7th European Meeting on 3D Geological Modelling

Warsaw, Poland

POLISH GEOLOGICAL INSTITUTE
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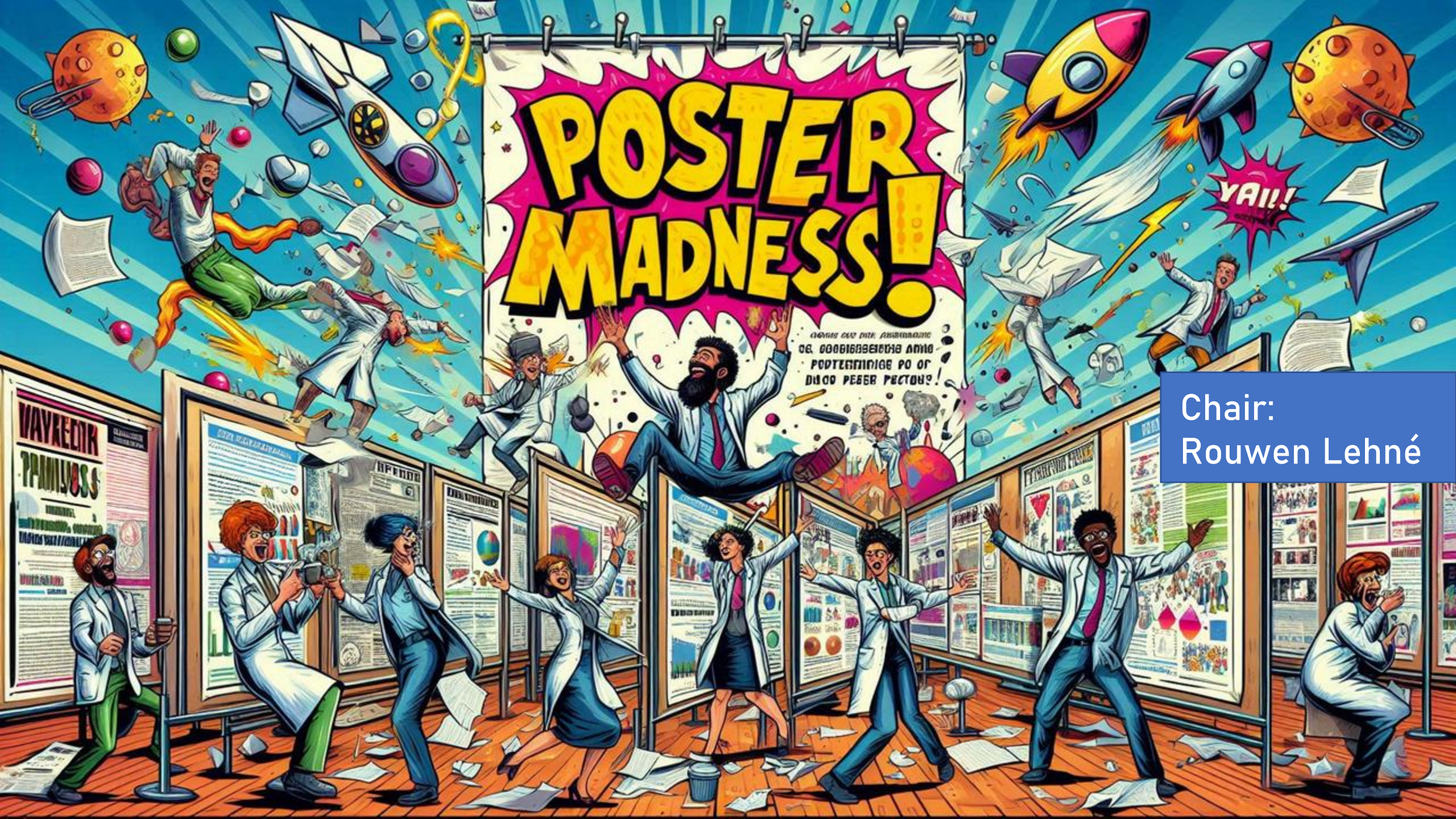
GEOScene3D ...by I•GIS

NATIONAL FUND FOR ENVIRONMENTAL PROTECTION AND WATER MANAGEMENT



Chair:
Rouwen Lehné

7th European Meeting on 3D Geological Modelling
"New frontiers and challenges in geomodelling"

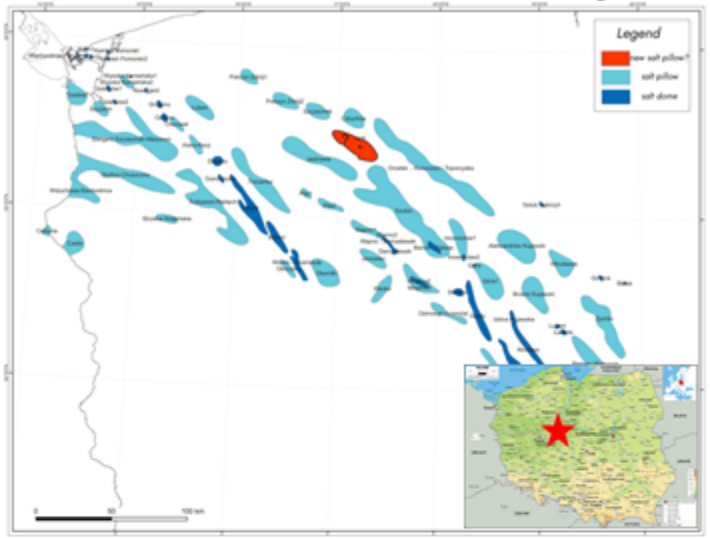
To be or not to be findable
– results of the first stage of the GSEU 3D geomodels inventory

Dana Čápová, Pavla Kramolišová, Maria Mancebo, Olga Moravcová, **Urszula Stępień**, Romana Šuráňová, Leticia Vega

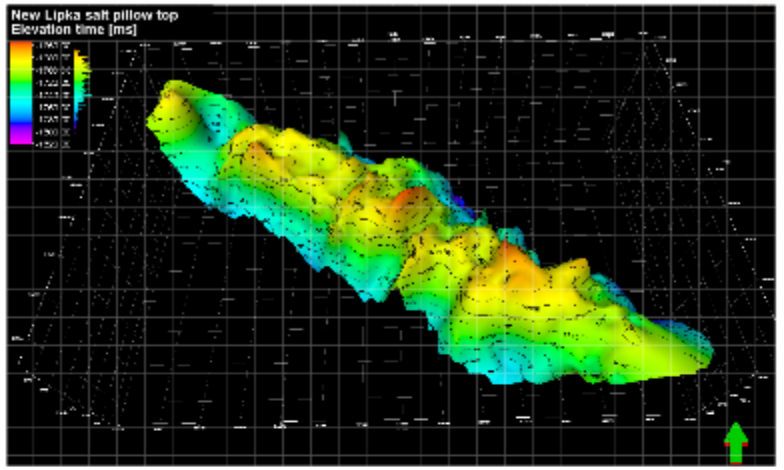
The project is co-funded by the Polish Ministry of Education and Science under the program entitled „International Projects Co-funded"

CZECH GEOLOGICAL SURVEY
Instituto Geológico y Minero de España
Funded by the European Union
EuroGeoSurveys
GSEU GEOLOGICAL SERVICE FOR EUROPE

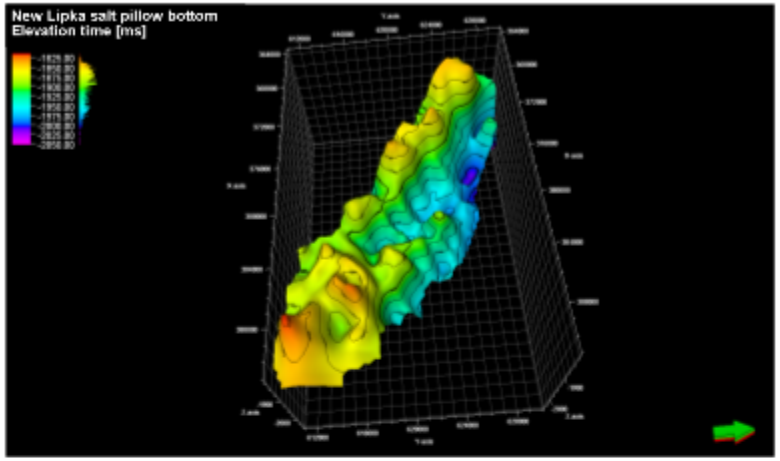
Spatial model of a potential salt pillow in the Złotów area



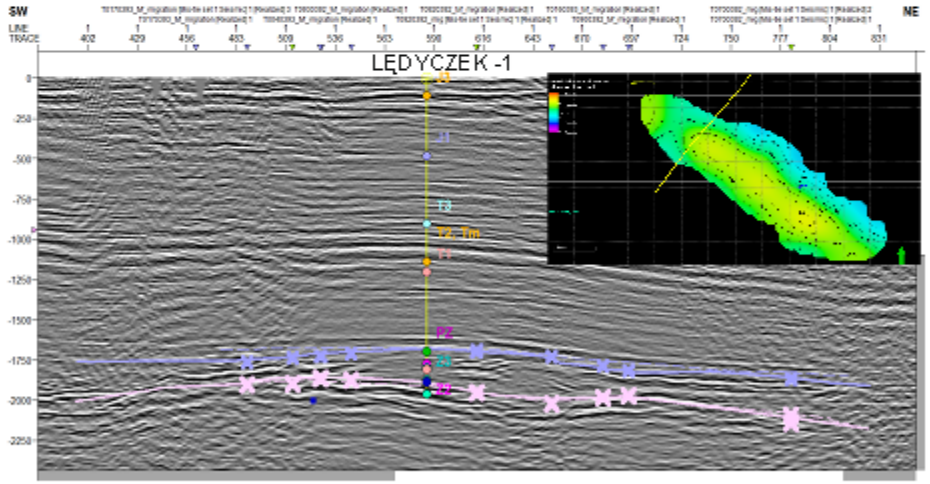
Map of salt structures with potential new Lipka salt pillow (Dadlez & Marek 1998; Czapowski, 2024)-modified



Map of the top of the potential new Lipka salt pillow in 3D



Map of the bottom of the potential new Lipka salt pillow in 3D



Seismic section (migrated in the time domain) across NW part of potential new Lipka salt pillow

The depth of the top of this pillow can be set based on the horizons interpreted from seismic data at values from approximately -1700 [ms] to approximately -1750 [ms], while the depth of the bottom of this pillow can be set at values from approximately -1900 [ms] and approximately -2000 [ms].

The newly identified potential salt pillow is estimated to be located at a depth of approximately 2,900 to 3,700 meters.

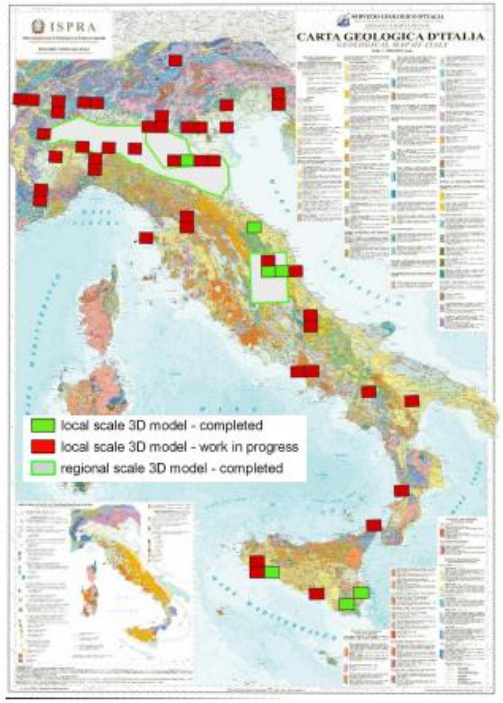
Polish Geological Institute
National Research Institute

pgi.gov.pl

Sfinansowano ze środków
NARODOWEGO FUNDUSZU
OCHRONY ŚRODOWISKA
i GOSPODARKI WODNEJ

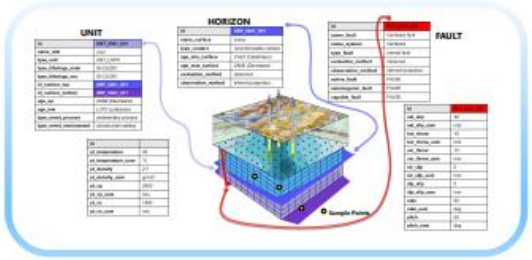
Strategies for Enhancing Communication and Visualization of 3D Geological Models adopted at the Servizio Geologico d'Italia

Patrizio Petricca, C. D'Ambrogi, M.P. Congi, L. Tomassetti, E. Roccatello, G. Castorina, F. Clemente

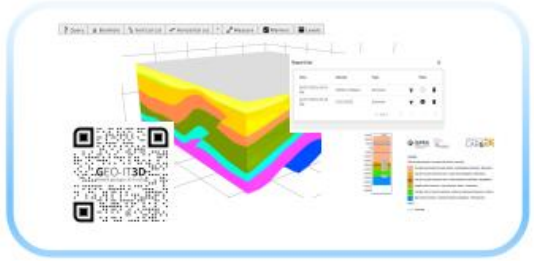


The Servizio Geologico d'Italia (SGI) supported by the Next Generation EU project GeoSciences IR, is working to enhance the accessibility, understanding, and diffusion of 3D geological models. Effective communication of 3D models requires an integrated approach that combines the collection of the models, their interactive visualization, and the production of communication resources to significantly improve their diffusion to a wide range of stakeholders, including researchers, government agencies, professionals, but also to non-experts.

DATA STRUCTURE



DATA VISUALIZATION



DATA DIFFUSION

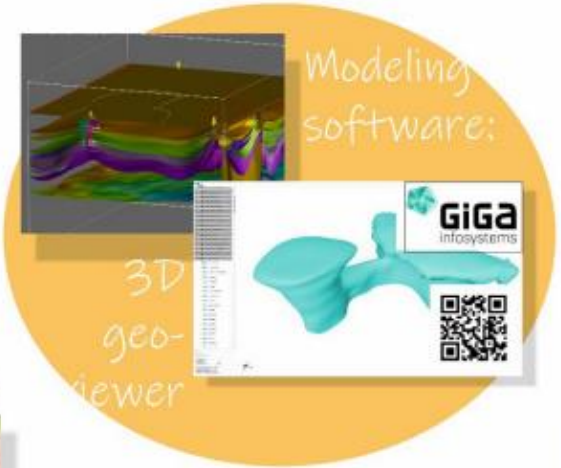
DATA COMMUNICATION

7TH EUROPEAN MEETING ON 3D GEOLOGICAL MODELLING
"New frontiers and challenges in geomodelling"
Warsaw 8-11 April 2025

Utilizing Modern 3D Visualization Techniques for Communicating Geological Models

Heidrun L. Stück, Stephan Steuer
Federal Institute for Geosciences and Natural Resources

Virtual Reality

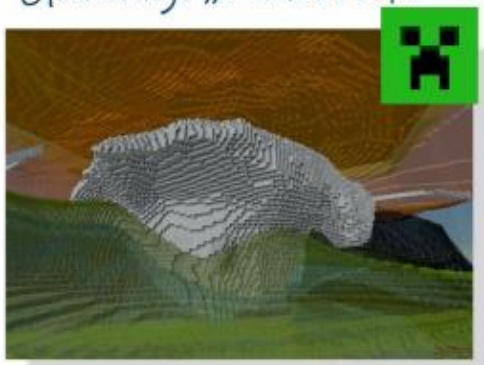


3D-Projector ....with shutter glasses

Augumented Reality

A geological 3D model of a salt diapir from the German North Sea, created as augmented reality. We developed our models using the giga-systems software. The app and our models stored there are

Gaming: „Minecraft"



The currently available 3D models in Minecraft were created for three selected salt domes from the 'Geopotential German North Sea' project (www.gpdn.de)

- Current public outreach status
- Best practices, advantages, and challenges
- On-site Demonstrations:
  - Augmented Reality
  - Virtual Reality
  - Minecraft

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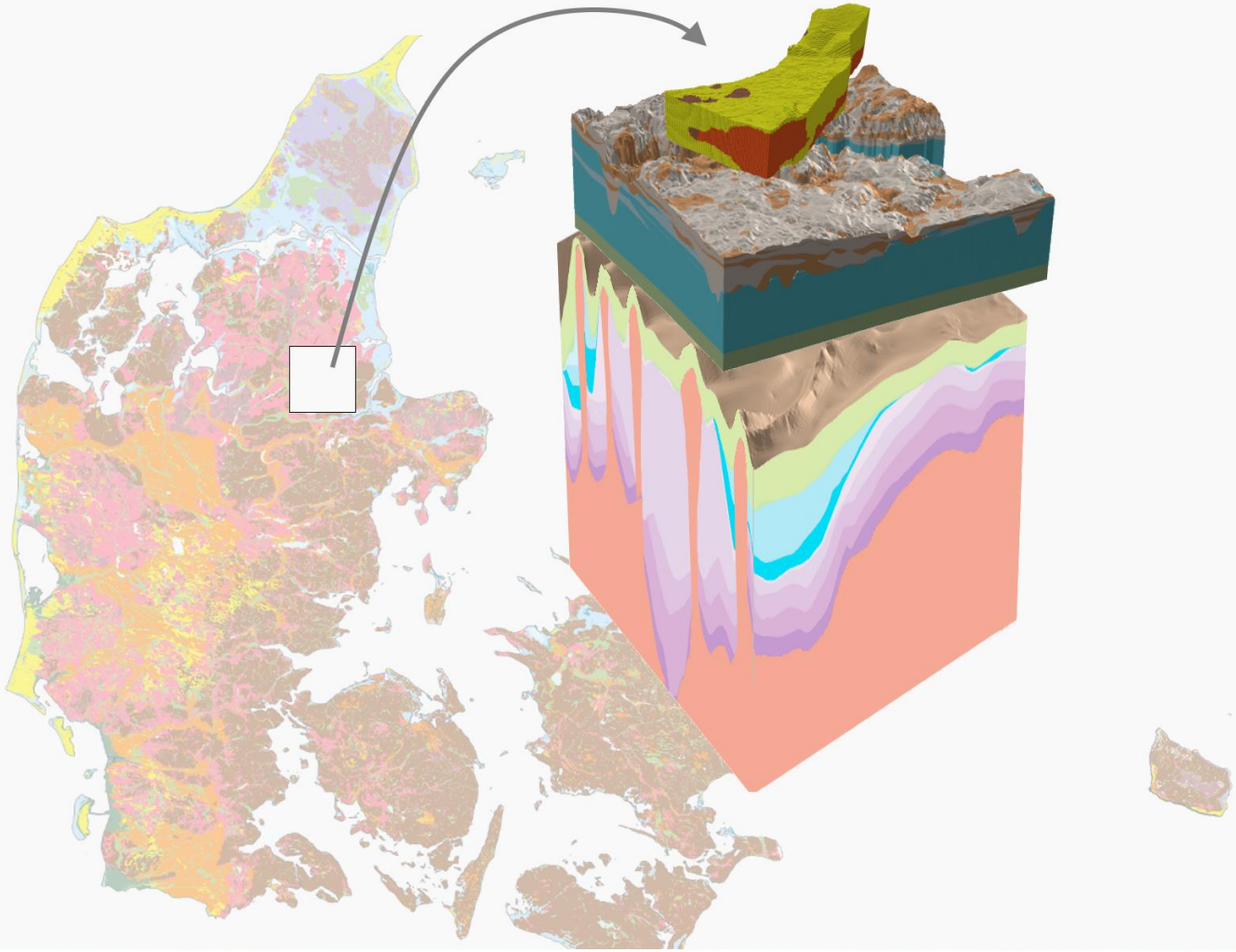
Warsaw

Cookie-cutting 3D Geological Models

Marianne B. WIESE

How to harmonize and/or combine
3D geological models of different scale and purpose ?



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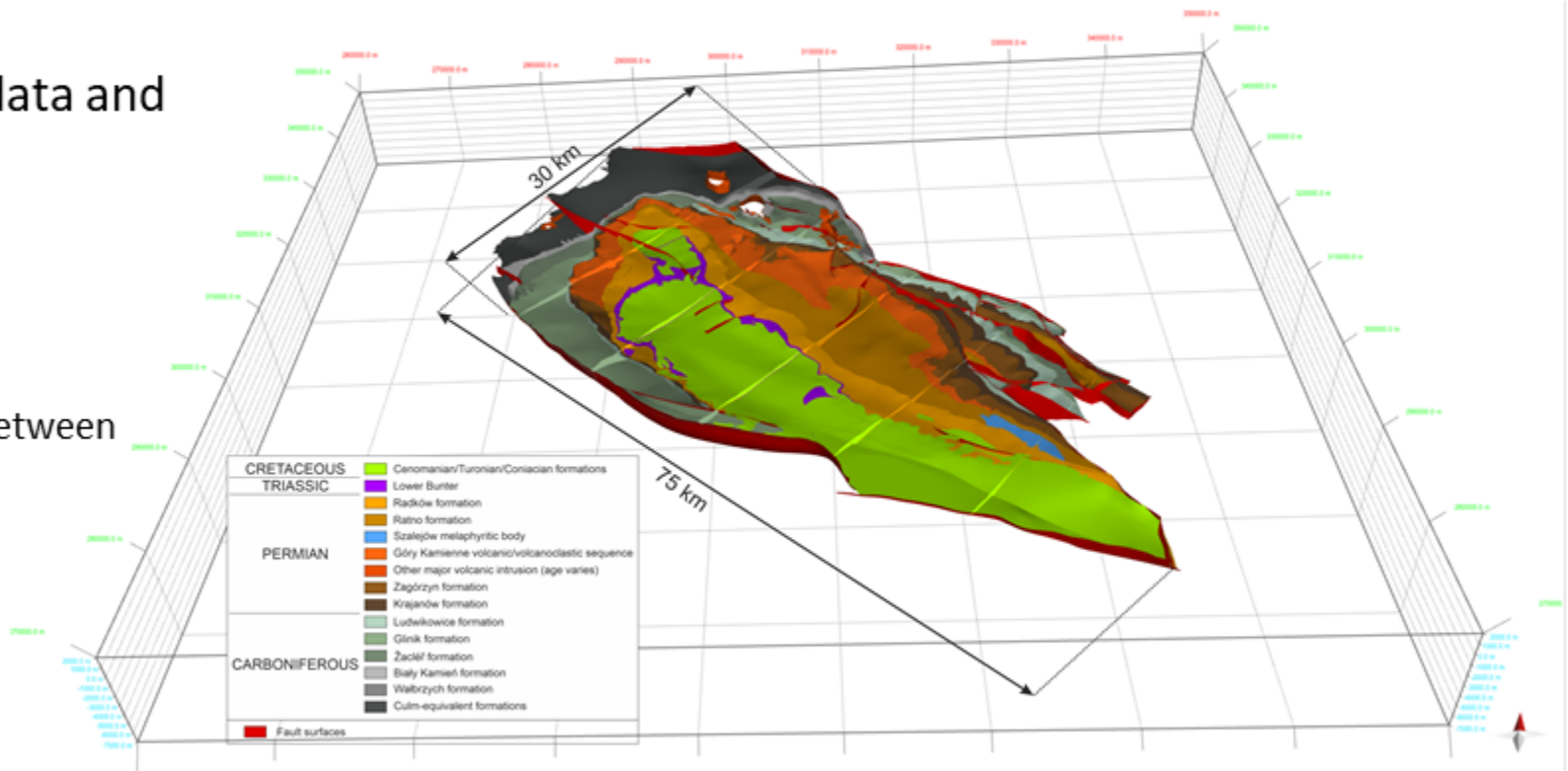
3D model of Intrasudetic Synclinorium(SW Poland) for use in geothermal prospecting and modelling

- 3D structural model in Petex Move
- Part of the *Geothermal Atlas of the Sudetes and Their Foreland* project
- Based primarily on archival borehole data and serial geological maps
- Model is supposed to help with determining the geothermal potential of the area by:
  - Estimation of the depth of boundary between sediments and crystalline basement
  - Estimation of thickness of individual lithostratigraphic units with differing thermal properties
  - Assist in design and interpretation of surveys
  - Estabilishing an unified fault framework
  - Serving as a domain for FEM numerical modelling



3D oblique view of the horizon and fault surfaces, along selected cross-sections, of the Intra-Sudetic Basin structural model

CENTRUM MODELOWANIA PROCESÓW GEOLOGICZNYCH

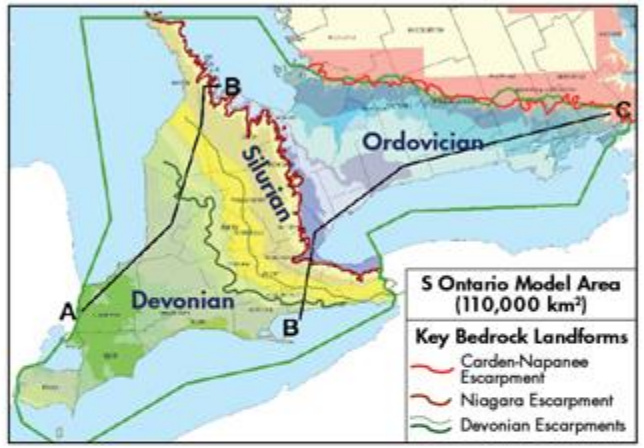
Państwowy Instytut Geologiczny - Państwowy Instytut Badawczy

Web-based 3D geological model viewers for open viewing accessibility: Case study for southern Ontario, Canada

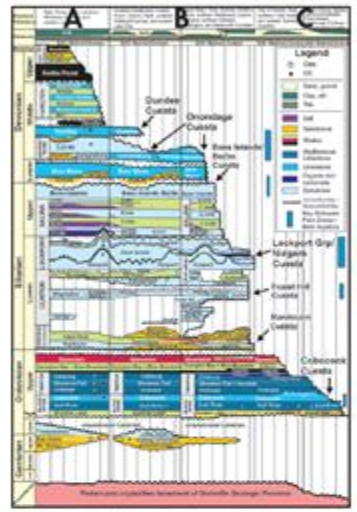
Małolepszy Z., Hillier, M., Clark, J., Logan, C.E., Ponchio, F., Szrek, D., and Russell, H.A.J

OGSR Library

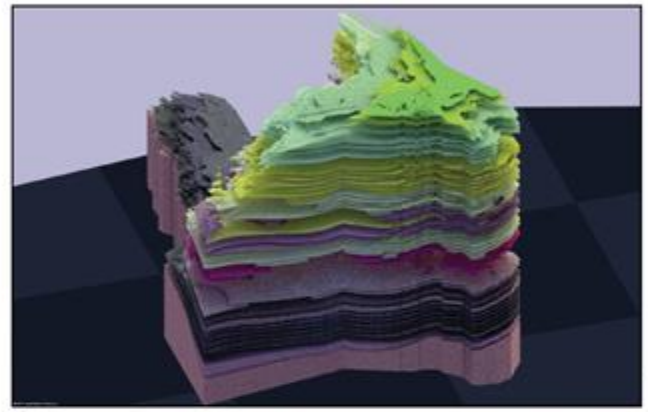
Location Great Lakes Basin



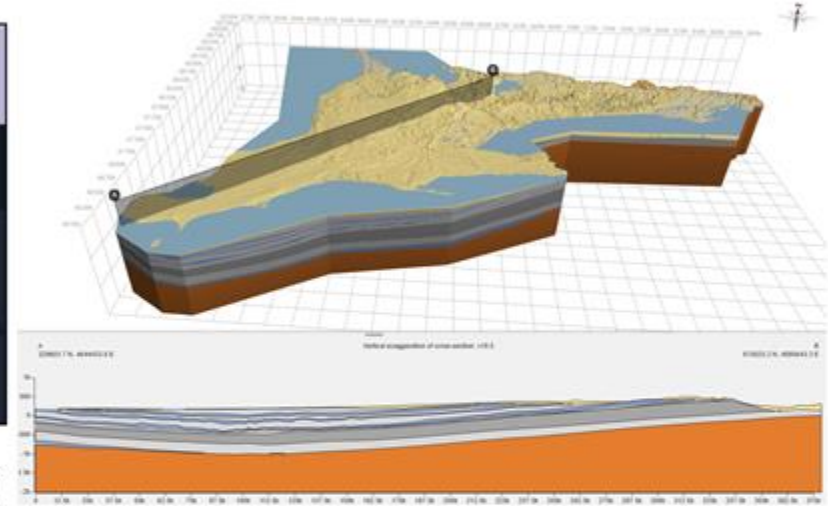
Ordovician to Devonian Outcrop



Lithostratigraphy

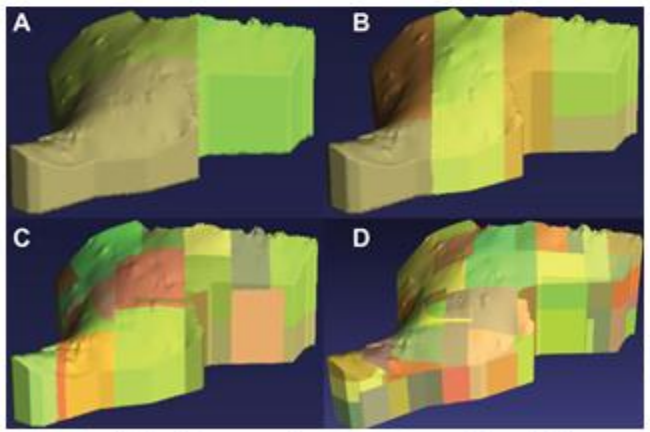


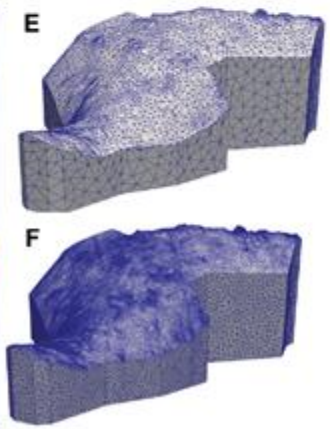
Complete 54 layer lithostratigraphic model viewed from the west over Lake Huron



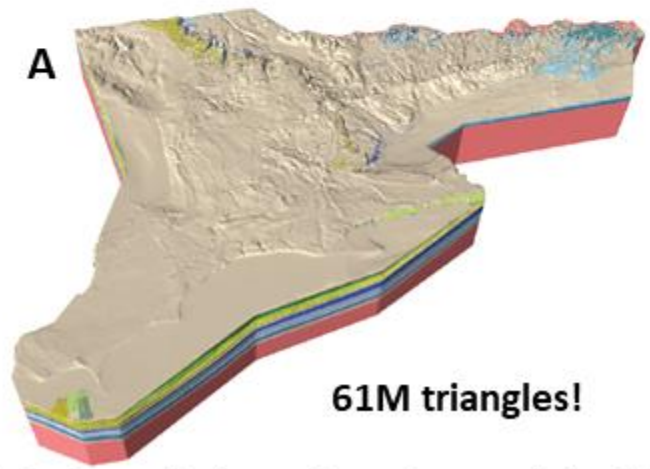
Geo3D web visualisation

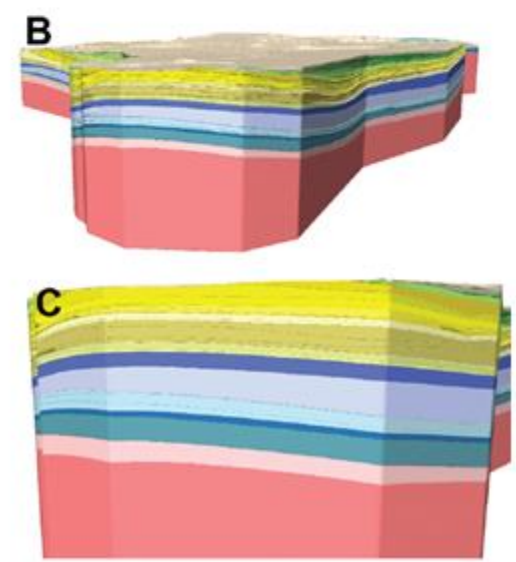
https://geo3d.pgi.gov.pl/Ontario/index.html





Multiresolution method for web-based streaming of large-scale 3D geological models.



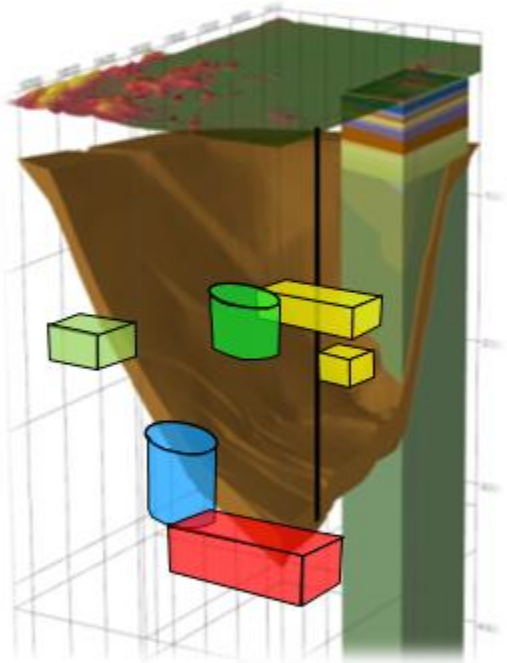


Web-based streaming of complete 3D geological model of southern Ontario.

3D modelling for subsurface policy needs

- 4 challenges for 3D modelling to strengthen subsurface management policy

1. Flexible visualisation for subsurface management



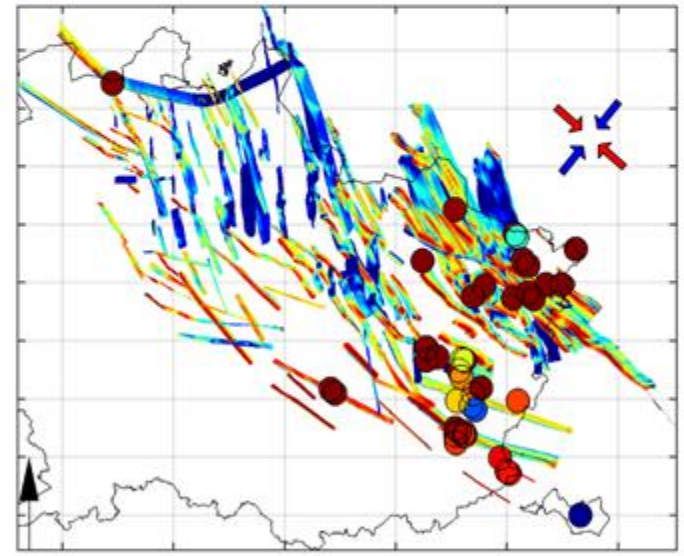
2. Data heterogeneity and model updates

Altough the local detail (e.g. from 3D cubes) cannot be integrated in the regional model, the tectonic style& concepts recognized in the detailed data helps deciding on regional structures

3. Derisking appraisal in blind zones

Explore seismic attributes (e.g. AVO) to predict reservoir potential → parametrized models for layers with low data density

4. Fault models and hazard analysis



tectonic style + assumptions made in fault model determine largely the outcome of for example geomechanical modelling

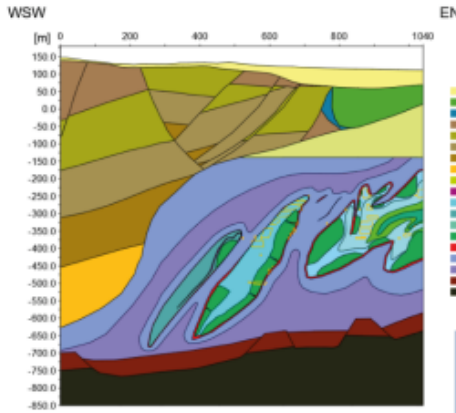
Vlaanderen
is omgeving

VLAKO Vlaams Kenniscentrum Ondergrond

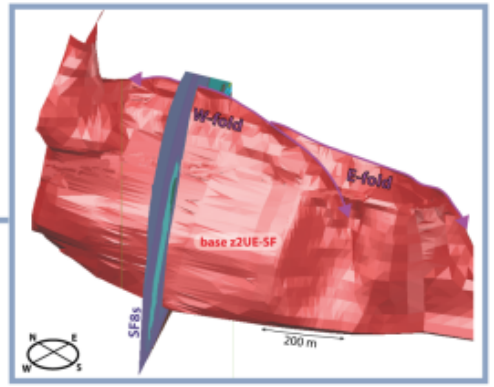
A 3D Geological Model of the Morsleben repository in Germany:
Modelling complex intra-salt deformation

Manuela C. Stehle[1]*, Christian Dresbach[1], Joachim Behlau[1]
[1]Federal Institute for Geosciences and Natural Resources (BGR), Stilleweg 2, 30655 Hanover, Germany
**manuela.stehle@bgr.de*

- Low-/medium-level radioactive waste
- **Decommission planned**:
  - ➢ 3D geological model needed
- Software: **AutoCAD based openGeo** (Bicad)
- Challenges:
  - ➢ **Complex folding** within salt body
  - ➢ **Brittle deformation of anhydrite**



Modified after Stehle *et al.* 2023.
Overburden from Fleig *et al.* 2023.



Modified after Stehle *et al.* 2023.

cooperation partner:

BGE BUNDESGESELLSCHAFT FÜR ENDLAGERUNG

09.04.2025

Evaluation of anthropogenic transformation of urbanized areas based on archival topographic maps and its impact on modeling of geological structure

Adam Popławski
Aneta Horbowicz
Szymon Zaryba
Katarzyna Borkiewska

Stage I

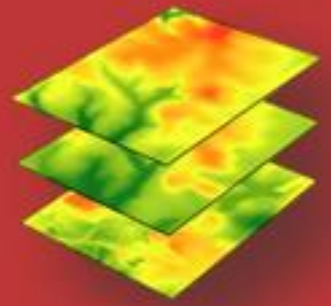
Data Collection

- selecting study area
- collection of topographic archival maps from the years 1883 and 1958
- georeferencing and digitalizing contour lines
- adding boreholes from Engineering Geological Database (BDGI)

Stage II

2D Analysis

- visualizing Digital Elevation Model (DEM)
- creating and visualizing Archival Digital Elevation Models (ADEM)
- calculating the DEM of difference (DoD)
- establishing the cross-sectional lines
- comparison of geomorphon maps from years: 2024, 1958 and 1883



Stage III

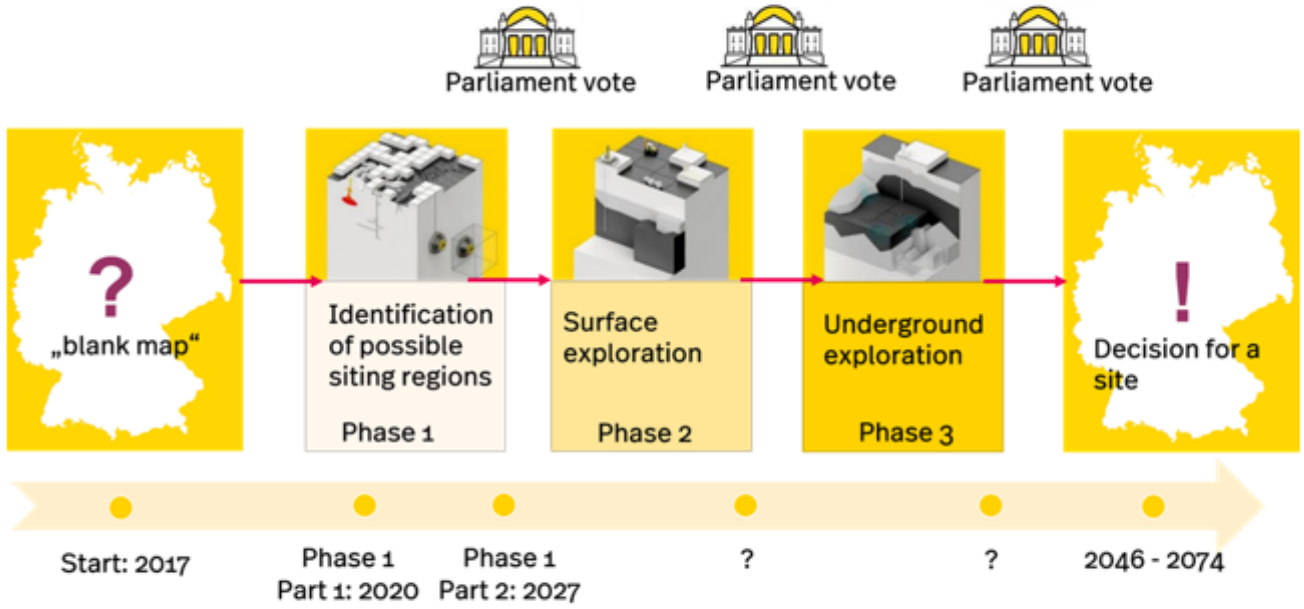
3D Analysis

- representing borehole data in 3D scene
- creating voxel 3D ground model
- comparison of cross-sections of 3D model to the old morphology lines
- discussing the importance of using archival maps in building 3D ground models

Uncertainties in Geological 3D-Models: A Challenge in the Search for a Repository for HLW Disposal in Germany

Bundesamt für die Sicherheit der nuklearen Entsorgung

The 3 phases of the site selection procedure



We would like to discuss:

Types of Uncertainties and *Methods to identify them*

- Aleatoric uncertainties
- Epistemic uncertainties

Further Questions:

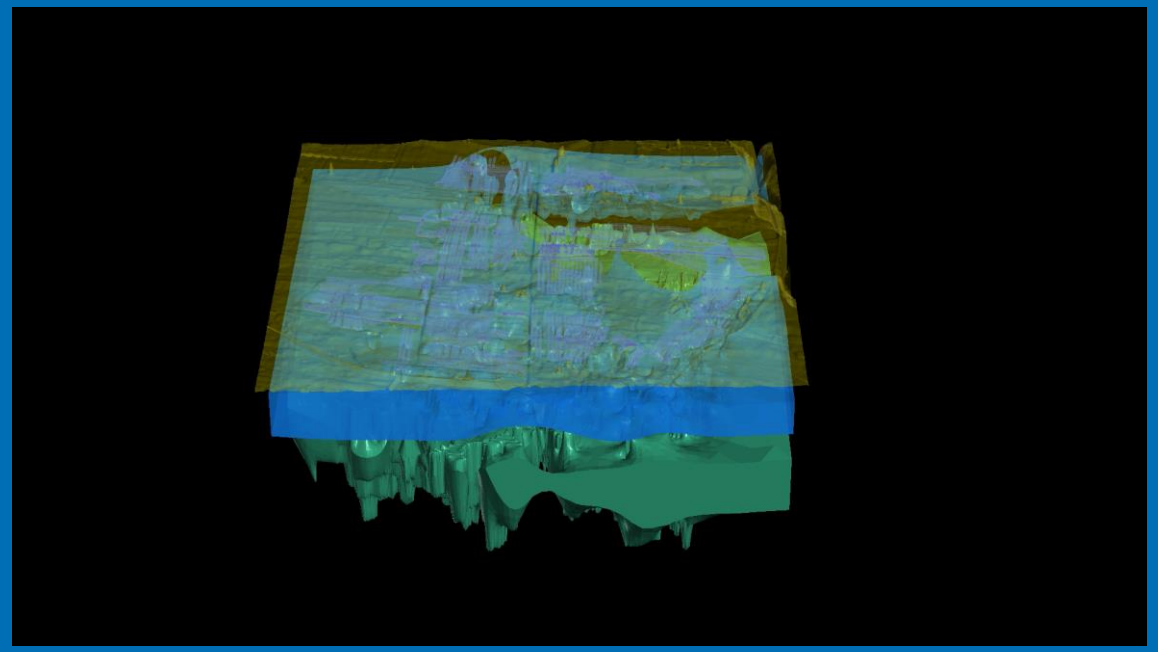
- How many data are enough?
- How to visualize and communicate uncertainties for the public?
- Which methods for verifying uncertainties in 3D models are already in use?
- Is it possible to derive a degree of certainty?
- What role could AI play in identifying, assessing, and reducing aleatoric and epistemic uncertainties?

Dr. Ute Maurer-Rurack, Maik Schilling, BASE, Berlin, Germany

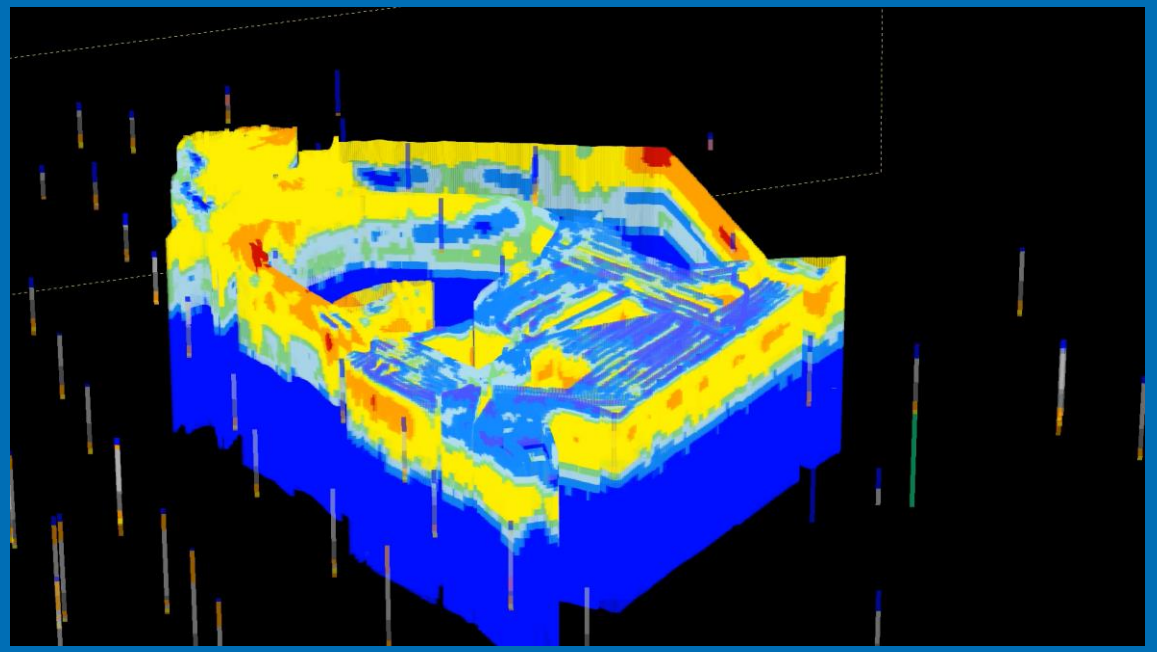
Eesti Geoloogiateenistus

Testing tTEM capabilities for geological mapping in Estonia

Pärnu area



Kunda area



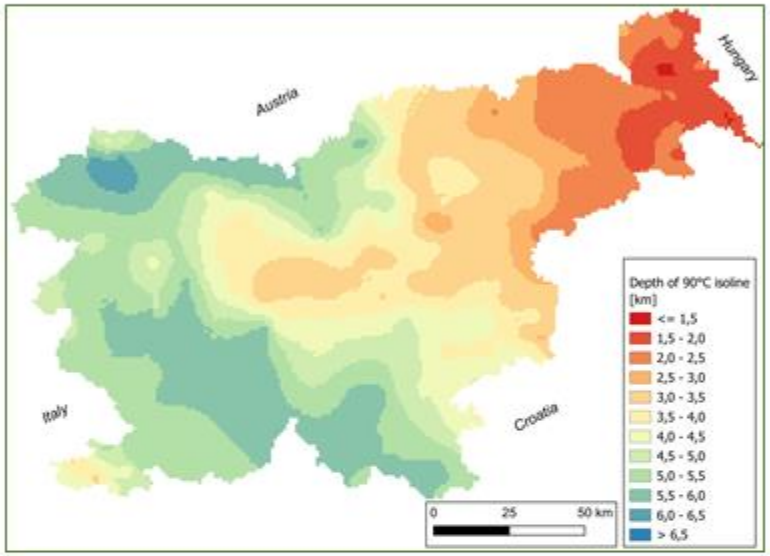
Tavo Ani

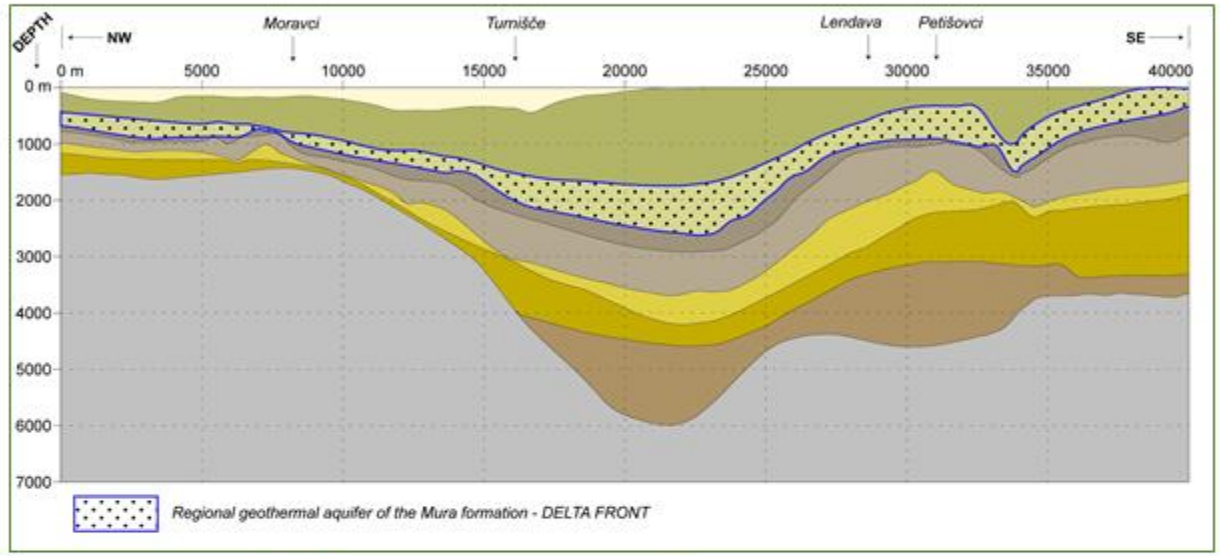
Warsaw, 09.04.2025

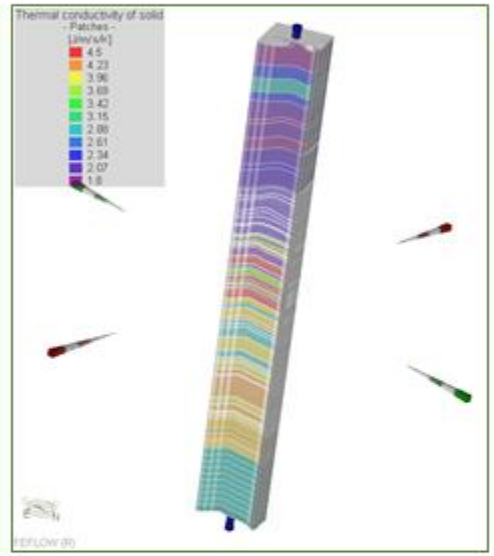
Challenges of 3D geological and geothermal models of the northeastern Slovenia (Pannonian Basin)

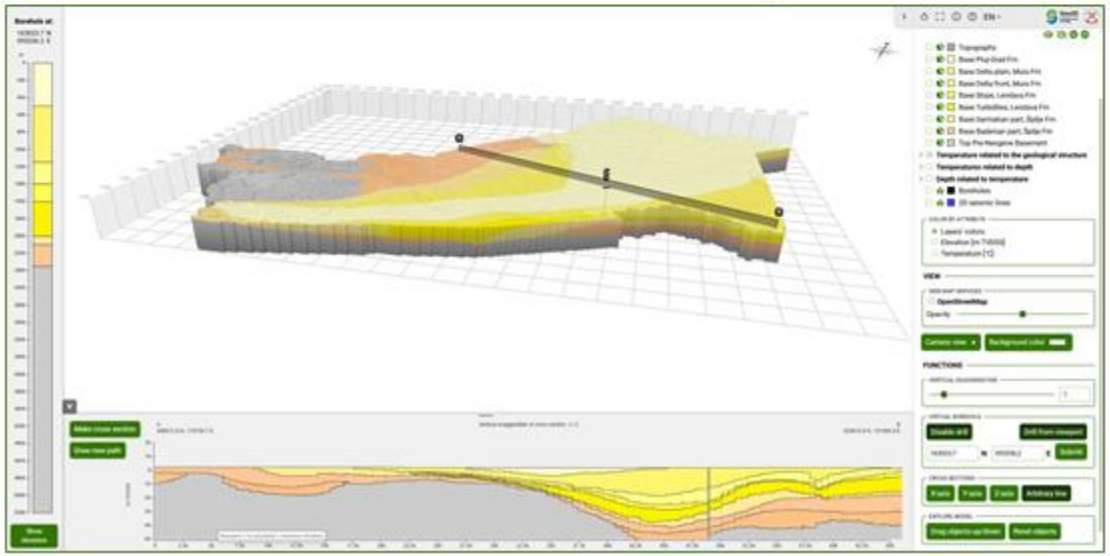
David GERČAR, Simona ADRINEK, Andrej LAPANJE, Dušan RAJVER, Jure ATANACKOV, Nina RMAN

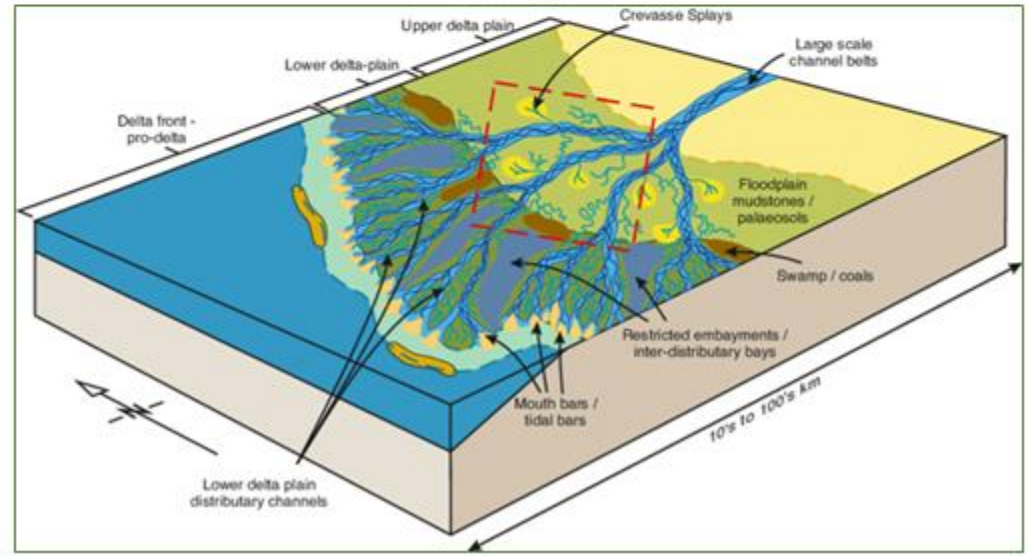
GeoZS
Geološki zavod Slovenije











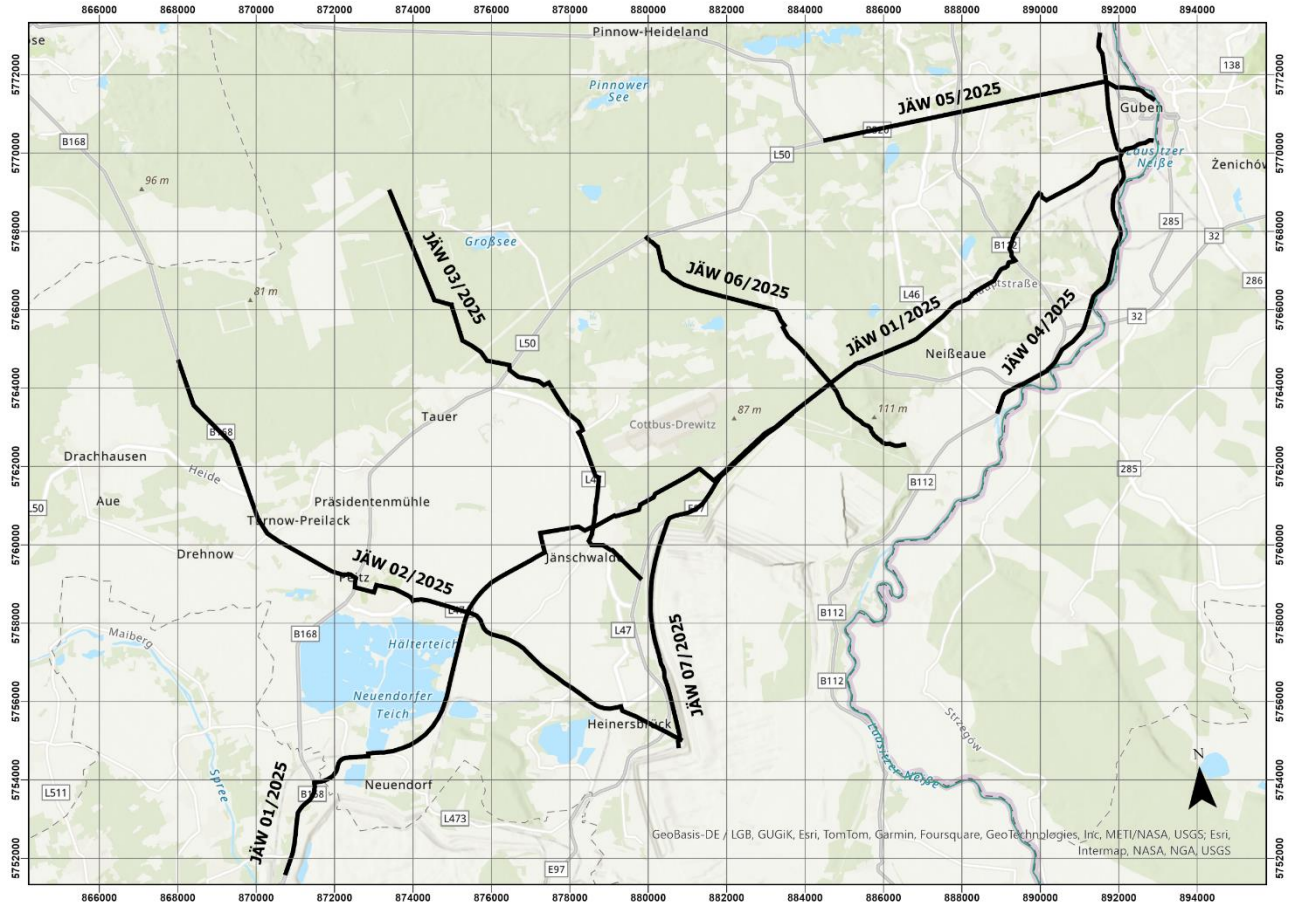
Enhancing 3D geological models: Regional geological mapping with a planned 2D seismic survey in Brandenburg

- About 100 km new state-funded 2D seismics
- Data acquisition in late 2025

→ Targeting fault zones

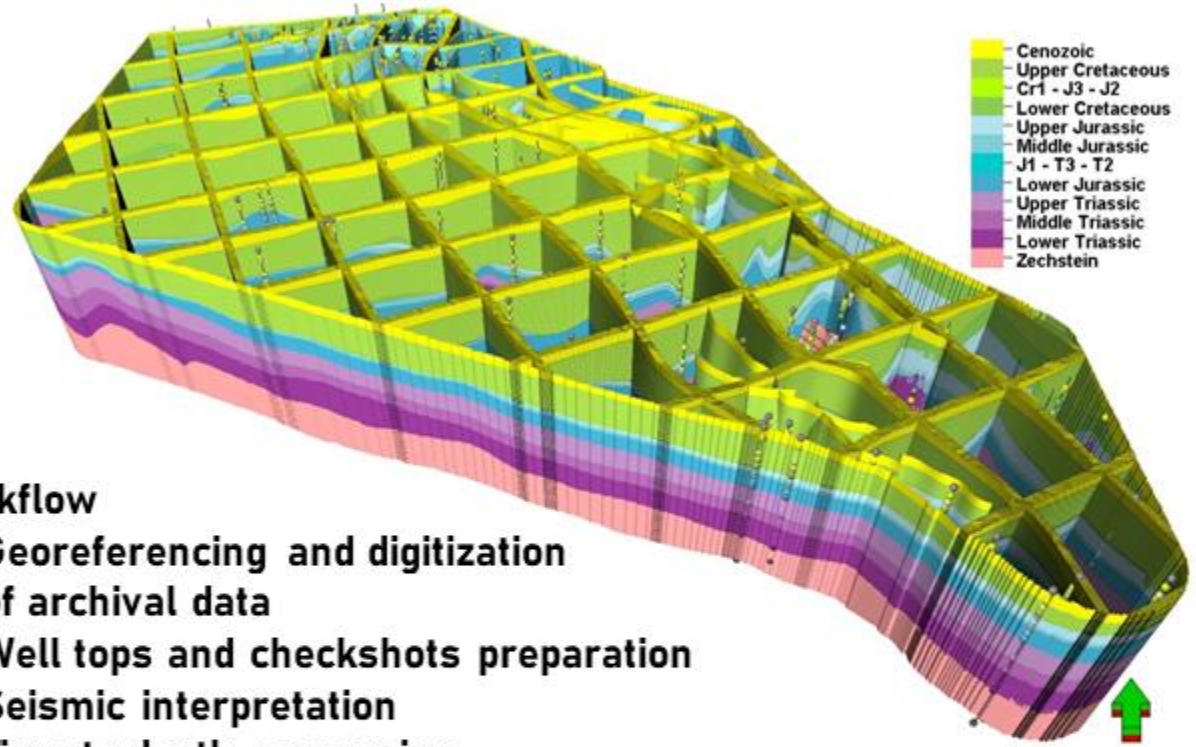
→ Rotliegend (maybe basement?)

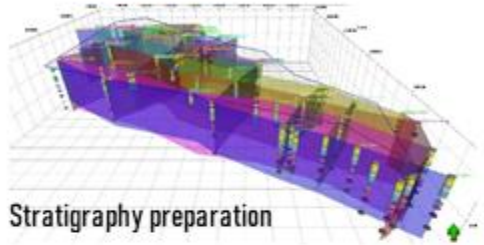
→ Insights for geothermal applications

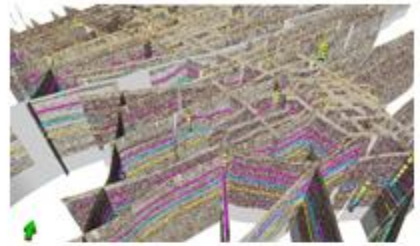


Regional structural models – challenges and limitations. An example from Szczecin Trough (NW Poland)

Michał MICHNA, Marta TOMASZCZYK, Łukasz NOWACKI, Łukasz SMAJDOR and Ewa SZYNKARUK
Polish Geological Institute – National Research Institute




Stratigraphy preparation

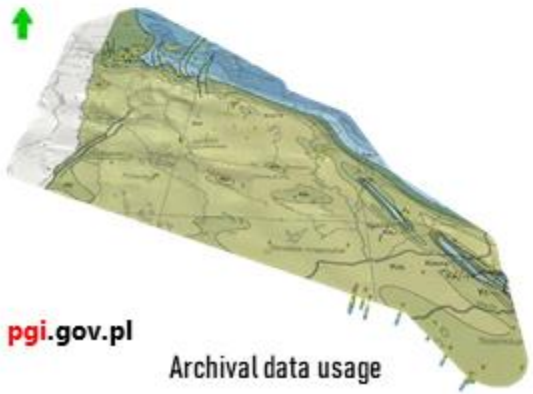

Seismic interpretation

Workflow

- Georeferencing and digitization of archival data
- Well tops and checkshots preparation
- Seismic interpretation
- Time to depth conversion
- Legacy models incorporation
- Structural surface building
- Fault framework modeling
- 3D gridding

Challenges and limitations

- Inconsistent borehole coordinates
- Mismatched coordinate systems
- Divergent stratigraphic nomenclature
- Incomplete or outdated seismic data
- Mixed time and depth domain data
- Limited access to recent interpretations
- Integration of legacy models


Archival data usage


Process automatization

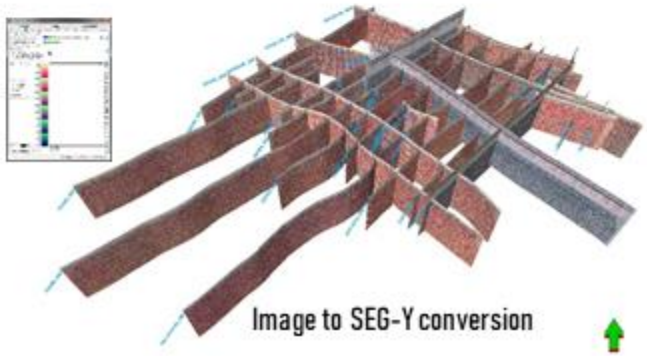


Image to SEG-Y conversion

Państwowy Instytut Geologiczny
Państwowy Instytut Badawczy
państwowa służba geologiczna
pgi.gov.pl

Fundación Carolina

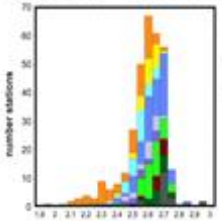
Harmonization of 3D models in poor exploratory scenarios based on the integration of geological, gravimetric, petrophysical and seismic data; a case study in the Pyrenees

Toro, R.[1,2]; Izquierdo-Llavall, E.[2,3]; Casas, A.M.[1,2]; Rubio, F.M.[3]; Ayala, C.[4]; Martin-Leon, J.[3]; Clariana, P.[2,3]; Soto, R.[2,3]; Santolaria, P.[5]; Mochales, T.[2,3]; Rey-Moral, C.[3]; Navas, J.[3]; Pueyo, E.L. [2,3] (*) and the 3DGeoEU WP6 Team

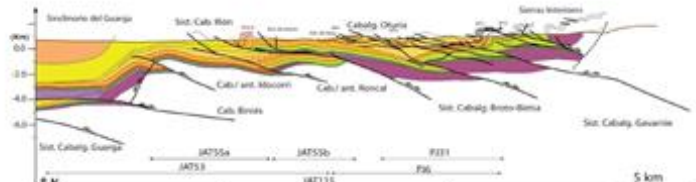
Rosibeth Toro

Vintage Seismics

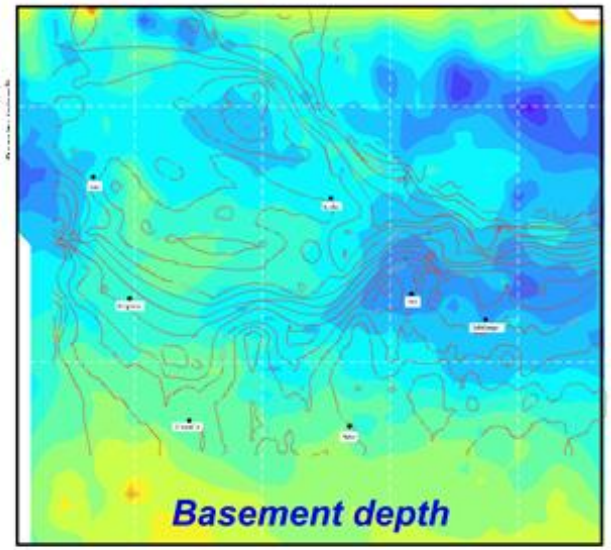
Gravimetry & petrophysics

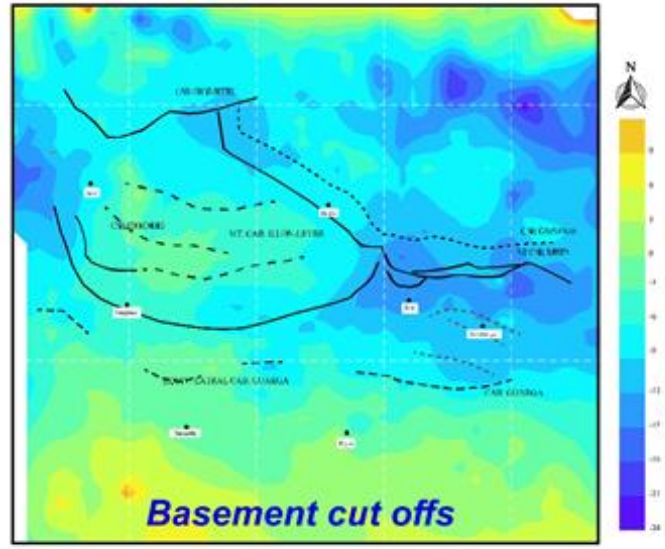


Gravimetry, petrophysics, vintage seismics and balanced sections; What else?



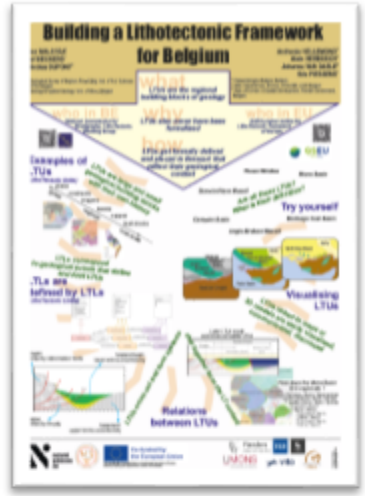
Hecho





Building a Lithotectonic Framework for Belgium

Jan WALSTRA (1), Jef DECKERS (2), Nicolas DUPONT (3), Anthonie HELLEMOND (4), Alain HERBOSCH (5), Johanna VAN DAELE (6) and Kris PIESSENS (1)



Lithotectonic units (LTUs)

- building blocks of regional geology, each with distinct history
- effective concept for organising geological information
- often ill-defined or conflicting interpretations

The lithotectonic framework approach

- LTUs defined and bounded by limits in time and space
- organised in standardised data models and vocabularies
- linked to maps or 3D models for visualisation and communication

7th European Meeting on 3D Geological Modelling

Warsaw, Poland

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