

Storing and delivering numerical geological models on demand

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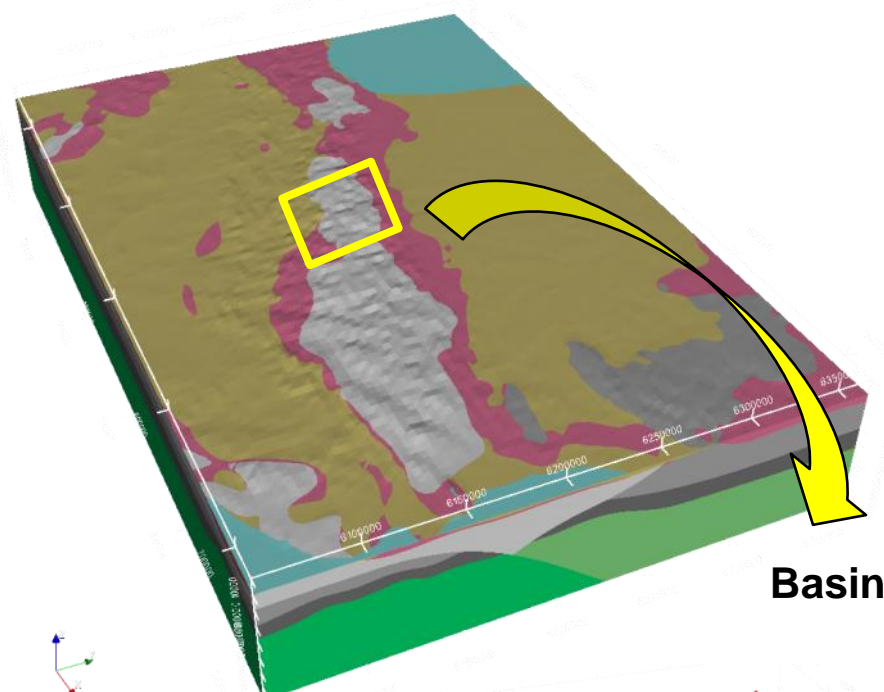
Géosciences pour une Terre durable

brgm

INTRODUCTION



Lithospheric Scale

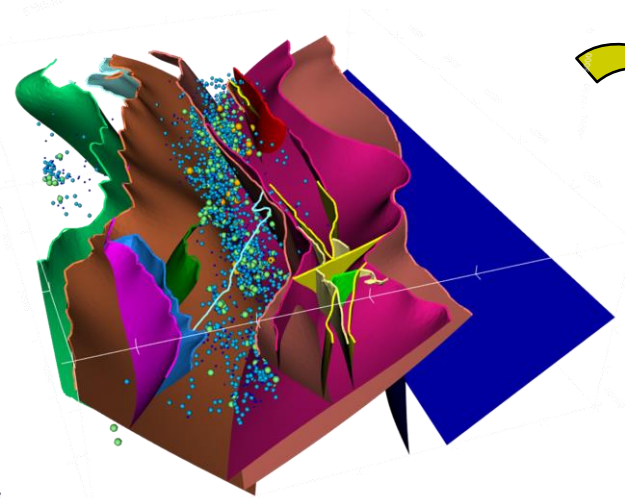


1- Model at different scales (lithospheric / crustal; basin; alluvium)

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

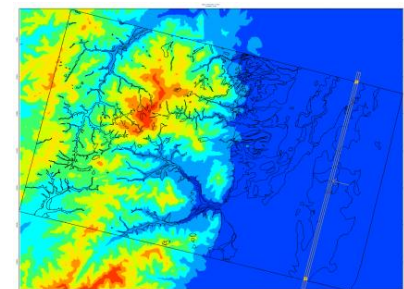
Basin Scale

A. Wehr 2017 (Ph.D thesis)



A.L. Argentin 2015 (Master Thesis)

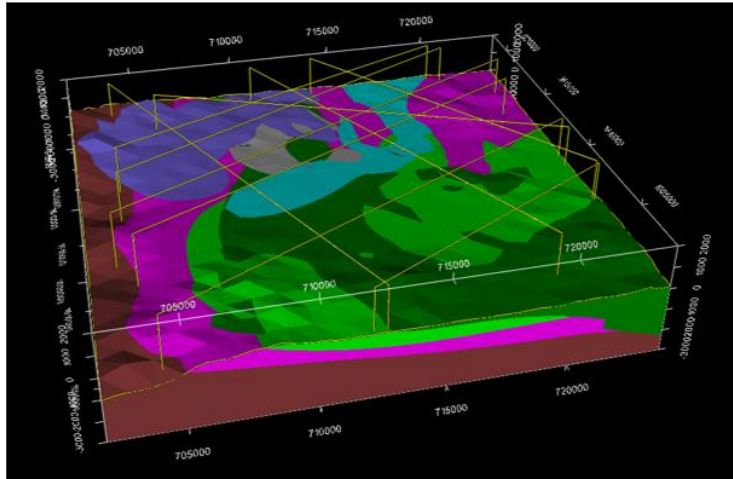
Alluvium Scale



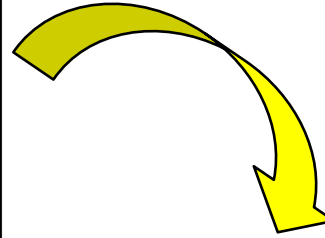
INTRODUCTION



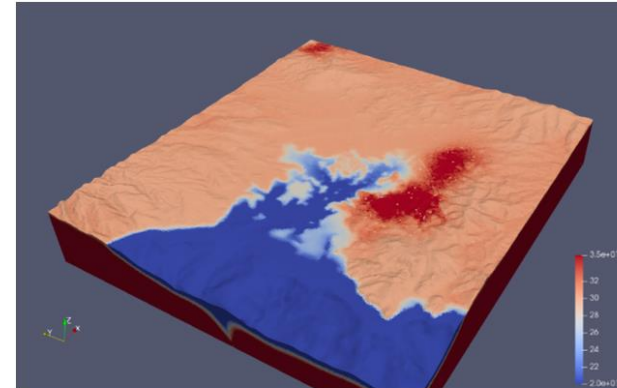
From Geological model



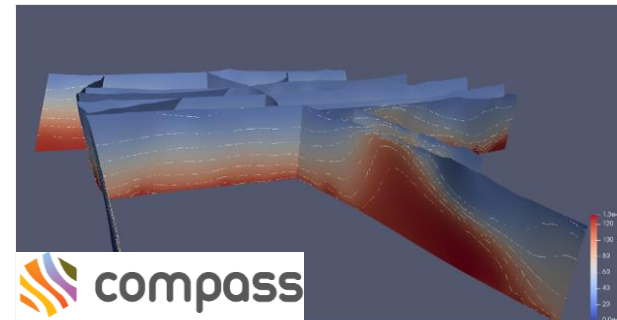
3- Geological geometry is input for simulation as limit boundaries



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 :

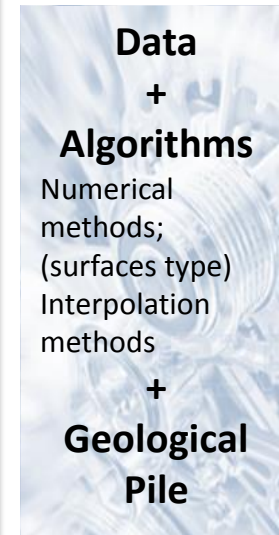
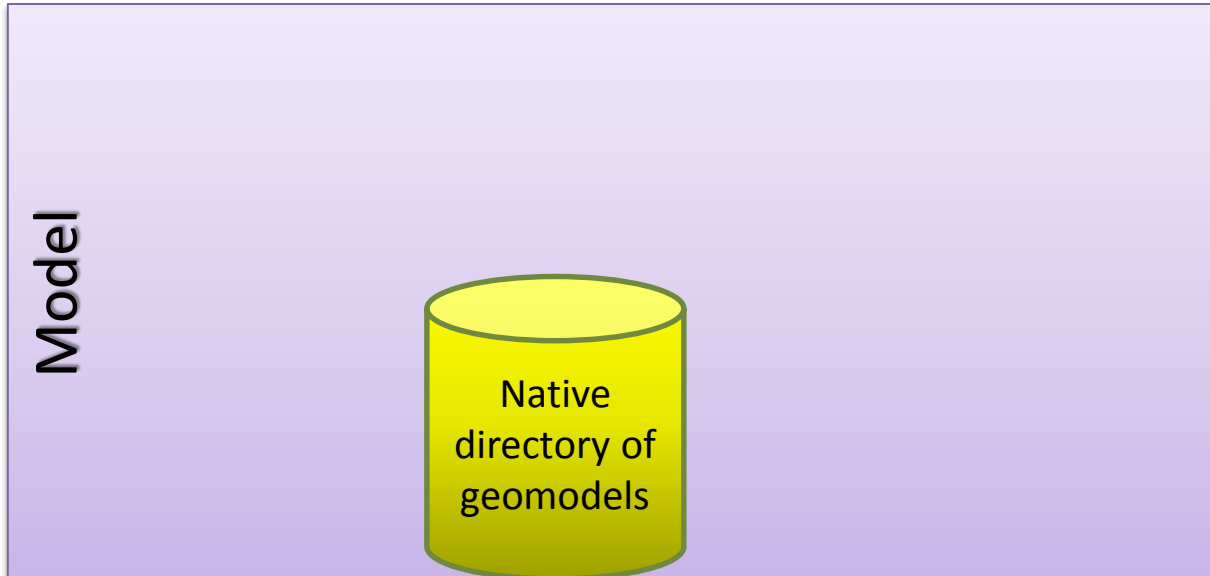
- To access and to re-use model easily
- To combine geometrical model with physical processes simulation, with CAO modeling, ... easily
- To represent model with any tool and more particularly with web client and in the three dimensions of the space

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 : SCUDDDD

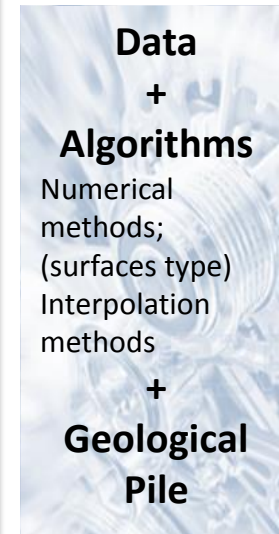
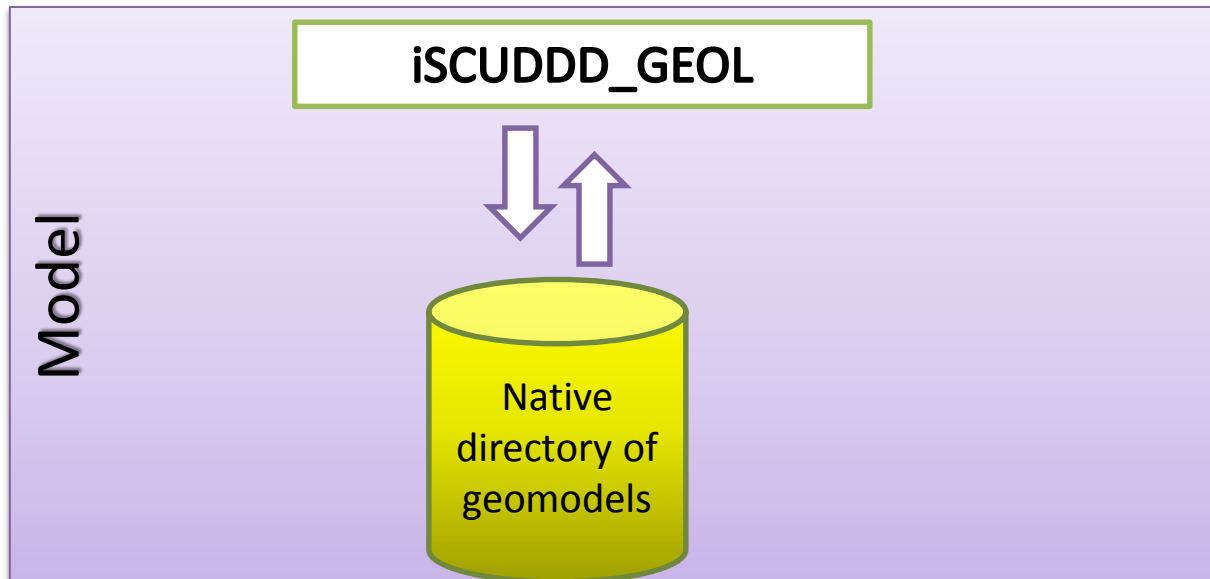
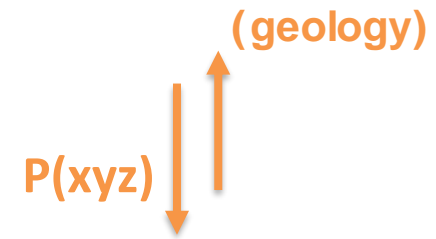


OUR APPROACH : SCUDDD



iSCUDDD_GEOL = Model queries / responses :

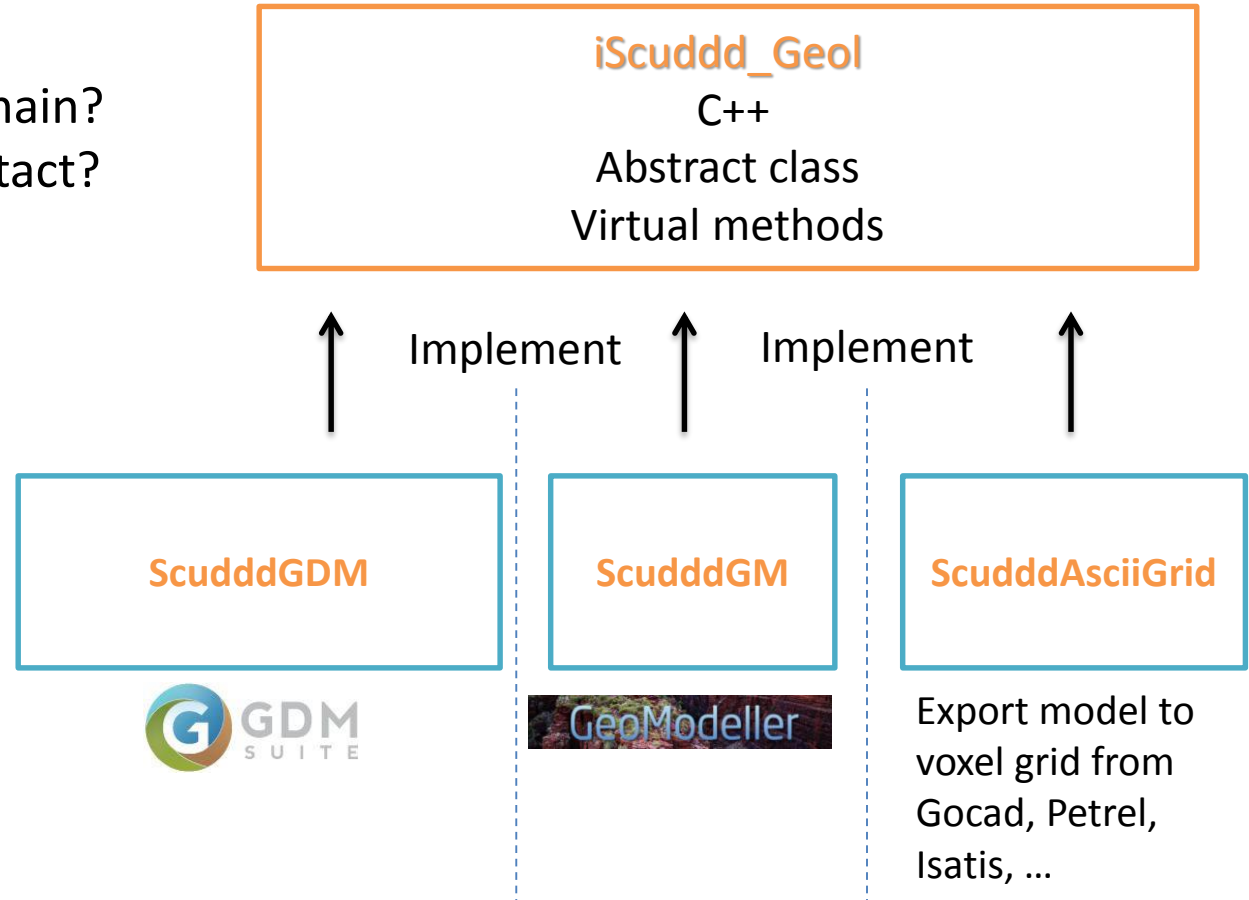
- 1) which formation ?
- 2) which contact ?



OUR APPROACH : SCUDDD

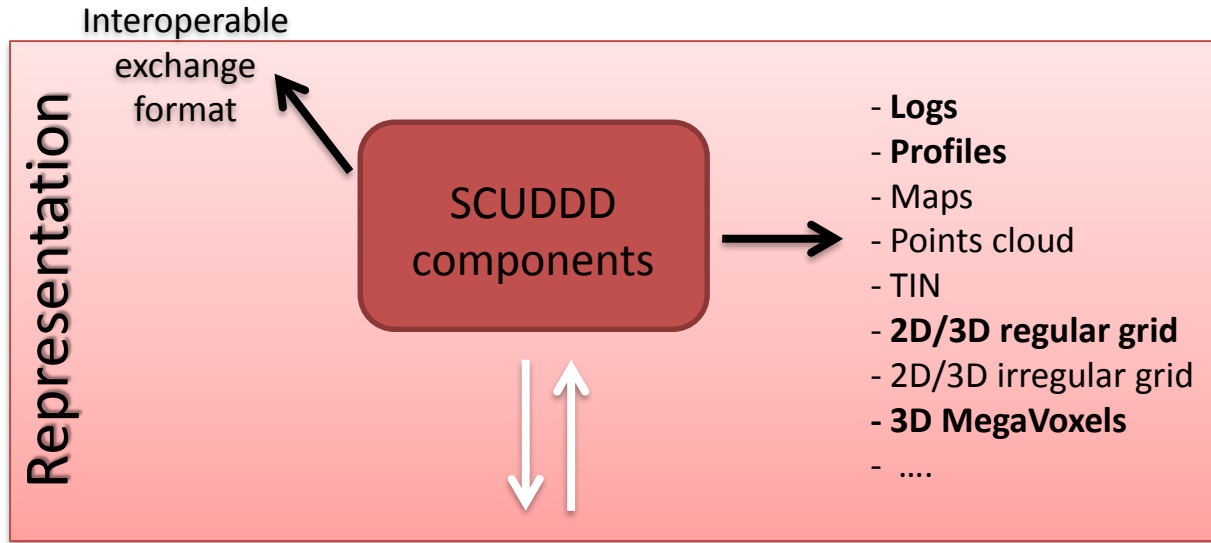


Which domain?
Which contact?

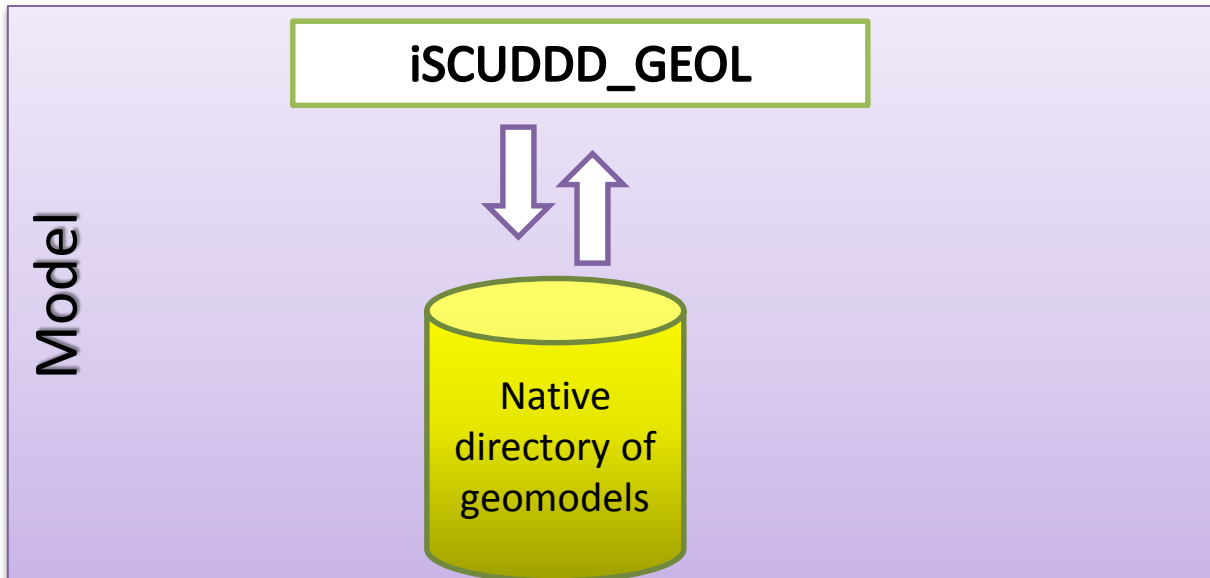
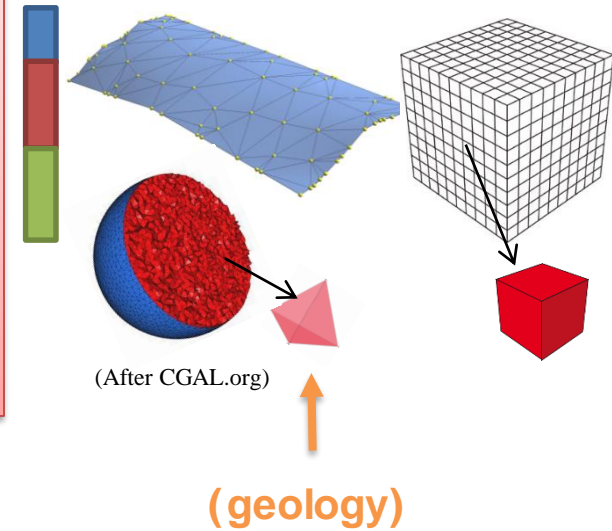


iScuddd_Geol have to be implemented by geomodel tools

OUR APPROACH : SCUDDD



Discretisation of space (xyz)



OUR APPROACH : SCUDDD



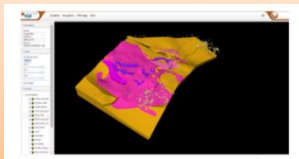
Delivery

Web Services

OGC[®]
Making location count.

GWS

3D Viewer :
.VTK
.VRML / X3D



Interoperable

Representation

exchange format

SCUDDD components

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

Model

iSCUDDD_GEOL

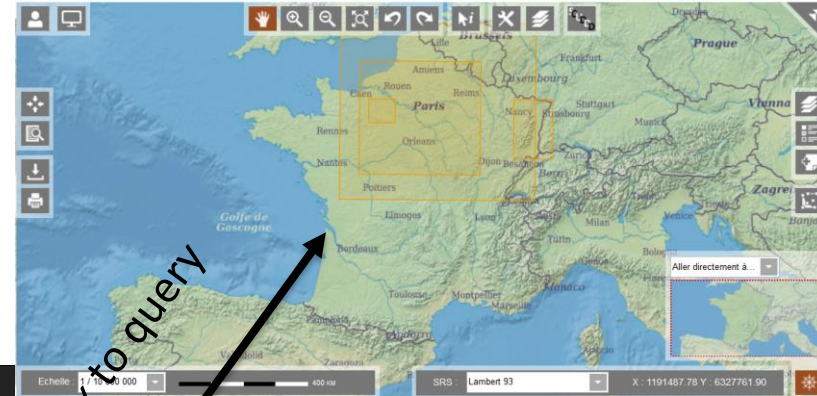
Native directory of geomodels

OUR APPROACH : SCUDDD

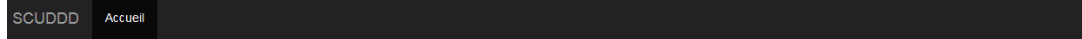


Store and Catalog models :

- 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)



Bounding Box to query existing models



Informations obligatoires

Identifiant du modèle:*

Nom du modèle:*

Catégorie thématique: Géologie

Logiciel: GDM

XMin:*

YMin:*

XMax:*

YMax:*

Système de projection (EPSG):*

Unité (SI): Mètre

Z Min (m):*

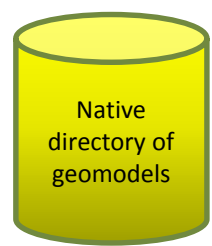
Z Max (m):*

Confidentialité: Publique

Déposer mes données

Attention le modèle doit être compressé en .zip

Parcourir... Aucun fichier sélectionné.



Accéder aux données ...

Recherche globale Recherche spécifique

Nature des informations : Data-BRGM (modifier)

Quoi: modele 3D ? Où: ?

Titre du projet: Producteur:

Code projet: Chef de projet:

Rechercher

Search Résultats 1 à 2 sur 2

Source	Titre et résumé
<input type="checkbox"/>	Modèle géologique 3D RGF DEMO VOSGES FOSSE RHENAN Description : Modèle géologique régional 3D du Massif des Vosges et du Fossé rhénan _2013 _GeoModeller _C. Allanic ; G. Courrioux ; S. Gabalda ; A. Guillen ; K. Schulmann ; E. Skrzypek _Lambert 93 Date de publication : 2015-08-28 Producteur : Delobelle Mot clé géographique : Vosges, Fossé Rhénan, Rhin, Alsace Encodage : Autre

Données

4 fichiers

- doc.zip
- export_visu_3D.zip
- metadata_bxt.zip
- output.zip



Search

APPLICATION : DELIVERY ON THE WEB



VISUALISER RECHERCHER PUBLIER

The screenshot shows a web-based geological map interface. At the top, there are navigation buttons: VISUALISER, RECHERCHER, and PUBLIER. Below these is a toolbar with icons for user profile, desktop view, hand, zoom in, zoom out, pan, rotate, and 3D view. The main map area displays a colorful geological map with a red rectangular selection box. To the right of the map, a dropdown menu is open, showing 'SCUDDD' and 'Choisir un modèle : Bassin Avre'. Below the dropdown, a list of 'ACTIONS DISPONIBLES' is shown: 'Voir la pile', 'Log Prédicatif', 'Profil', 'Coupe brisée', and 'Vue 3D'. An orange arrow points from 'Voir la pile' to a larger preview window on the right. The preview window shows a 3D cross-section of the geological layers with the title 'SCUDDD' and 'GEOLGDMbassinavre'. Below the preview, there are 'Paramètres' (Parameters) and a 'Pile' (Stratigraphic column) table.

ACTIONS DISPONIBLES

- Voir la pile
- Log Prédicatif
- Profil
- Coupe brisée
- Vue 3D

SCUDDD

GEOLGDMbassinavre

Paramètres

ScuddLogX 561214
 ScuddLogY 6960852
 ScuddLogZmax 337
 ScuddLogZmin -140
 srs EPSG:2154

Pile

Formation	SurfaceType	Description
ALLU	EROD	ALLUvions
ARGS	EROD	ARGès à Sàlex
SENO	ONLAP	SENOrien
CENS	ONLAP	CENomancien Supérieur
PERC	ONLAP	Sàble de PERChe
CENI	ONLAP	CENomancien Intérieur
CENB	ONLAP	CENomancien Basal
GAUL	EROD	GAULt
BASE	EROD	BASE

Processing
 Web
 services



Representation
 / view



Call web services

APPLICATION : DELIVERY ON THE WEB



VISUALISER RECHERCHER PUBLIER

SCUDD

GEOLGDMbassinavre

Paramètres
 ScuddLogX 561214
 ScuddLogY 6963852
 ScuddLogZmax 337
 ScuddLogZmin -140
 srs EPSG:2154

Pile

Formation	SurfaceType	Description
ALLU	EROD	ALLUVions
ARGS	EROD	ARGiles à Silex
SENO	ONLAP	SENOmien
CENS	ONLAP	CENomanien Supérieur
PERC	ONLAP	Sable de PERche
CENI	ONLAP	CENomanien Inférieur
CENB	ONLAP	CENomanien Basal
GAUL	EROD	GAULI
BASE		BASE

Réponse

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

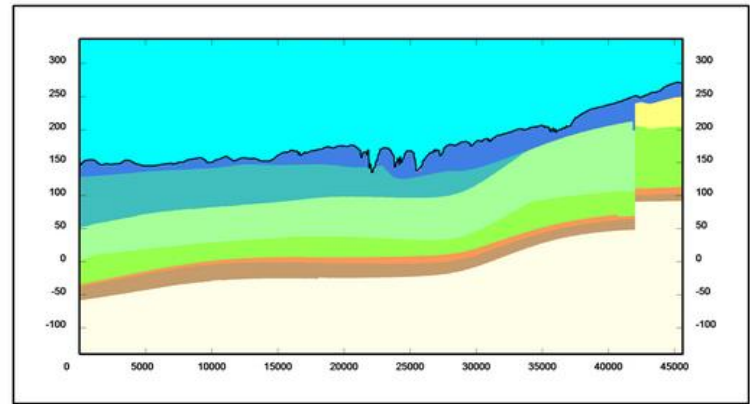
APPLICATION : DELIVERY ON THE WEB



VISUALISER RECHERCHER PUBLIER

GEOLOGDbassinavre

Paramètres
 ScuddVerticalSectionLeft 570077
 ScuddVerticalSectionRight 542605
 ScuddVerticalSectionX1 6870316
 ScuddVerticalSectionY1 6833962
 ScuddVerticalSectionY2 337
 ScuddVerticalSectionZmax -140
 ScuddVerticalSectionZmin sfs
 EPSG:2154



File

Formation	SurfaceType	Description
ALLU	EROD	ALLUvions
ARGS	EROD	ARGÛles à Silex
SENO	ONLAP	SENOnien
CENS	ONLAP	CENomancien Supérieur
PERC	ONLAP	Sable de PERChe
CENI	ONLAP	CENomancien Inférieur
CENB	ONLAP	CENomancien Basal

APPLICATION : DELIVERY ON THE WEB



VISUALISER RECHERCHER PUBLIER

SCUDD

Choisir un modèle : Bassin Avre

ACTIONS DISPONIBLES

- Voir la pile
- Log Prédictif
- Profile
- Coupe bris
- Vue 3D

Echelle : 1 / 2 000 000 80 KM

SCUDD Demo X3DOM

scuidd.brgm-rec.fr/WebAppDemo/DemoSCUDD

- ALLU
- ARGS
- SENO
- CENS
- PERC
- CENI
- CENB
- GAUL
- BASE

APPLICATION :

Coupling between geological model and simulation



iSCUDDD_GEOL

3D geological model (RGF-demo)

$P(xyz)$

(Geology)

iSCUDDD_phys

Physical properties
(V_s , V_p)

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

APPLICATION



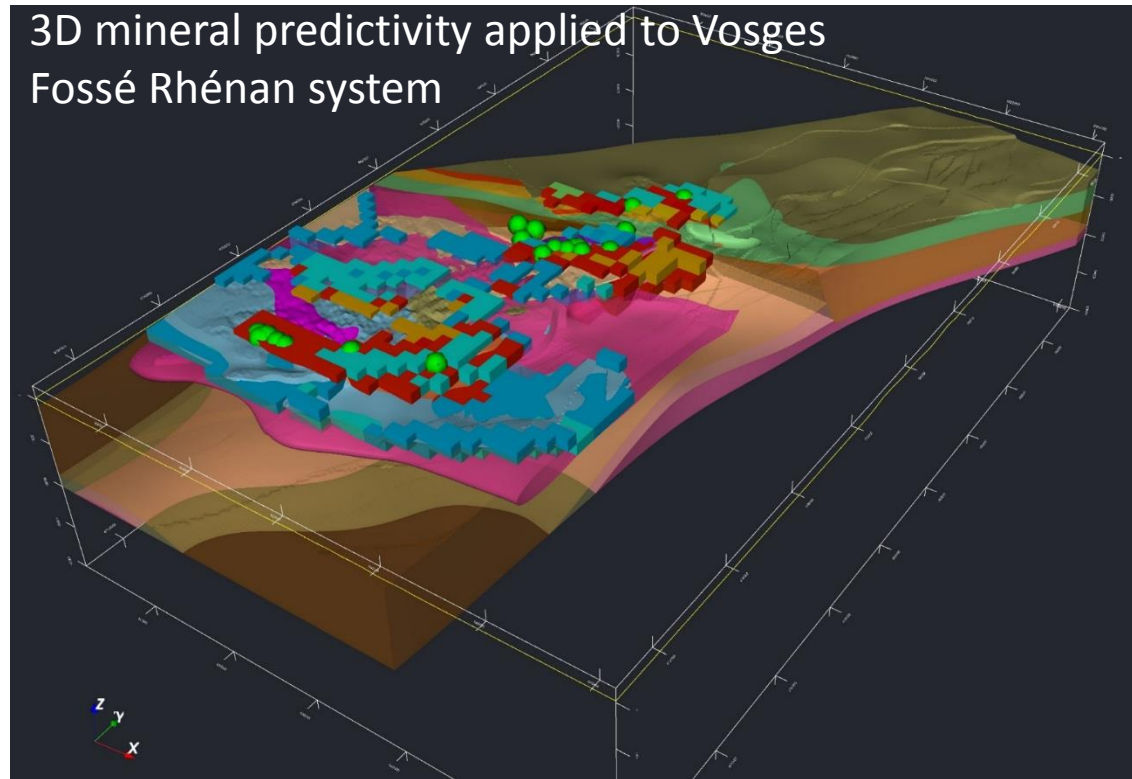
3D mineral predictivity method (CBA) using 3D geological information

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

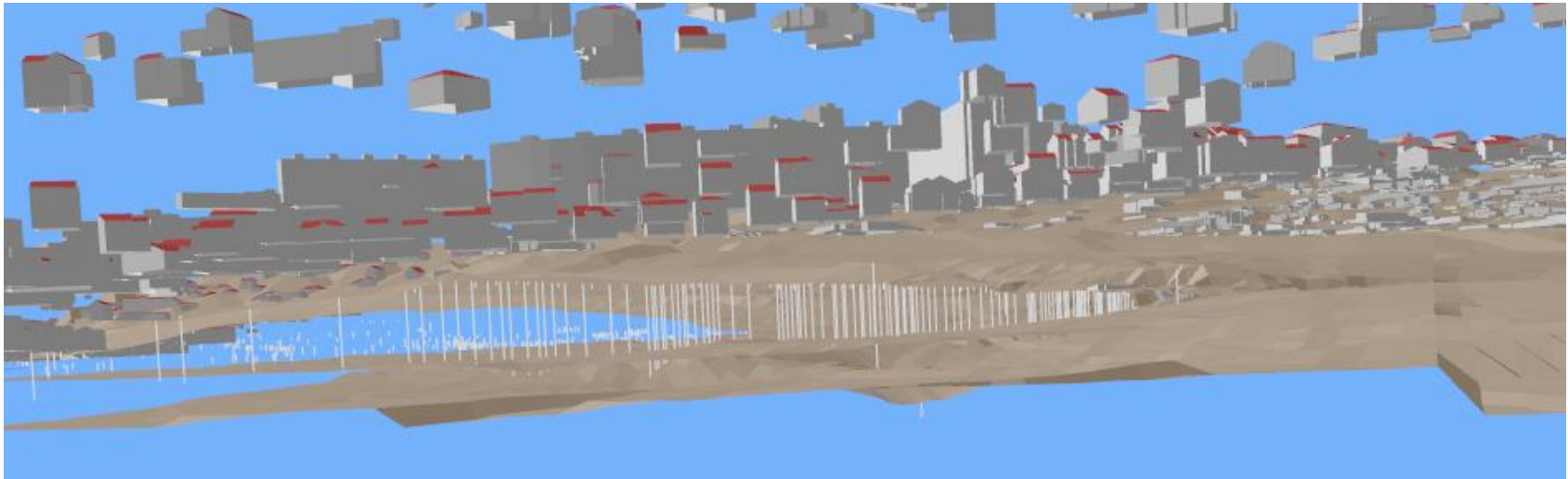


Tourlière et al., 2017



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)



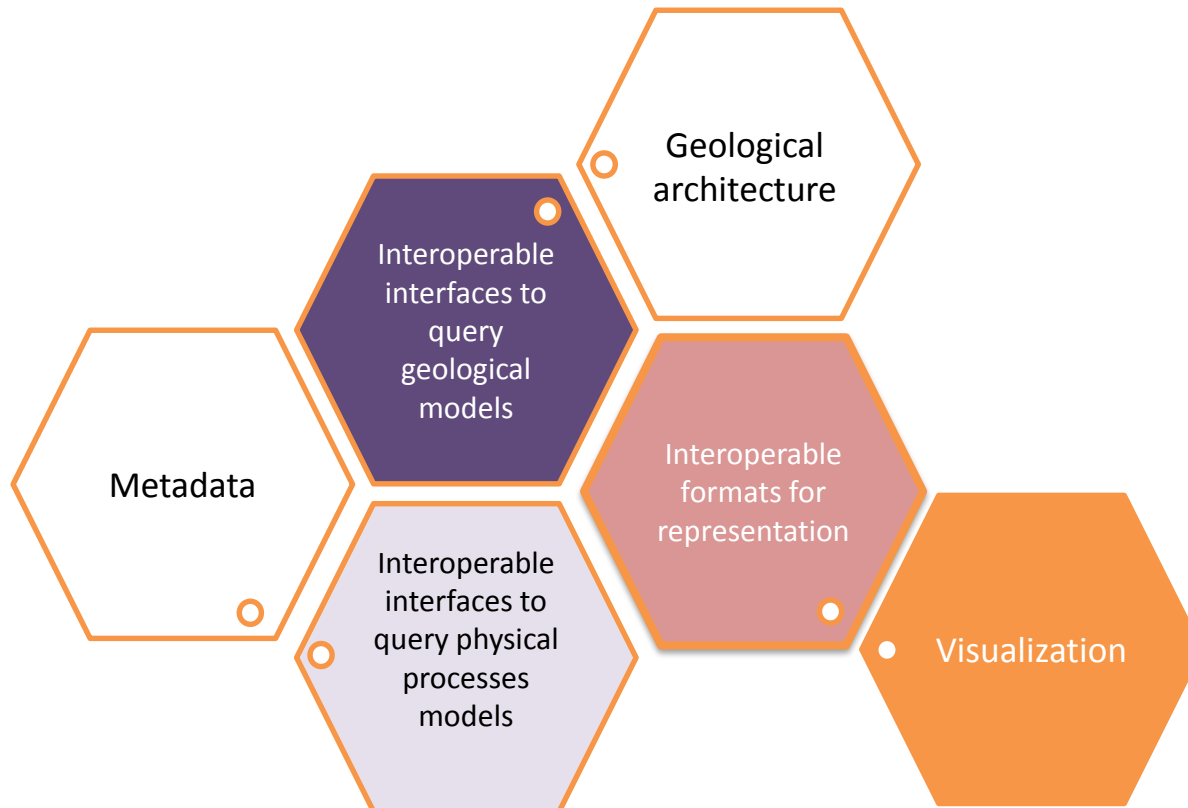
3D Lyon city view : surface infrastructure combined with 3D subsurface geology (from geological model of Lyon city - BRGM) (Picture from F. Pedrinis)

- **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.



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

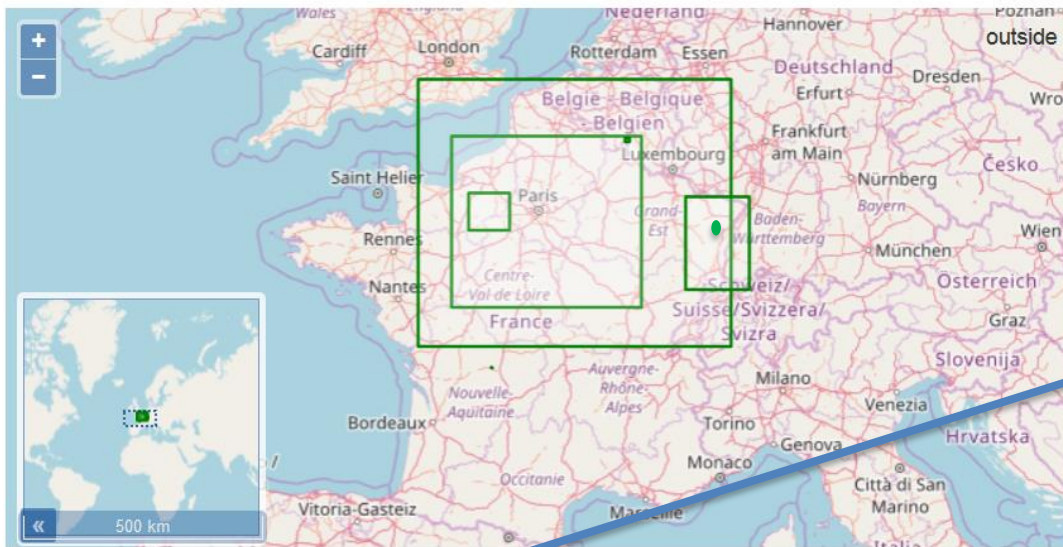
Thank you for your attention

And

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

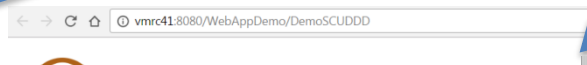


<http://scudd.brgm-rec.fr/WebAppDemo/Viewer>



Model : Format :

- Pile
- Log
- Section
- Profile
- Visu 3D
- Download VTK



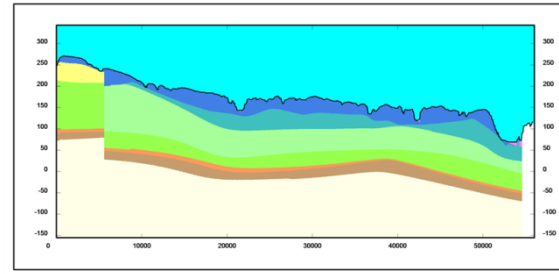
Bassin Avre

Coordonnées : 126273.97072711118, 6252243.165614277
 Z max : 343
 Z min : -155.5635

Depth (M)	Formation	Formation	SurfaceType	Description	Thickness (M)	Elevation (M)
17.69	ARGS	EROD	EROD	ARGOles à Silex	17.69	139.44
74.74	SENO	ONLAP	ONLAP	SENOrien	57.06	82.36
123.22	CENS	ONLAP	ONLAP	CENomanien Supérieur	48.48	33.90
150.68	CENI	ONLAP	ONLAP	CENomanien Inférieur	27.46	6.45
155.14	CENB	ONLAP	ONLAP	CENomanien Basal	4.46	1.89
180.91	GAUL	EROD	EROD	GAULI	25.77	-23.78
312.69	BASE			BASE	131.78	-155.56

Bassin Avre

Coordonnées : 105860.1872845027, 6197351.18785726, 124205.07407294499, 6280514.674631532
 Z max : 343
 Z min : -155.5635



- ALLU
- ARGS
- SENO
- CENS
- PERC
- CENI
- CENB
- GAUL
- BASE

biect: