Storing and delivering numerical geological models on demand

C. LOISELET

c.loiselet@brgm.fr

Orléans - France
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INSTITUT CARNOT brgm

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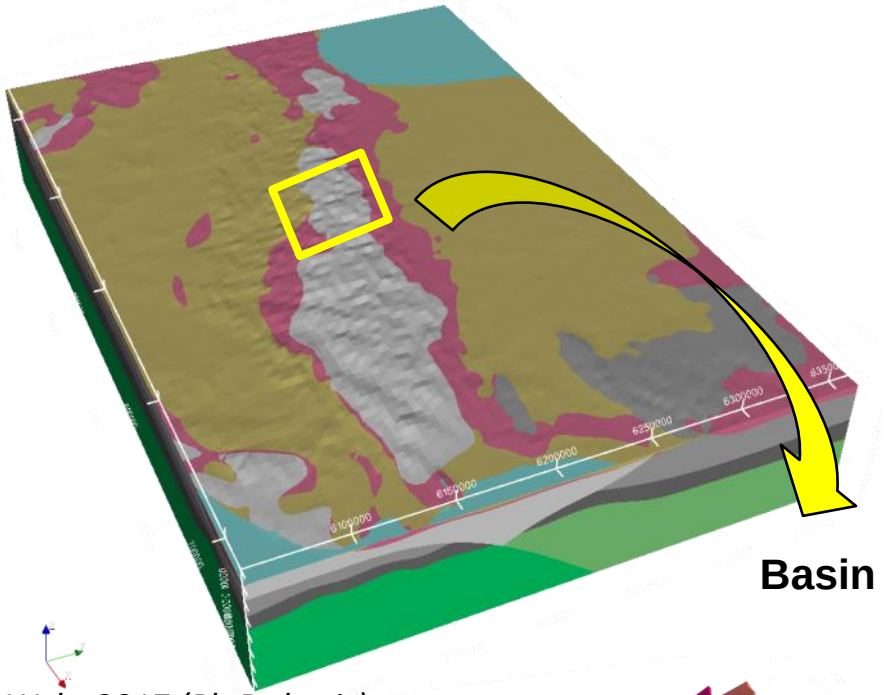
INTRODUCTION

Lithospheric Scale

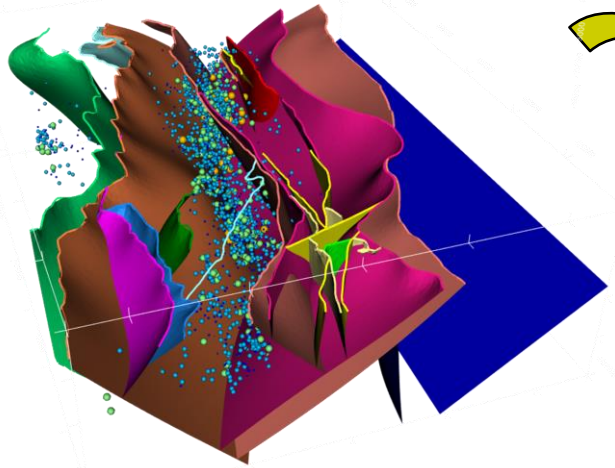


A. Wehr 2017 (Ph.D thesis)

1- Model at different scales (lithospheric / crustal; basin; alluvium)

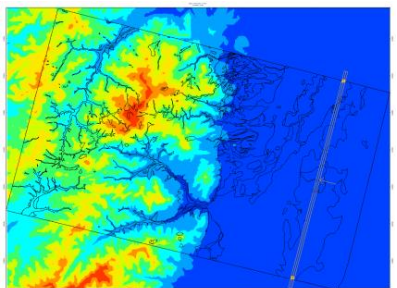
2- Several tools for geomodeling (Geomodeller, GDM Suite, Petrel, Isatis, Gocad, LeapFrog, …) as function of the needs

Basin Scale



A.L. Argentin 2015 (Master Thesis)

Alluvium Scale



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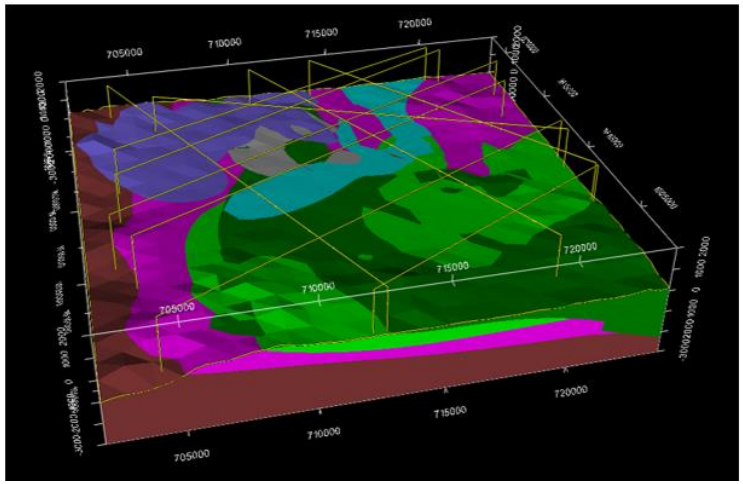
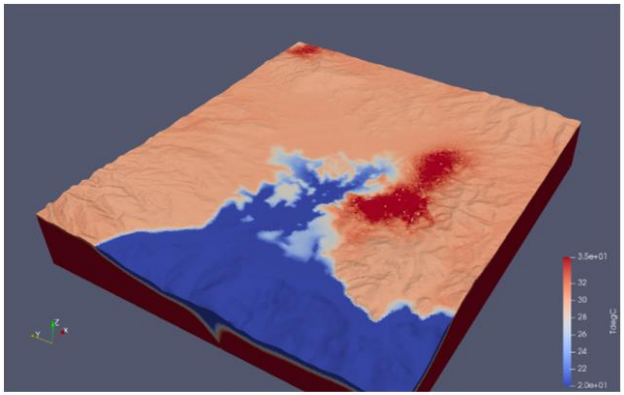
INTRODUCTION

From Geological model

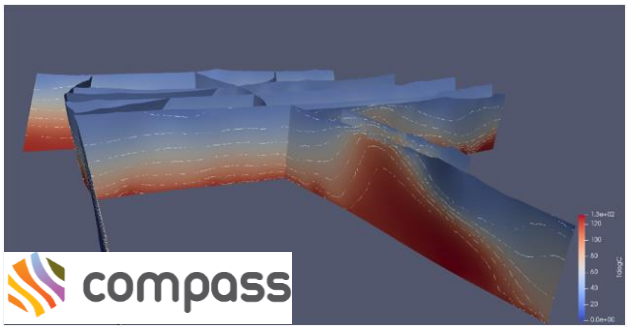


3- Geological geometry is input for simulation as limit boundaries

To Geo-physical model



Heat flow model



INTRODUCTION

In ideal world, users would like :

- To access and to re-use model easily
- To combine geometrical model with physical processes simulation, with CAO modeling, … easily
- To represent model with any tool and more particularly with web client and in the three dimensions of the space

INTRODUCTION

In ideal world, users would like :

- To access and to re-use model easily
- To combine geometrical model with physical processes simulation, with CAO modeling, … easily
- To represent model with any tool and more particularly with web client and in the three dimensions of the space

1/ How to store data from the static and/or dynamic models ?

2/ How to improve coupling between static & dynamic models ?

3/ How to combine these data sets to provide 3D information at the global/local scale ?

OUR APPROACH : SCUDDD

Model

Native directory of geomodels

Data

+

Algorithms

Numerical methods;
(surfaces type) Interpolation methods

+

Geological Pile

OUR APPROACH : SCUDDD

iSCUDDD_GEOL = Model queries / responses :

1) which formation ?
2) which contact ?

(geology)

P(xyz)

Model

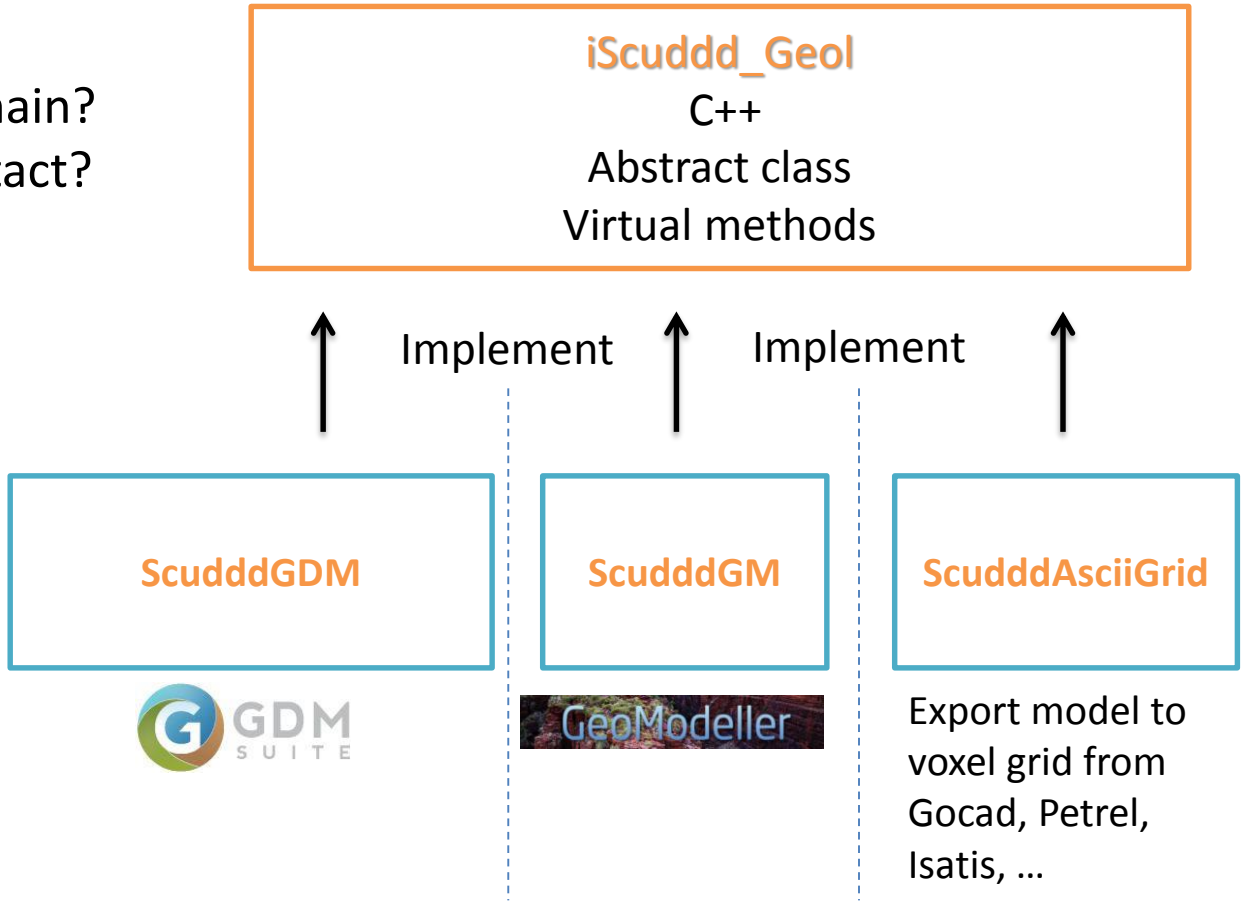
iSCUDDD_GEOL

Native directory of geomodels

Data
+
Algorithms
Numerical methods;
(surfaces type) Interpolation methods
+
Geological Pile

OUR APPROACH : SCUDDD

Which domain?
Which contact?



iScuddd_Geol have to be implemented by geomodel tools

OUR APPROACH : SCUDDD

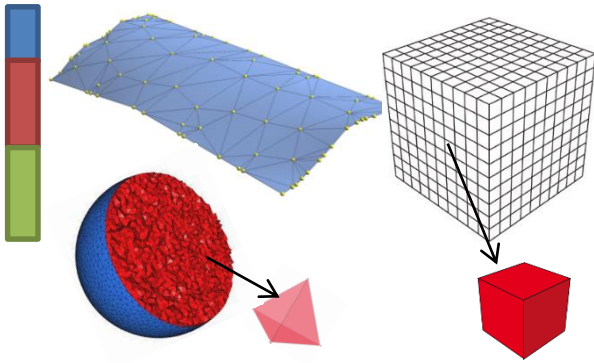
Interoperable exchange format

Representation

SCUDDD components

- **Logs**
- **Profiles**
- Maps
- Points cloud
- TIN
- **2D/3D regular grid**
- 2D/3D irregular grid
- **3D MegaVoxels**
- ....

Discretisation of space (xyz)



(After CGAL.org)

(geology)

Model

iSCUDDD_GEOL

Native directory of geomodels

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OUR APPROACH : SCUDDD

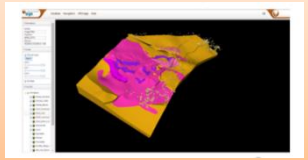
Delivery

Web Services

OGC Making location count.

WS

3D Viewer :
.VTK
.VRML / X3D



Representation

Interoperable exchange format

SCUDDD components

- Logs
- Profiles
- Maps
- Points cloud
- TIN
- 2D/3D regular grid
- 2D/3D irregular grid
- ….

Model

iSCUDDD_GEOL

Native directory of geomodels

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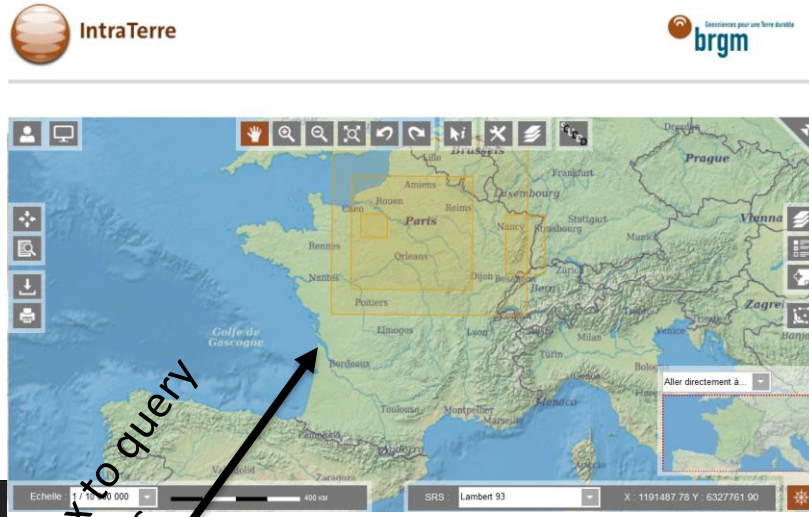
OUR APPROACH : SCUDDD

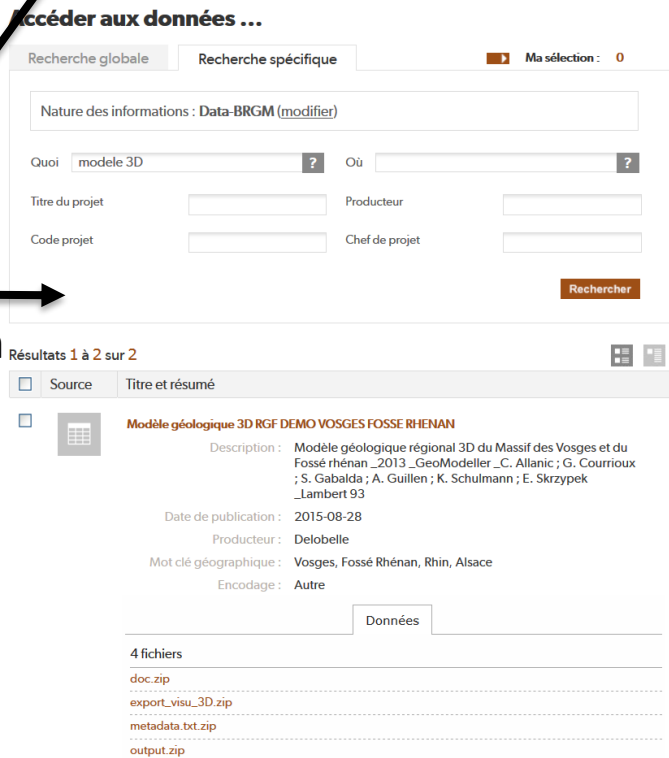
Store and Catalog models :

- Metadata form : imposed attributes to run model queries
- → Stored in a BRGM BD model (from EPOS/wp7 approach)
- Import Model.zip (file of the model native directory)



Native directory of geomodels

Search



APPLICATION : DELIVERY ON THE WEB

IntraTerre

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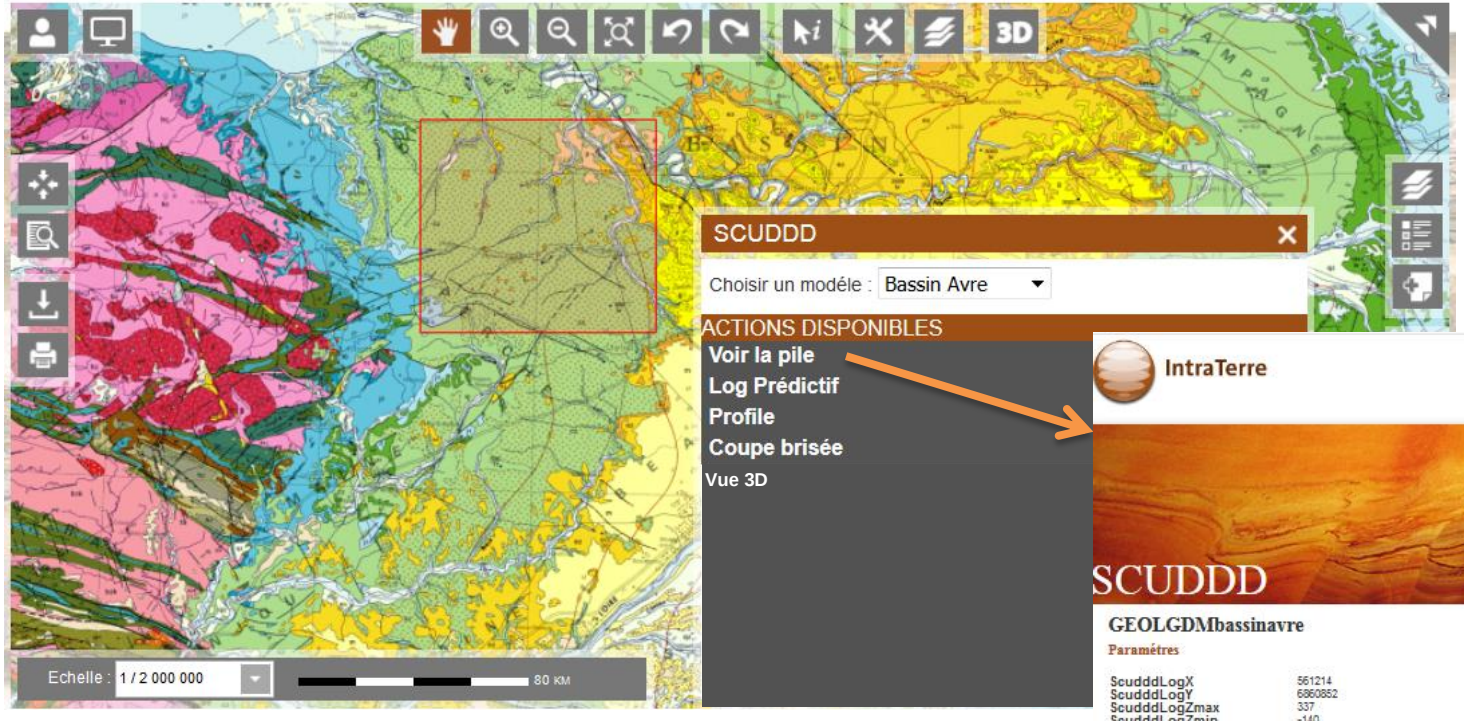
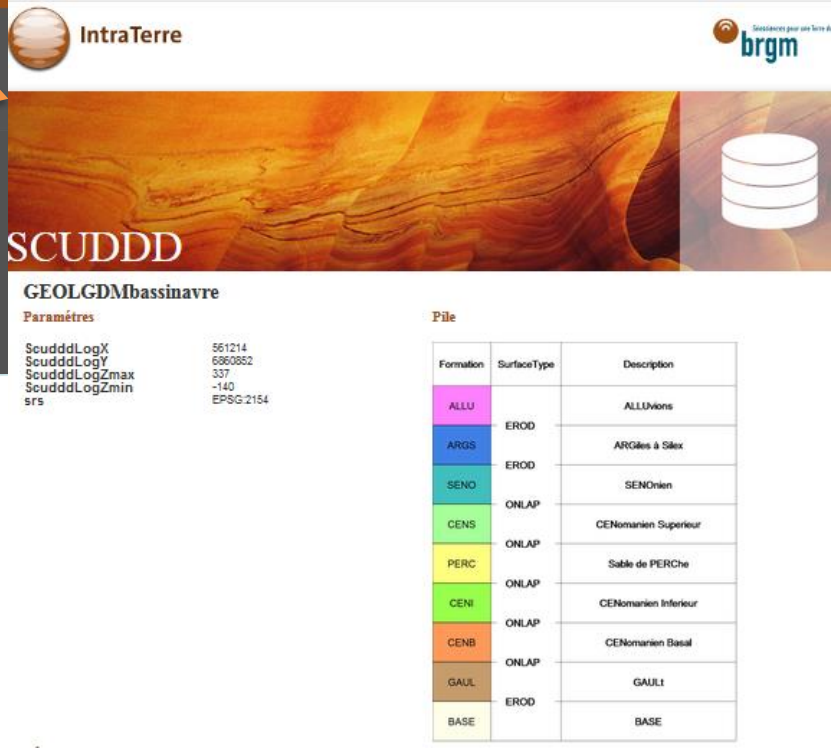
VISUALISER RECHERCHER PUBLIER





Call web services

Processing Web services

OGC® Making location count.

Representation / view

GWS

APPLICATION : DELIVERY ON THE WEB

IntraTerre

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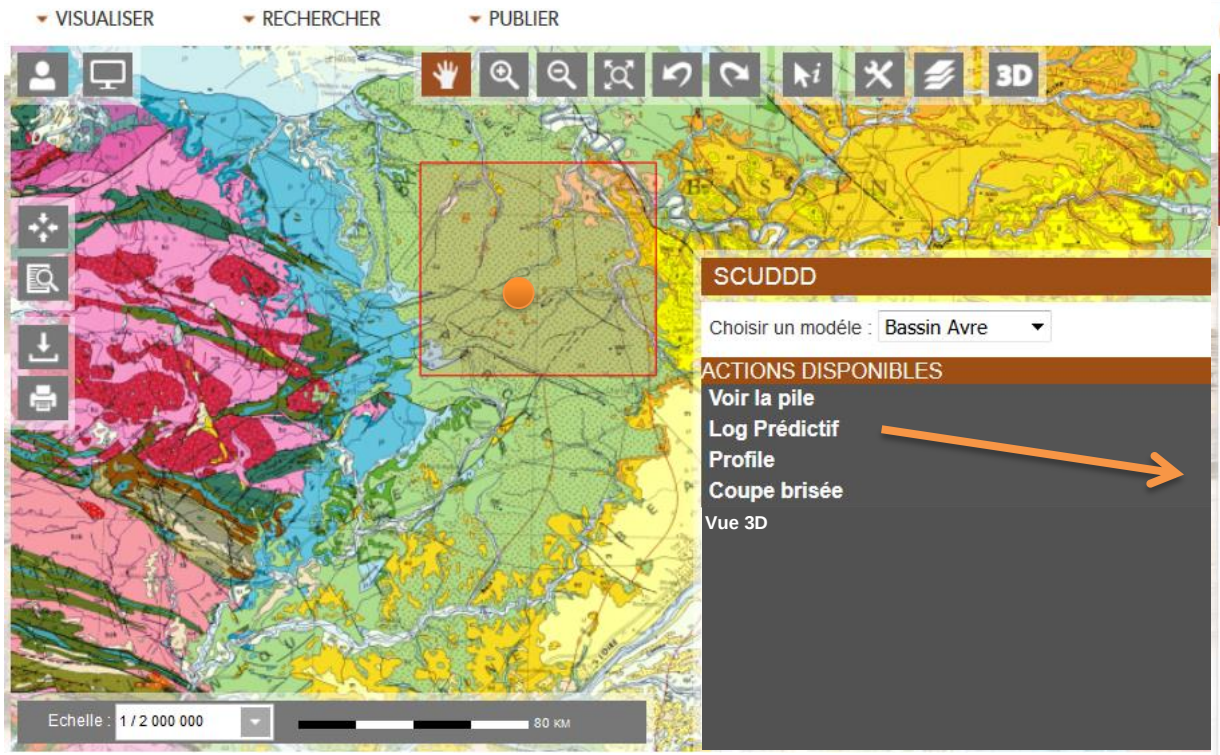
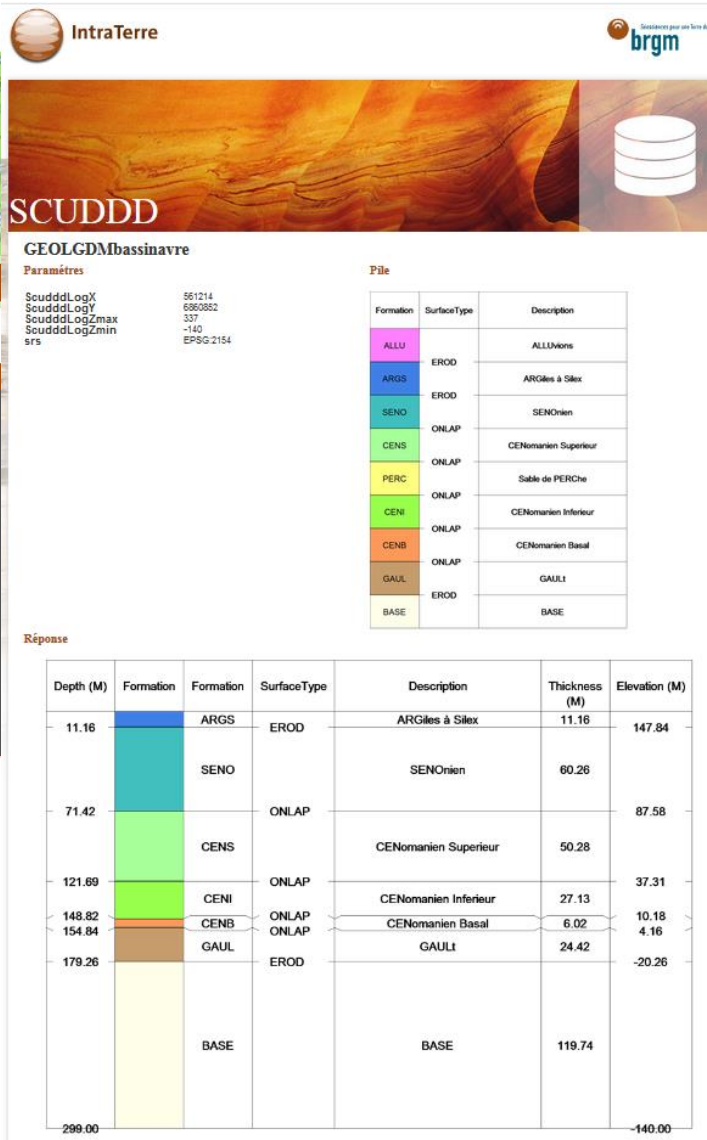


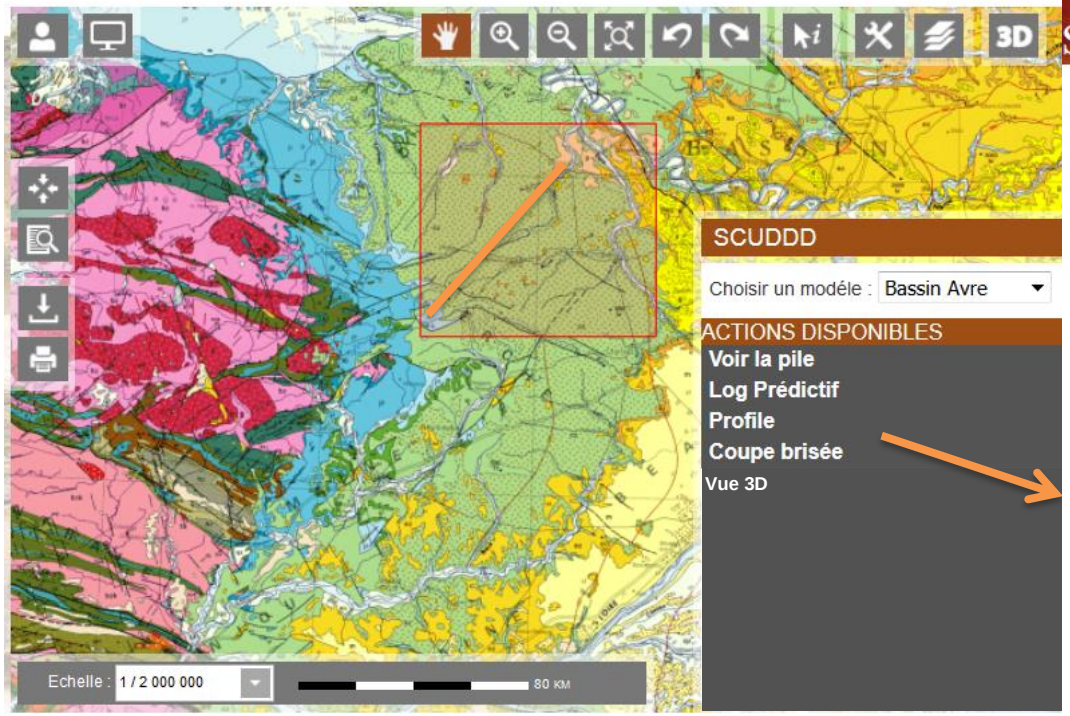


Depth (M)	Formation	Formation	SurfaceType	Description	Thickness (M)	Elevation (M)
11.16		ARGS	EROD	ARGiles à Silex	11.16	147.84
		SENO		SENOnien	60.26	
71.42			ONLAP			87.58
		CENS		CENomanien Superieur	50.28	
121.69			ONLAP			37.31
		CENI		CENomanien Inferieur	27.13	
148.82			ONLAP			10.18
154.84		CENB	ONLAP	CENomanien Basal	6.02	4.16
		GAUL		GAULt	24.42	
179.26			EROD			-20.26
		BASE		BASE	119.74	
299.00						-140.00

APPLICATION : DELIVERY ON THE WEB

IntraTerre

VISUALISER RECHERCHER PUBLIER



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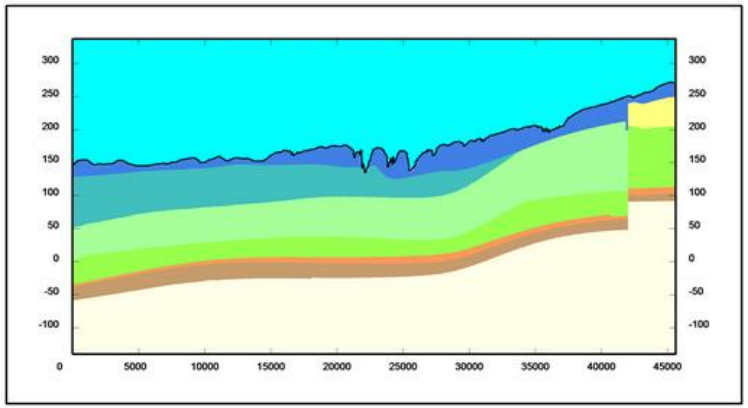
GEOLGDMbassinavre

Paramétres

ScudddVerticalSectionLeft	
ScudddVerticalSectionRight	
ScudddVerticalSectionX1	570077
ScudddVerticalSectionX2	542605
ScudddVerticalSectionY1	6870316
ScudddVerticalSectionY2	6833862
ScudddVerticalSectionZmax	337
ScudddVerticalSectionZmin	-140
srs	EPSG:2154

Réponse



Pile

Formation	SurfaceType	Description
ALLU	EROD	ALLUvions
ARGS	EROD	ARGiles à Silex
SENO	ONLAP	SENOnien
CENS	ONLAP	CENomanien Superieur
PERC	ONLAP	Sable de PERChe
CENI	ONLAP	CENomanien Inferieur
CENB	ONLAP	CENomanien Basal

APPLICATION : DELIVERY ON THE WEB

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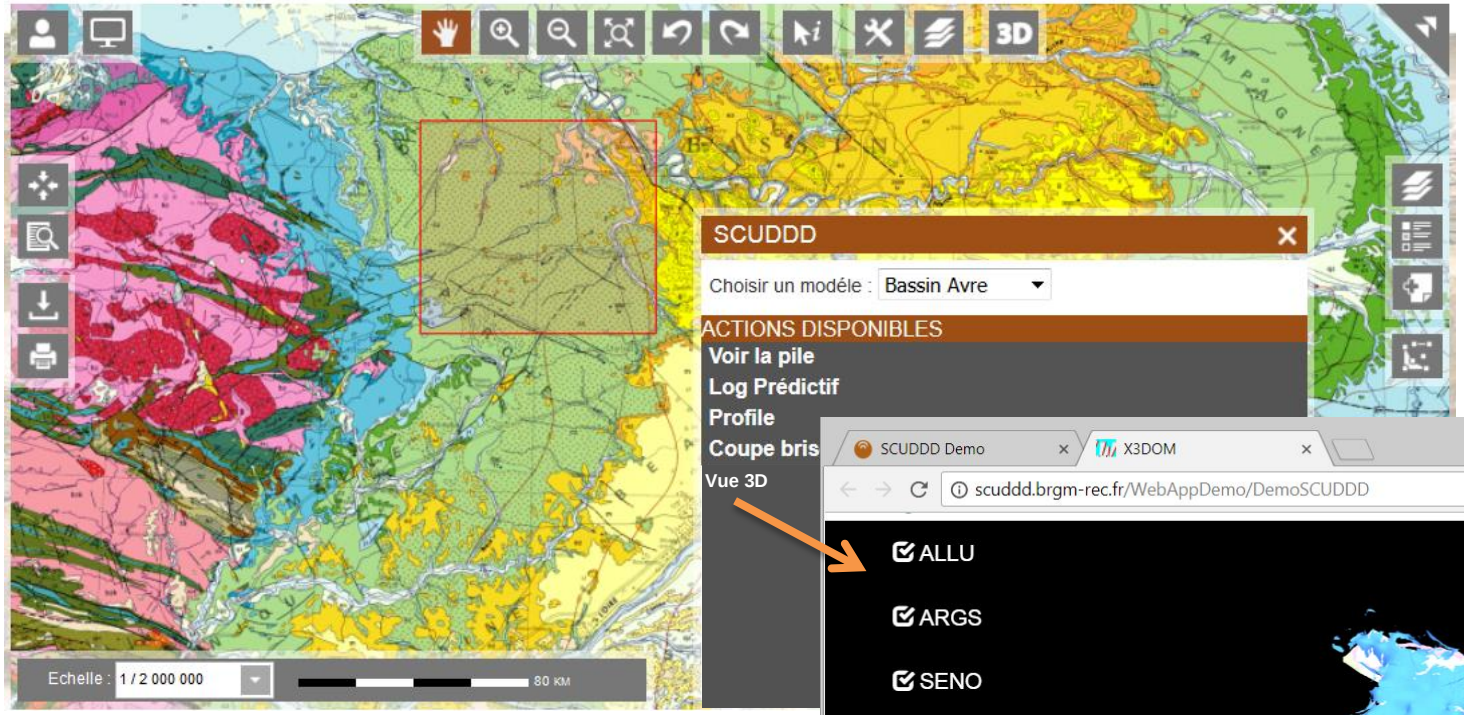
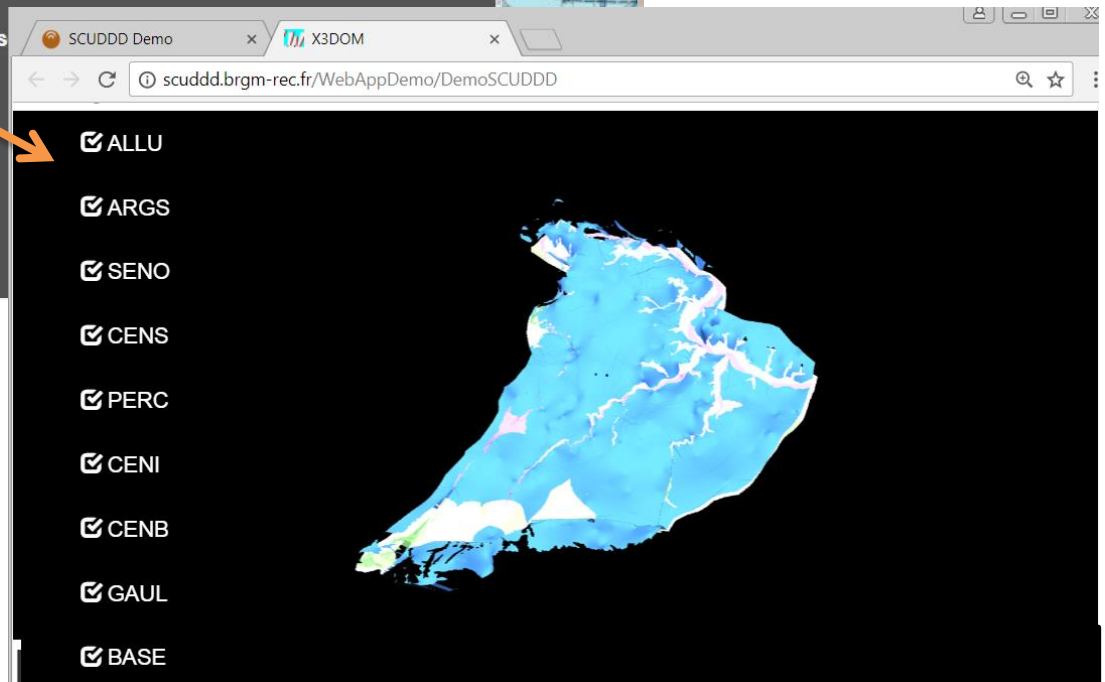
VISUALISER RECHERCHER PUBLIER

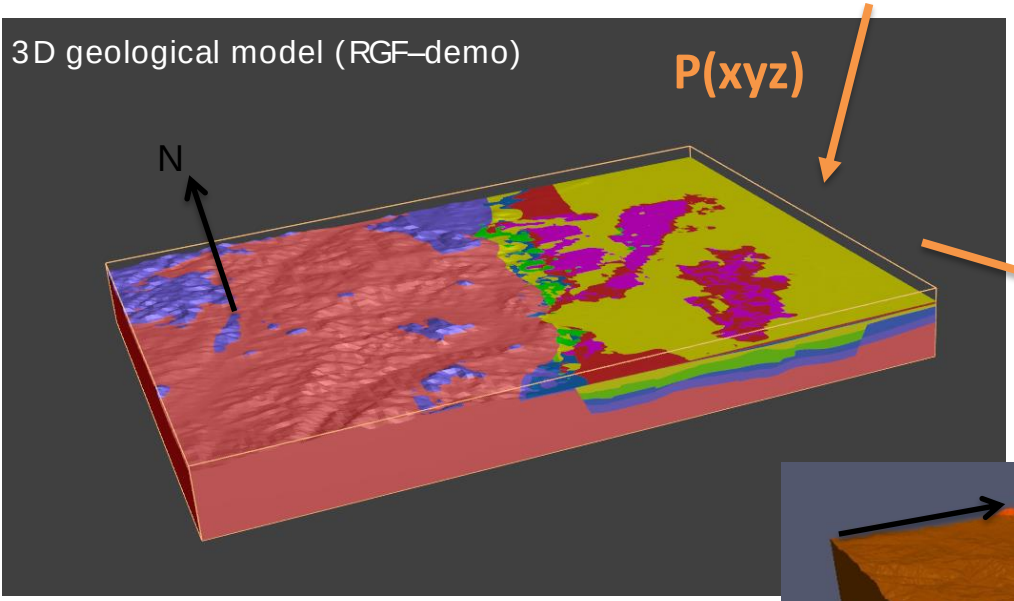




APPLICATION :

Coupling between geological model and simulation

iSCUDDD_GEOL

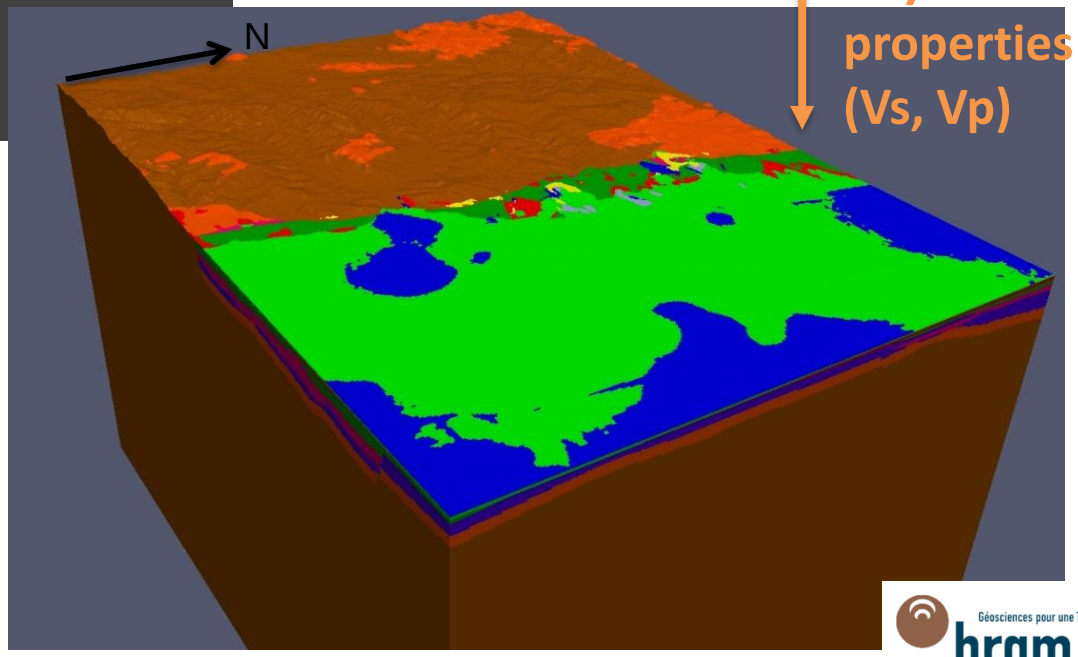


P(xyz)

(Geology)

iSCUDDD_phys

Physical properties (Vs, Vp)



Voxel mesh filled by lithology properties from geological model to seismic waves propagation simulation (RGF-demo).

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APPLICATION

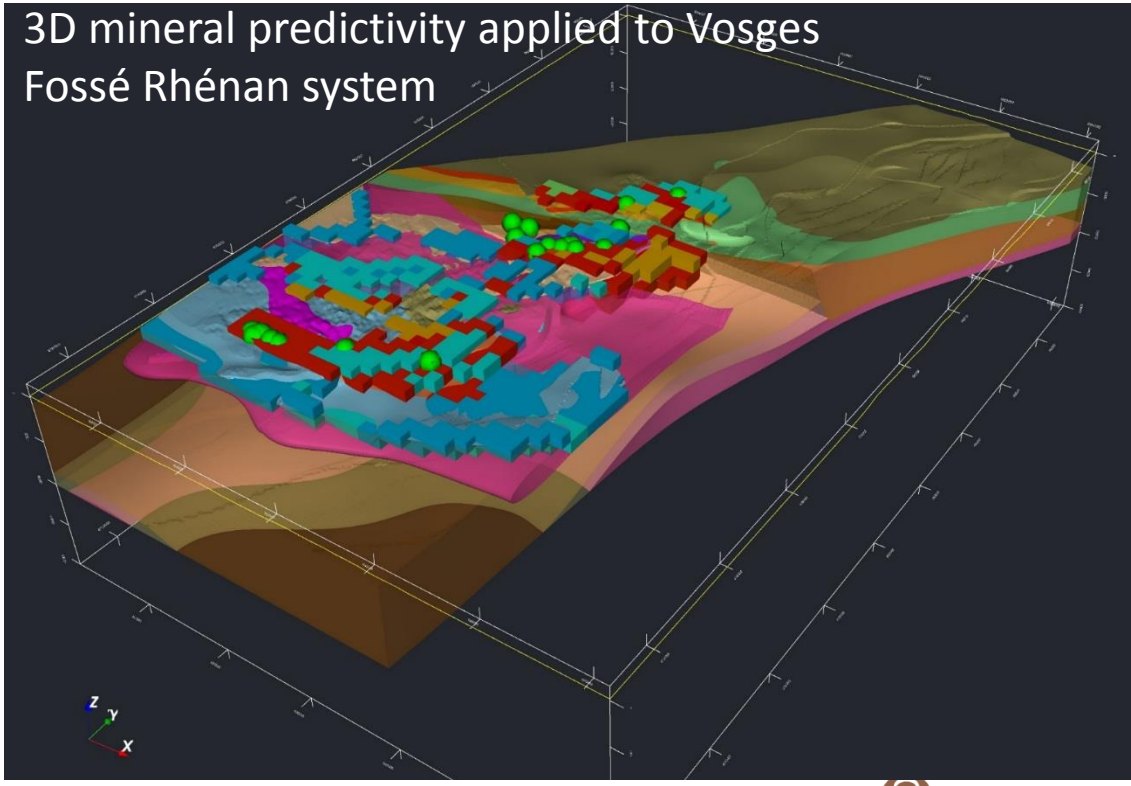
3D mineral predictivity method (CBA) using 3D geological information

The use of SCUDDD services allows to easily transfer mineral predictivity method (CBA) to 3D by :

- Creating a 3D of megavoxel including several contiguous monolithological voxels
- Creating a lithological spectrum by coding the presence/ absence of every formation for each megavoxel

→ CBA ranking technique is directly applicable to lithological spectrum by using standard megavoxels association

→ The application of the ranking to the 3D megavoxels grid allows to extend the favorability results in depth

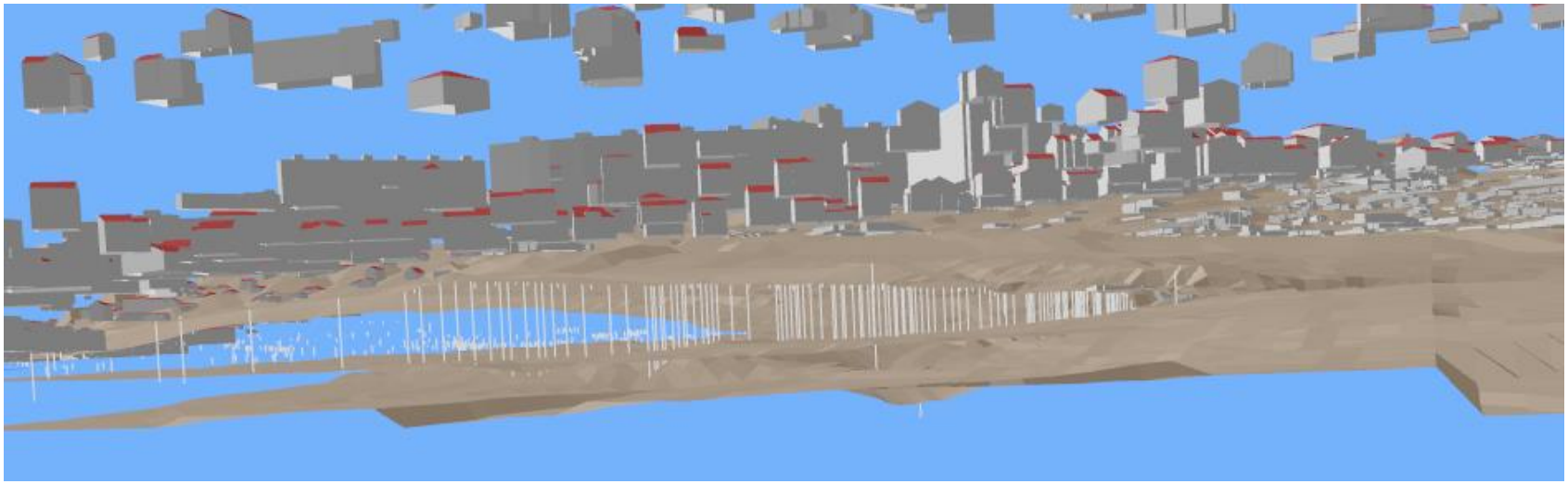


Tourlière et al., 2017

PERSPECTIVES

Example applied to Urban Geology – coupling between geological model and urban infrastructures

- City representation : « work in progress » with LIRIS-Univ. Lyon (Prof. G. Gesquiere and F. Pedrinis)



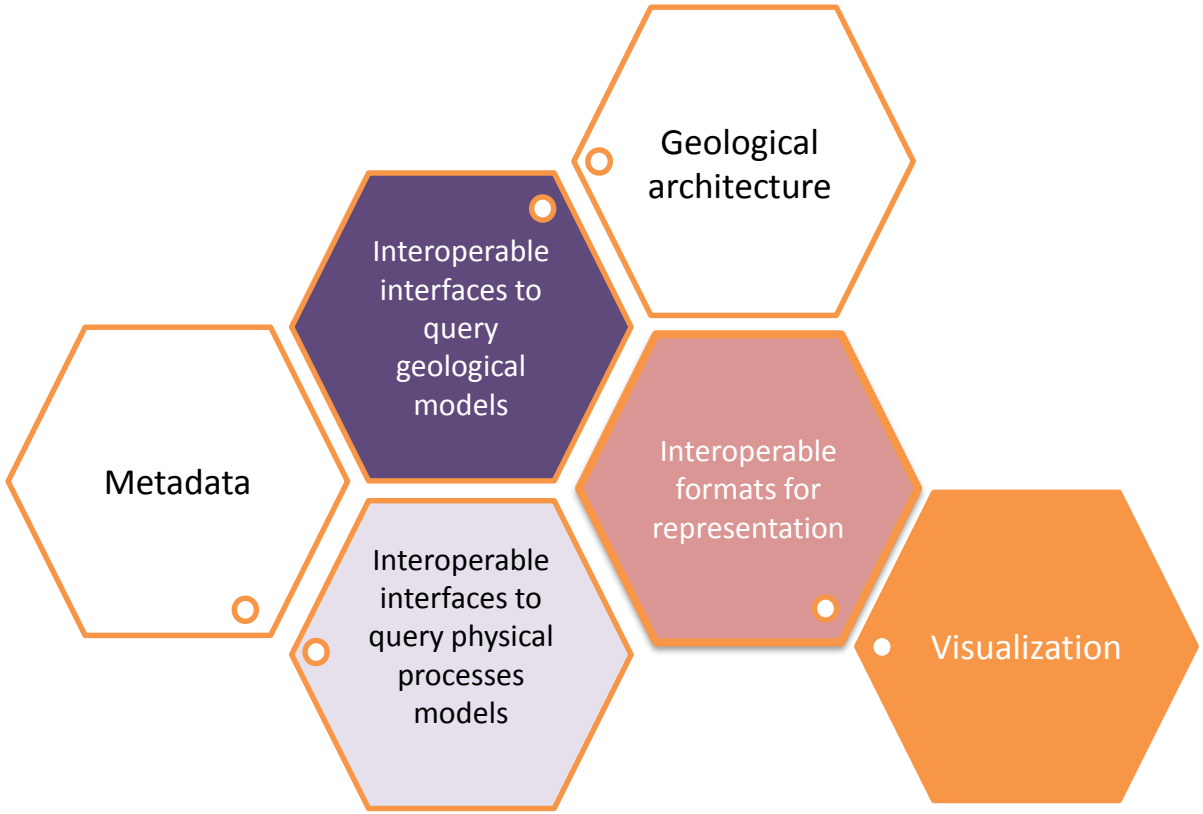
3D Lyon city view : surface infrastructure combined with 3D subsurface geology (from geological model of Lyon city - BRGM) (Picture from F. Pedrinis)

- Minnd project : cf. Beaufils et al. talk in Urban geology session Friday morning

CONCLUSION

- No data interoperability but iScuddd_Geol is an interoperable programming interface if and only if geomodel tools implement it

- In perspectives, we have to develop the same way interoperable programming interface to query dynamical models and infrastructure models (i.e. iScuddd_Simu ; iScuddd_Infra) in order to deliver information related to.



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SCUDDD project

C. Loiselet, C. Bellier, G. Courrioux, S. Lopez, J. Durand, F. DeMartin, E. Taffoureau, N. Mauroy, A. Quentin, J. Goncalves and F. Robida

Thank you for your attention

And

Hope to see you at Scuddd live demo at the poster session

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http://scuddd.brgm-rec.fr/WebAppDemo/Viewer