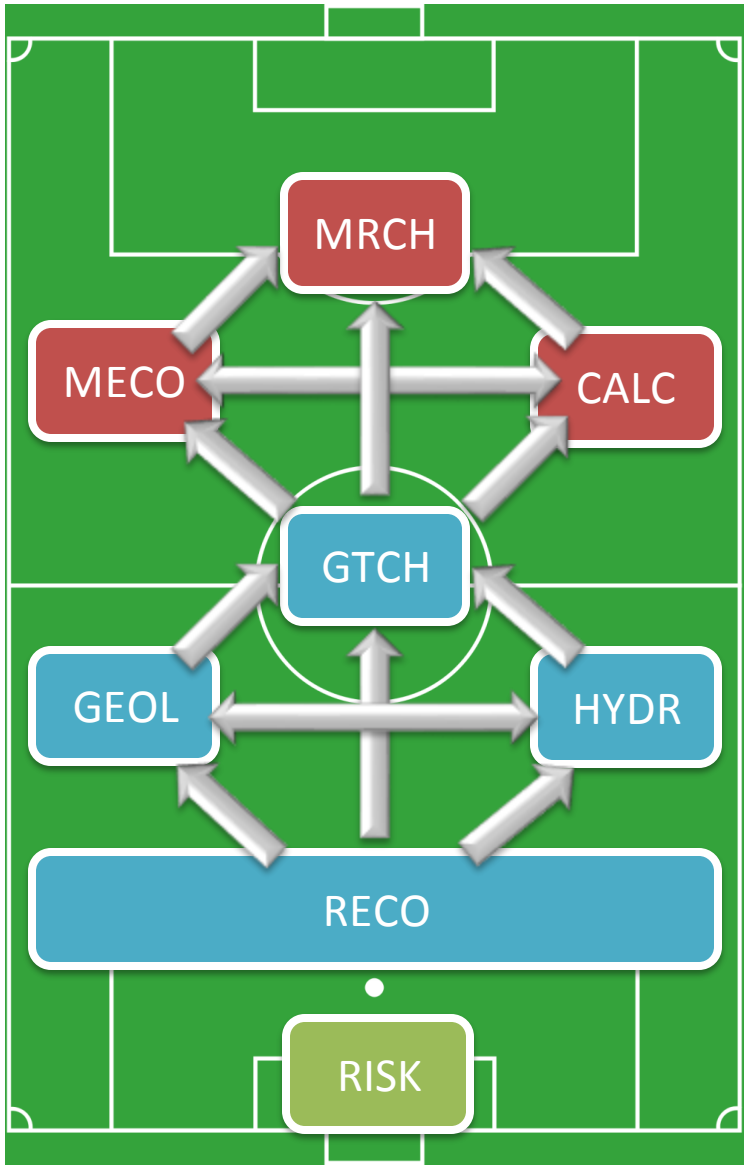


RECOMMANDATION DE L'AFTES N°GT43R1F1

	Mission d'un AMO spécialisé en géotechnique et ouvrages souterrains	
Problématique	EP – G1 (ES et PGC 1e itération)	EP – G1 (PGC 2e itération)
Programme du MOA		
Programme	- expressions des besoins du MOA	- programme du MOA (finalisé à l'issue de l'enquête) - étude des variantes
Recueil des données factuelles (cahier A1) et Mémoire de synthèse géotechnique (cahier B1)		
Géologie, hydrogéologie et géotechnique	- visite du site - enquête documentaire géotechnique - identification du comportement des terrains - identification préliminaire des nappes, des sens d'écoulement, des variations saisonnières	- conduite du programme de reconnaissances (sondages, mesures piézométriques, recueil de données de pluie, …) : avis sur les offres techniques, surveillance, analyse, interprétation, confrontation
Modèle géologique et hydrogéologique et incertitudes	- modèle géologique et hydrogéologique préalable - analyse de la fiabilité du modèle - première identification des incertitudes	- actualisation du modèle géologique hydrogéologique et établissement du profil en long géotechnique prévisionnel - analyse de la fiabilité du modèle - établissement du registre des incertitudes

ENVIRONMENTAL MODELING: A TEAM PLAY

Designation	Id	
Structure sizing and definition of the geotechnical influence zone	CALC	What builders want to get
Construction methods	MECO	
Contractual documents	MRCH	
Risk and uncertainty assessment	RISK	
Observations and Measurements	RECO	What results are based on
Geological modeling	GEOL	
Hydrogeological modeling	HYDR	
Geotechnical modeling	GTCH	
Anthropic environment impact	AVOI	Constraints
Environmental impact	ENVI	

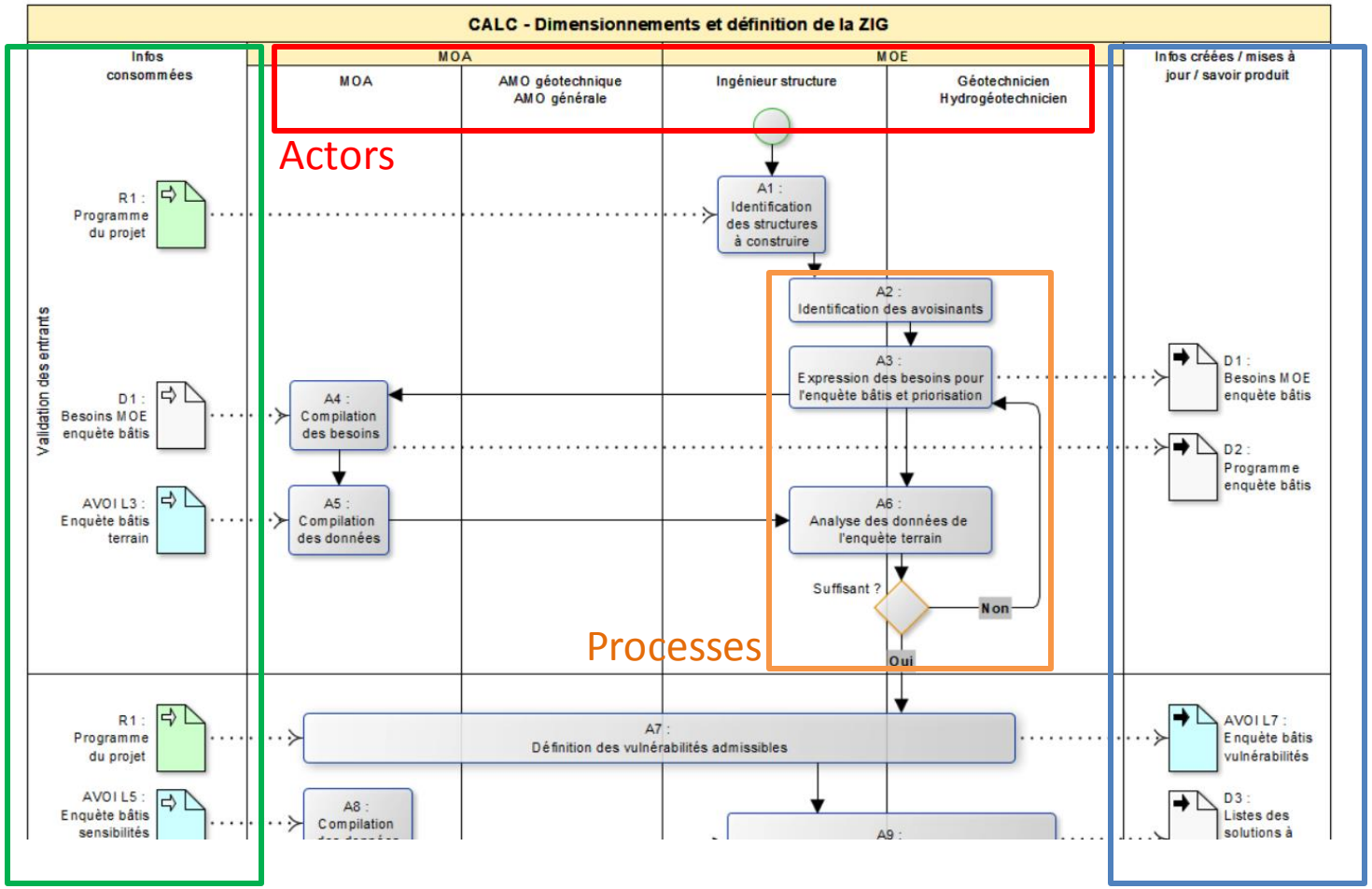


ENVI

AVOI

DESCRIBING HOW GEOTECHNICAL KNOWLEDGE IS BUILT

- **Information Delivery Manual (IDM)**
  - Workflow description
  - ISO 29481-1:2016
  - 1 per subject
- **Highlight basics**
  - Who does what?
  - Which data?
  - Which results?
- **Focus on knowledge construction**
  - Not methods and tools



THINGS WE PUT IN LIGHT FROM THIS WORK

- Many infrastructures projects does not rely on 3D geomodels… but sections
- Some 3D geomodels are not designed with geomodeling tools… but with CAD

« No clear consensus on geomodel definition »

- Building community do not expressly ask for (3D) geomodels
- They mainly expect answers to their questions
  - Can I build here?
  - How much would it cost? Considering risk / uncertainty management
- For them, geomodels are (just) « media » to build the answers

« How can we put some standardization in this? »

How did we get it?

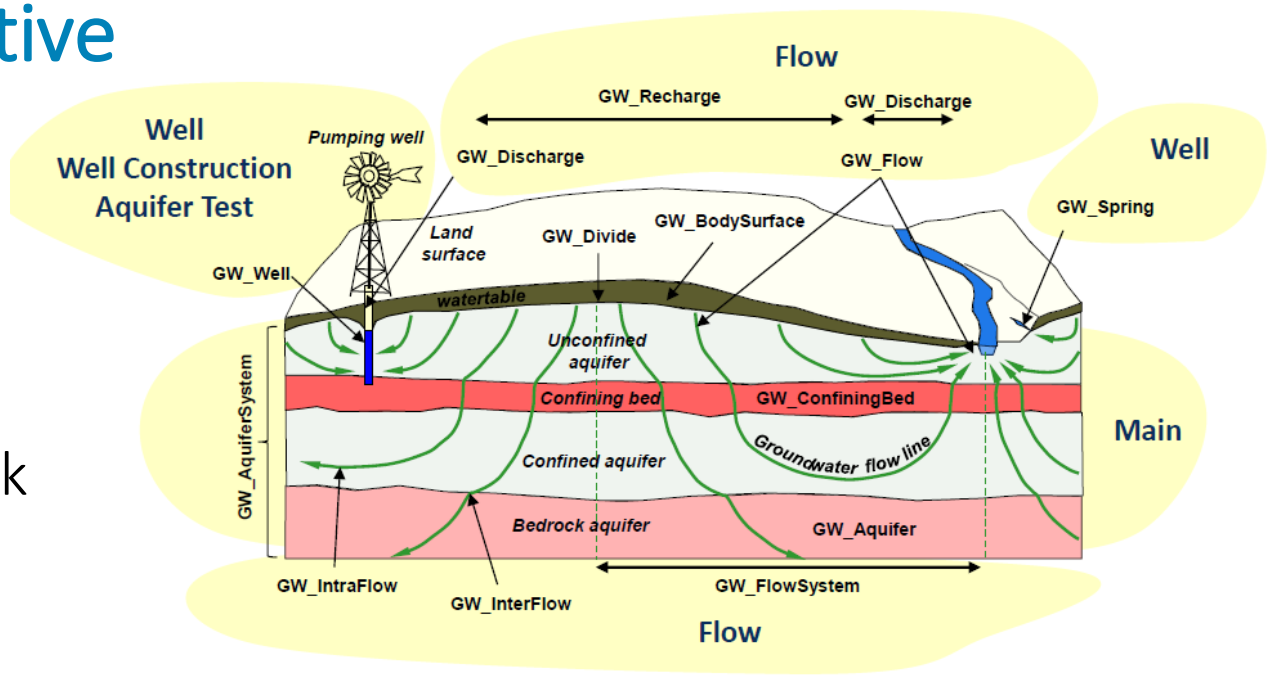
	RECO Surveys	HYDR Hydrogeological Modelling	GEOL Geological modelling	GTCH Geotechnical modelling
Expression of recommended surveys		x	x	x
Definition of survey program	x			
Description of the survey (borehole, onfield observation, laboratory analysis, geophysics)	x			
Raw result expression	x			
First interpretation of result	x			
Analysis or reinterpretation of the result		x	x	x
Compilation and model scale interpretation		x	x	x
Model building (with geomodelling software)		x	x	x

« A serie of observations/measurement/interpretation »

> We have OGC standards this!

Conceptual Model building tentative based on OGC standards

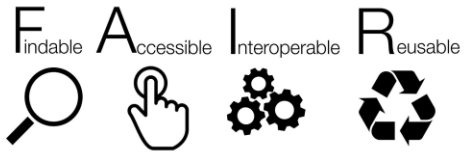
- Observations & Measurements
  - For surveys data, and sucessive interpretations
  - For results of infrastructure sizing, risk assessment
  - To describe geomodels themselves
- GeoSciML and GroundWaterML
  - To provide appropriate semantics
  - Identify potential needs for extensions to describe geotechnics



Some GroundWaterML 2.2 concepts

CONCLUSION: WHAT WE DO IN MINᴺD

- MINⁿD is not focusing on integrating buildings in geomodels (or vice versa)
  - It is about increasing geoscience data quality to make it reusable



- 3D geomodels are not systematically built during infrastructure construction
  - Yet building community is willing to build / update some

- Cities want to know what they have below their feet (cf New York)
  - To reduce maintenance cost (Building cost : 10% construction, 90% maintenance)
  - Being able to collect high data quality from building community would enable to build 3D urban geomodels, and maintain it!
  - Opportunities of collaboration with geological surveys?

GeoScience Domain Working Group

- The joint OGC / CGI-IUGS Domain Working Group dedicated to geoscience data interoperability

- Next meeting : Orleans OGC TC (March 19-23)
  - **Thursday 22, 8:30 – 12:30 (French local time)**

- Agenda
  - **Borehole description harmonization** IE + **3D Model discovery** IE charters presentations
  - Presentation session: « **Exploring GeoScienceDWG frontiers** »
    - Geomodelling + BIM
    - Geomodelling + LIDAR
    - AstroGeoSciML

More to come…

Thanks for your attention!

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Useful links:

- MIN^{n}D website : http://www.minnd.fr/en/
- GeoScienceDWG home page : http://external.opengis.org/twiki_public/GeoScienceDWG/WebHome