



Open
Geospatial
Consortium

GeoScience DWG

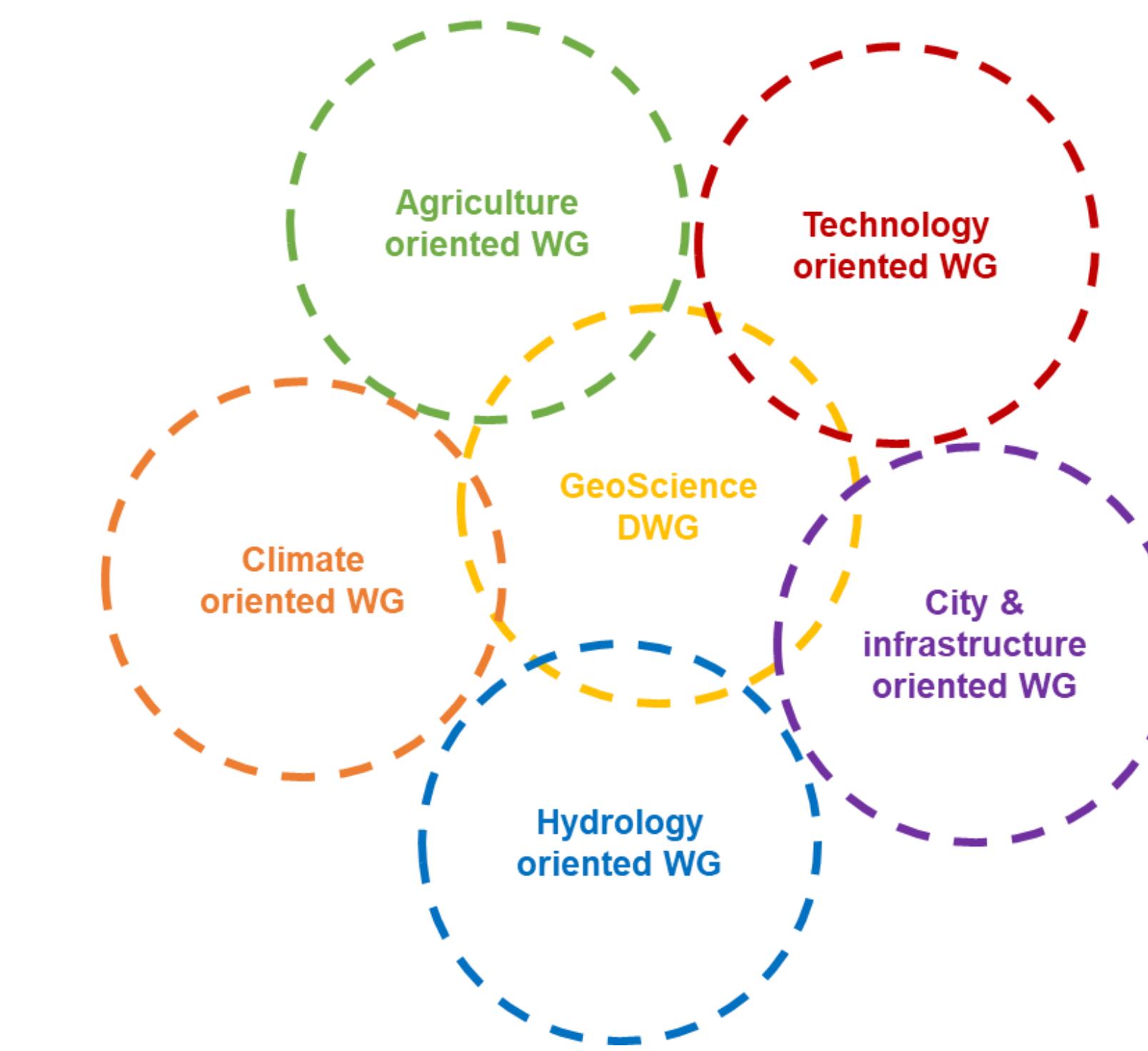
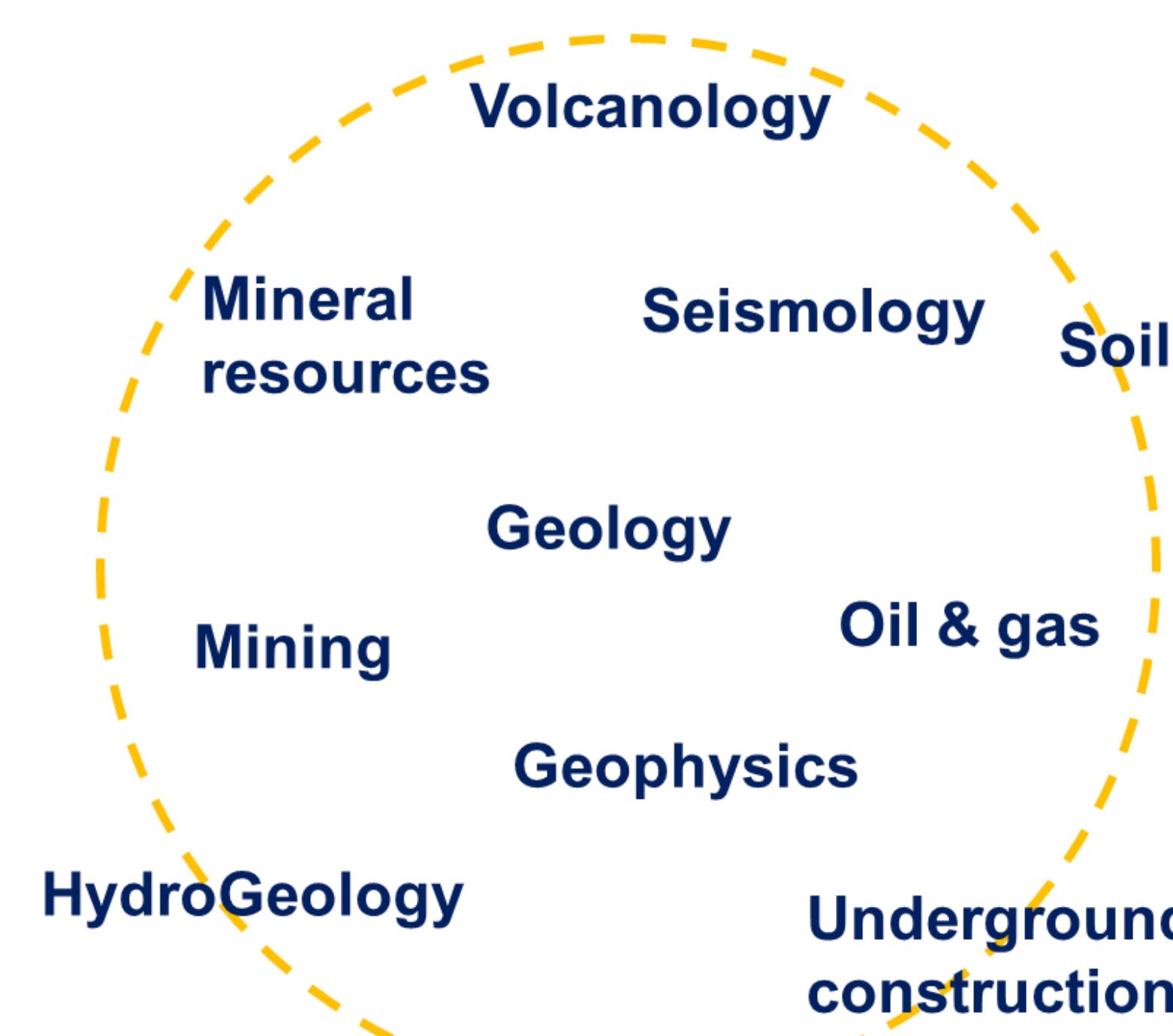
Standards OGC pour les géosciences
et connexion avec le BIM

Mickaël Beaufils, BRGM
J2I 2024 – Champs sur Marne, 23 janvier 2024



GeoScienceDWG ?

- Domain Working group (DWG) commun OGC & CGI-IUGS
 - Né en Septembre 2017
 - Forum pour les standards géosciences
 - Animation d'activités de standardisation



OGC Standards and Working Groups for Geoscience

GeoSciML

The GeoScience Markup Language (GeoSciML) is a data model and data transfer standard for geological data.

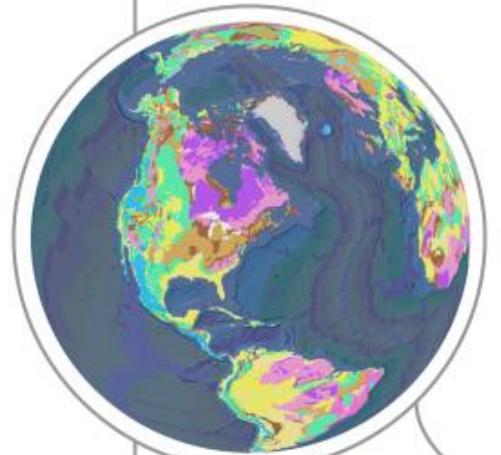
It formalizes the description of geological features commonly portrayed in geological maps, cross sections, geological reports and databases. It provides geological surveys, and other geoscience data providers, a common vocabulary for the electronic dissemination of geoscientific information.

GeoSciML is an XML-based data transfer standard for the exchange of digital geoscientific information. It accommodates the representation and description of features typically found on geological maps (e.g., geological units, structures, earth materials), as well as being extensible to other geoscience data such as drilling, sampling, and analytical data.

Supporting objects such as the geologic timescale and vocabularies are also provided as linked resources, so that they can be used as classifiers for the primary objects in the GeoSciML standard.

GeoSciML is used in the OneGeology project to propose a dynamic digital geological map data for the world.

Resources: <http://www.geosciml.org/>
<https://www.opengeospatial.org/standards/geoscm>

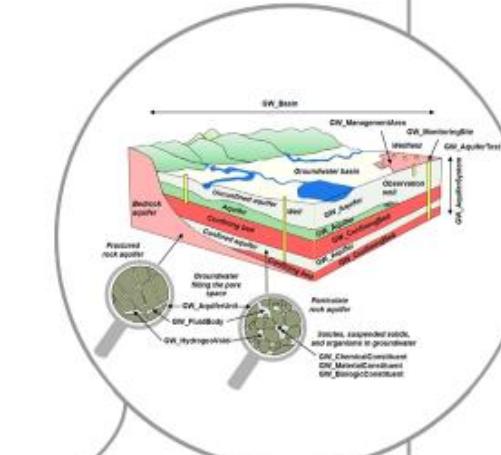


OGC
Making location count.
www.opengeospatial.org

The Open Geospatial Consortium (OGC) is an international organization committed to develop and promote open standards for the global geospatial community. Its membership includes more than 500 organizations that come from across government, commercial organizations, non-governmental organizations, academic, and research institutes.

OGC activities address both semantic and technological standardization in a wide variety of domains including: Geosciences & Environment; Smart Cities, IoT & Sensor Webs, mobile technology, 3D & Built Environment, Emergency Response & Disaster Management, Energy & Utilities, and many more.

With the main objective to propose standards to the International Organization for Standardization (ISO), OGC regularly collaborates with other international organizations, such as Research Data Alliance, the World Meteorological Organization or building Smart International and many more in order to propose consistent standards and solutions.



GroundWaterML2

The GroundWater Markup Language 2 (GroundWaterML 2 or GWML2) is an international standard for the online exchange of groundwater data that addresses the problem of data heterogeneity.

This problem makes groundwater data hard to find and use because the data are diverse and fragmented into numerous data silos. Overcoming data heterogeneity requires a common data format; however, until the development of GWML2, an appropriate international standard has been lacking.

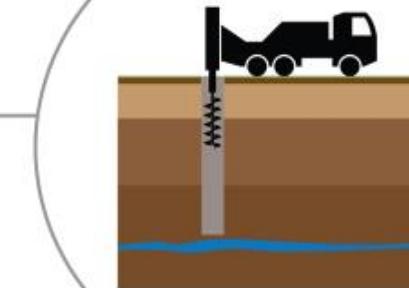
As part of the WaterML 2.0 standard and linked to GeoSciML, GWML2 introduces some concepts such as aquifers and water wells, as well as related measurements and groundwater flows.

It describes a conceptual and logical model for the exchange of groundwater data, as well as a GML/XML encoding with examples.

GWML2 has developed, tested and implemented by several groundwater data providers from North America, Europe, and Australasia, and facilitates many forms of data exchange, information representation, and the development of online web portals and tools.

Resources: <https://www.opengeospatial.org/standards/gwml2>

Even though several standards already exist to describe a borehole, its associated data and their position along a borehole (including OGC standards), they all restrict themselves to a specific viewpoint.

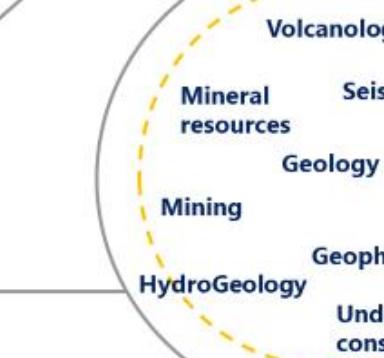


Involving key implementers and editors of the existing standards, the Borehole Interoperability Experiment (Borehole IE) aims at defining a domain agnostic and comprehensive (umbrella) vocabulary for a general concept of boreholes, which may eventually become its own specification and be properly reused by various domains when needed.

Based on a wide variety of use cases such as 'scientific exchange within and across research infrastructures', 'industrial', 'building and construction', 'regulatory obligations' and 'georesources monitoring and exploitation' it will provide the basis for establishing a better integration of existing standards and possibly a future common approach for describing boreholes.

Resources:
<https://github.com/opengeospatial/boreholeie/>
<http://www.opengeospatial.org/projects/initiatives/boreholeie>

BoreholeIE



The GeoScienceDWG is a joint group between OGC and the Commission for the Management and Application of Geoscience Information of the International Union of Geological Sciences (CGI-IUGS).

The GeoScience Domain Working Group (DWG) is a forum to discuss, organize and harmonize geoscience related standards.

In this context, Geoscience encompasses several scientific domains which all aim to provide a better understanding and representation of the Earth: Geology, Geomechanics, Geophysics, Geotechnics, Hydrogeology, Mineralogy, Seismology or Volcanology.

Resources: https://external.opengeospatial.org/twiki_public/GeoScienceDWG/WebHome

GeoScienceDWG

Authors and contact:

Mickaël Beaufils – BRGM (m.beaufils@brgm.fr), Eric Boisvert – NRCan (eric.boisvert2@canada.ca), Boyan Brodaric – NRCan (boyan.brodaric@canada.ca)
Carina Kemp – AARNET (carina.kemp@aarnet.edu.au), Matthew Harrison – BGS (mh@bgs.co.uk), David Blodgett – USGS (dblodgett@usgs.gov), Sylvain Grellet – BRGM (s.grellet@brgm.fr)

While addressing these use cases, the IE has aimed to address issues of encoding data as specific views of a linked data graph that would be passed between systems. These linked data graph views are expected to support architectures involving linked data catalogs and registries.



The Environmental Linked Features Interoperability Experiment (ELFIE) is intended to test existing OGC and W3C standards with the goal of establishing a best practice for exposing links between and among environmental domain and sampling features in a highly adoptable standards compliant way that is compatible with modern web search technology.

The IE is focused on two cross-domain use cases:

- 1) exposing topological and domain feature model relationships between features and
- 2) description of sampling data available for and linked to sampled domain features

Resources: <https://opengeospatial.github.io/ELFIE/>

ELFIE



Want a PDF version of that poster?
Just catch that QRCode.

Les standards maison GeoSciML & GroundWaterML2

- **GeoSciML : v4.1**
 - Pour décrire la géologie et l'hydrogéologie du sous-sol
 - Concepts clés : Borehole, GeologicUnit, ShearDisplacementStructure, Contact, Fold
- **GroundWaterML2 : v2.2**
 - Extension de GeoSciML pour les aspects hydrogéologie
 - Concepts clés : Well, HydroGeoUnit, FluidBody, Void
- **Des standards de 2016**
 - Conceptuellement toujours d'actualité
 - Mais pas basés sur les dernières briques / tendances (OMS, Linked Data)

Quelques réalisations majeures des membres

- **Borehole IE (2018 – 2019)**
 - Harmoniser la description des forages / sondages au sein de la communauté
- **Environmental Linked Features IE 1 & 2 (2018 – 2021)**
 - Test de standards OGC & W3C pour la mise à disposition de données environnementales liées
- **Participants**
 - Services géologiques, acteurs du BTP, autres communautés de standards (Energistics, BoreholeML, WMO)
- **Livrables**
 - Engineering reports
 - Borehole IE : Proposition d'un modèle conceptuel BhML (basé sur ISO 19148)

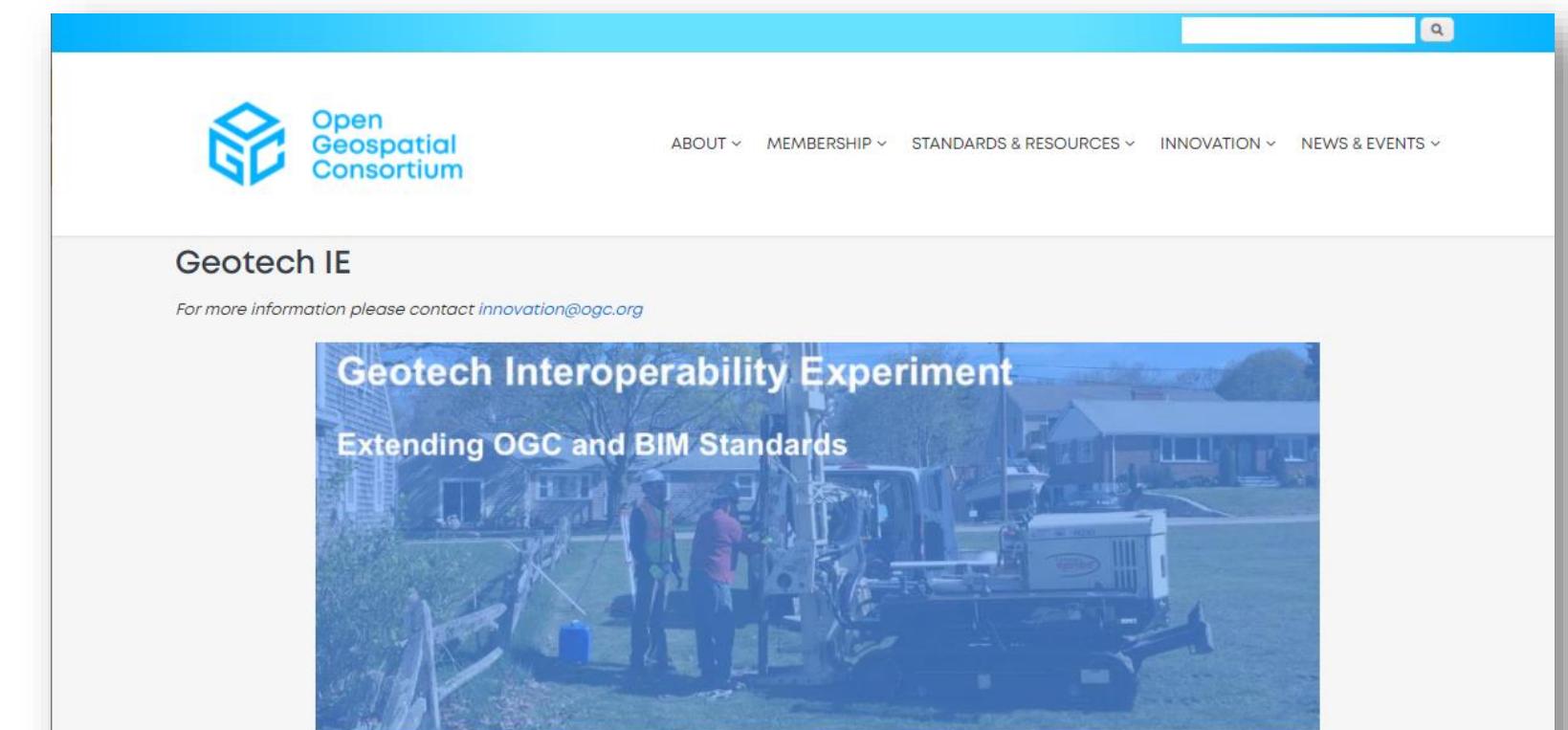
Genèse du Geotech Interoperability Experiment

Janvier 2019



- Sémantique partagée
- Outils & APIs communs
- Guides & Documentation

Février 2022 > Décembre 2023



Join the initiative

The Open Geospatial Consortium (OGC) is releasing this [Call for Participation \(CFP\)](#) to solicit proposals for the **OGC Geotech Interoperability Experiment (IE)**. This IE will assess the integration of geotechnical engineering data encoded in different specifications within Geospatial Information Systems (GIS) and Building Information Modeling (BIM) environments.

The goal of this IE is to ensure that geotechnical engineering data can seamlessly move between GIS and BIM environments to support engineering and infrastructure projects that rely upon those technologies. The IE will leverage OGC and buildingSMART International (bSI) Standards.

IE participants will produce an OGC Engineering Report (ER) that summarizes the activities of the IE, describes the suitability of the experiments for more broad use, and provides a description of gaps and further necessary experimentation, if any.

The [Call For Participation \(CFP\)](#) for this IE is available. Responses to the CFP are due 10 February 2022.



Geotech IE objectives and Work Packages

Community oriented goals

- Contribute to federate the geotechnical community around a common position / proposal for geotechnical data,
 - Scientific – IT connection
 - BIM – GIS and more connection
 - Users – Solution providers connection

Work packages:

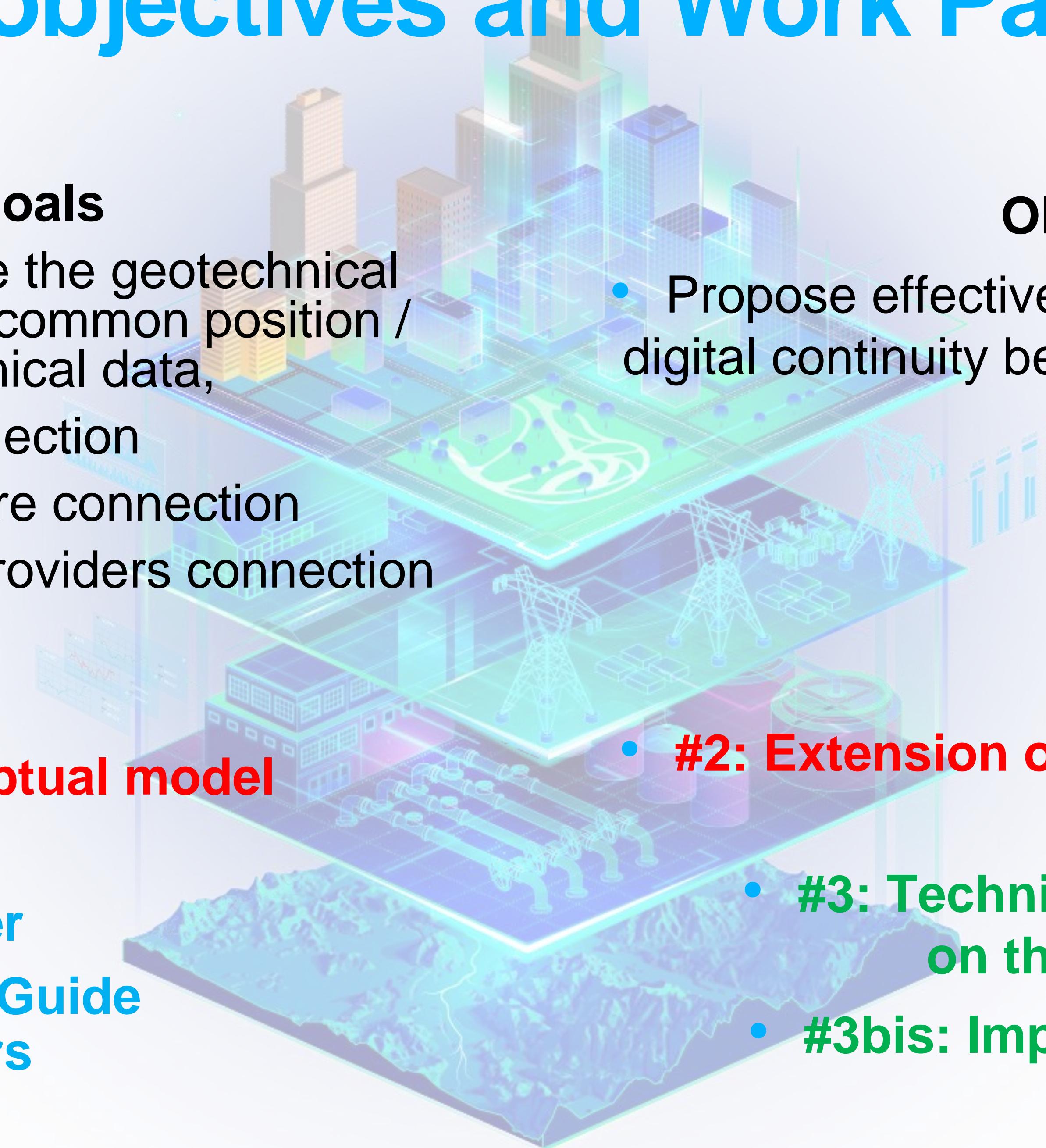
- **#1: Common conceptual model**
- **#4a: White paper**
- **#4b: Technical paper**
- **#5: Implementation Guide for Software Vendors**

Objectifs techniques

- Propose effective solutions to enable digital continuity between GIS and BIM

Work packages:

- **#2: Extension of OGC Geoscience standards,**
- **#3: Technical documentation on the use of OGC APIs**
- **#3bis: Implementation forum**



Organisation des livrables

#4b: Technical paper

#4a: White paper



<https://github.com/opengeospatial/Geotech/blob/master/Geotech%20IE/white%20paper/Digital%20continuity%20for%20Geotechnics%20at%20the%20BIM%20era%20v1.pdf>

<https://github.com/opengeospatial/Geotech/wiki>

- #1 : Common conceptual model
- #2: Extension proposal of OGC Geoscience standards
 - #3: Technical documentation on the use of OGC APIs
 - #3bis: Implementation forum
 - #5: Implementation Guide for Software Vendors

#1 : Concepts / Objets géotechniques



Investigations géotechniques

Book A concepts

- [About Book A](#)

Hole in the ground

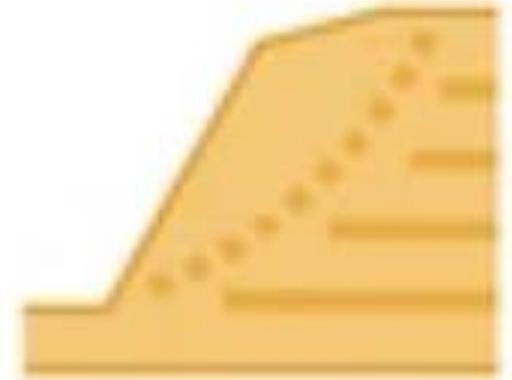
- [Borehole](#)
- [TrialPit](#)

For the activity of observation and its results

- [Observations](#)
- [Geotech Procedures \(codelist\)](#)
- [Geotech Observable Properties \(codelist\)](#)

For the activity of sampling and preparation

- [MaterialSample](#)
- [Sampling and Preparation](#)



Modélisation du sous-sol et de ses aléas

Book B concepts

- [About Book B](#)
- [Geomodel](#)

For Geological Modeling

- [GeologicUnit](#)
- [Fault](#)
- [Contact](#)
- [Fold](#)

For Hydrogeological Modeling

- [HydrogeoUnit](#)
- [FluidBody](#)
- [FluidBodySurface](#)

For Geotechnical Modeling

- [GeotechUnit](#)
- [DiscreteDiscontinuity](#)
- [Void](#)

For Hazard Modeling

- [HazardArea](#)
- [SurroundingConstruction](#)



Dimensionnement de l'ouvrage et risques associés

Book C concepts

- [About Book C](#)
- [GeotechSynthesisModel](#)
- [Alignment](#)
- [GeotechTypicalSection](#)
- [RiskZone](#)

#2 : Extensions de standards OGC & co.

General considerations

- [About the Borehole IE and Sampling Boreholes](#)
- [Geometry considerations](#)
- [Features properties vs observations](#)

ISO19148 and ISO19156

- [A brief introduction to ISO 19148 and ISO 19156](#)
- [Enabling linear referencing based observations](#)
- [Conceptual Borehole Model](#)

SensorThingsAPI datamodel

- [A brief introduction to the SensorThingsAPI data model](#)
- [STA Borehole Model](#)

GeoSciML

- [A brief introduction to GeoSciML](#)
- [Extending gsml:GeologicUnit](#)
- [Extending gsml:ShearStructureDisplacement](#)
- [Extending gsml:Fold](#)
- [Extending gsml>Contact](#)
- [Adding gsml:GeotechUnit](#)
- [Extending gsml:Joint](#)

GroundWaterML2

- [A brief introduction to GroundWaterML2](#)
- [Extending gwml2:HydroGeoUnit](#)
- [Extending gwml2:FluidBody](#)
- [Extending gwml2:FluidBodySurface](#)
- [Extending gwml2:HydroGeoVoid](#)

EPOS WP15

- [A brief introduction to the EPOS TCS GIM](#)
- [Extending eposl:Modelview](#)

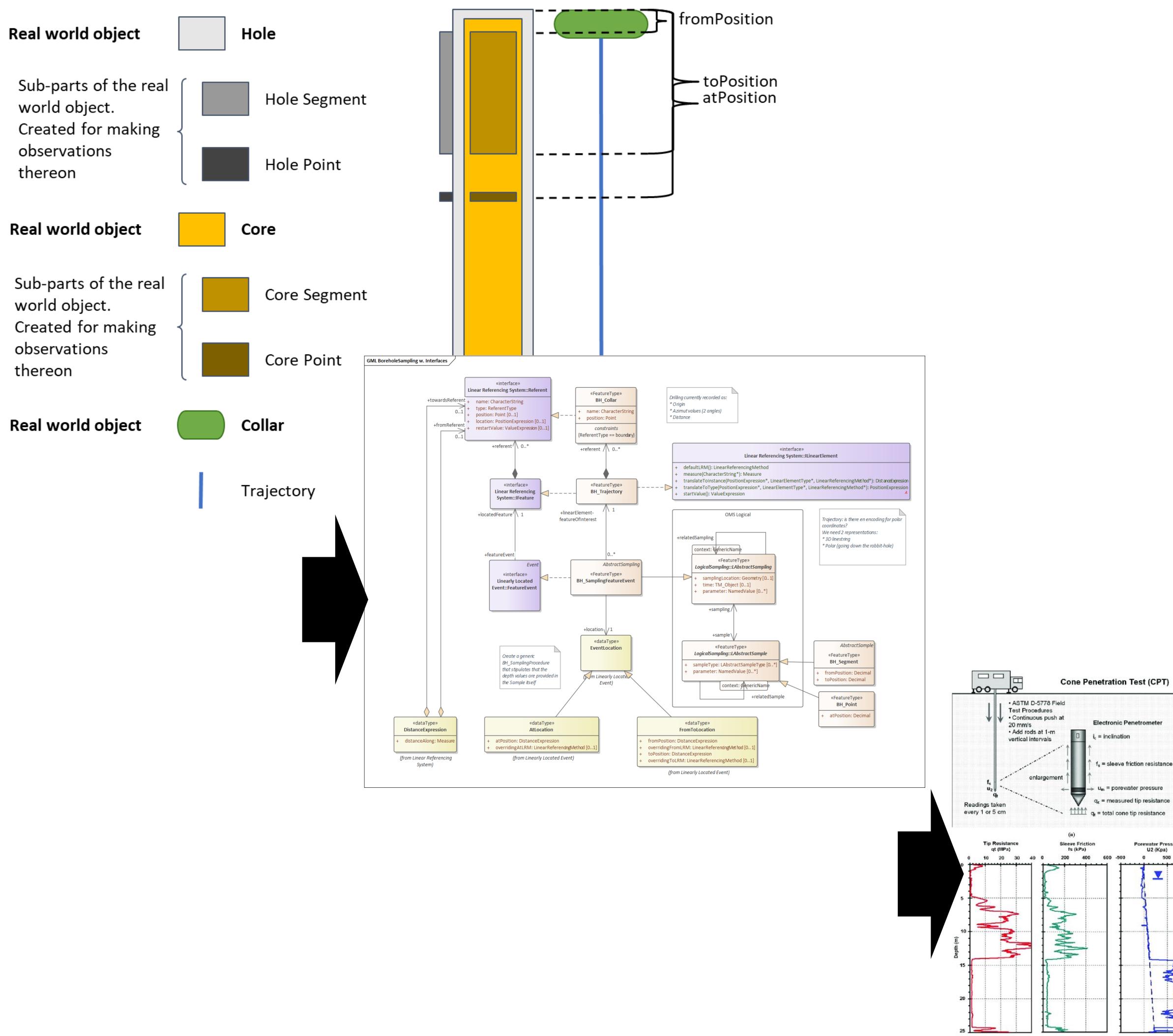
LandInfra & InfraGML

- [A brief introduction to LandInfra and InfraGML](#)
- [Reusing InfraGML:Alignment](#)
- [Extending InfraGML:Facility and FacilityPart](#)

INSPIRE Theme III: Natural Risk Zone

- [A brief introduction to INSPIRE NZ](#)
- [Extending NZ:HazardArea](#)
- [Extending NZ:RiskZone](#)

#3, #5 : API pour les investigations géotechniques et guide de mise en oeuvre



Implementation guide, resources and examples

- [About implementation](#)
- [About OGC APIs](#)
- [About FROST](#)
- [FROST plugin for Geotech](#)

Exposing geotech investigation data with OGC SensorThings API

- [Approach for Borehole logs](#)
- [Approach for CPT](#)
- [Approach for SPT](#)
- [Approach for Pressuremeter](#)
- [Approach for Atterberg limits](#)
- [Mappings from AGS and DIGGS](#)
- [EndPoints](#)
- [Relevant queries to FROST for Geotech](#)

Vocabulary and codelist for geotech

- [Geotech vocabularies and codelists](#)

Geotech IE : résumé et perspectives

- Une initiative pour rassembler quatre communautés de standards pour la géotechnique OGC, bSI, AGS et DIGGS
 - Modèle expliquant les points communs / divergences entre modèles
 - Propositions d'extensions de nombreux standards OGC
 - API pour la mise à disposition de données de forage
 - Très documenté : <https://github.com/opengeospatial/Geotech/wiki>
- Nombreuses ouvertures
 - Mise à jour des modèles de données existants
 - Modélisation (hydro)géologique / géotechnique 3D
 - Géophysique
- Bientôt : sondage pour le choix des nouvelles activités du groupe

ISSMGE TC222



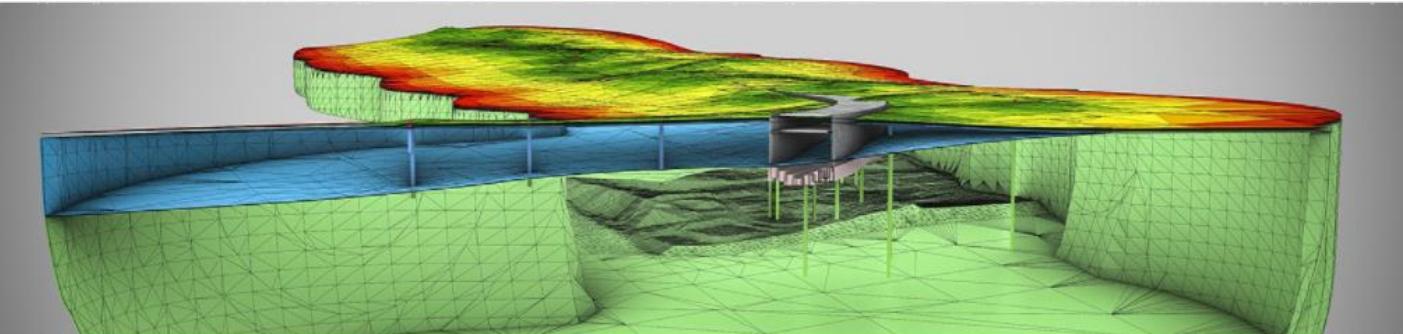
International Society for Soil Mechanics and Geotechnical Engineering

SIMSG ISSMGE

HOME THE SOCIETY CORPORATE ASSOCIATES YOUNG MEMBERS EVENTS COMMITTEES PUBLICATIONS EDUCATION FOUNDATION NETWORKING NEWS

TC222 Geotechnical BIM and DT

Home / Committees / Technical Committees / TC222 Geotechnical BIM and DT



Geotechnical BIM and Digital Twins

About

News

Terms of Reference

Membership

Contact

Digital Model (BIM)

Digital Shadow

Digital Twin

Sign-up to receive committee news

Manual data flow

Automatic data flow

Reference: Füller et al (2020)

International Society for Soil Mechanics and Geotechnical Engineering

TC222 : Geotechnical BIM & Digital Twins

Dissemination and Conference Assistance

Guidelines and Recommendations

Better connection between State of the art & State of the practice

<https://www.issmge.org/committees/technical-committees/applications/geotechnical-bim-and-dt>

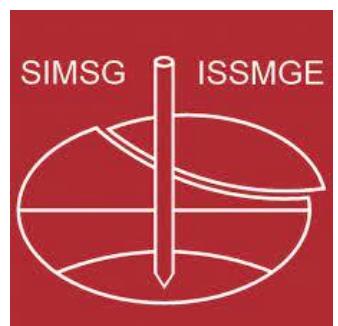
Prochains rendez-vous (non exhaustif)



- **~Mars – Avril 2024 : Workshop en ligne du TC222**
 - Thème : présentation des résultats du Geotech IE et suites



- **Fin Mars 2024 : TC OGC Delft**
 - Session du GeoScience DWG : nouvelles activités
 - Session Observationnal Data
 - Session Built Environnement



- **Aout 2024 : ECSMGE 2024**
 - Réunion des membres du TC222



The background of the slide is a photograph taken from an airplane window, showing a vast, snow-covered landscape below. The terrain is a mix of white snow and dark, possibly forested or rocky areas. In the distance, there are snow-capped mountains. The sky above is a clear, pale blue.

Merci pour votre attention

Questions ?

Contact : m.beaufils@brgm.fr