A 3D geological model is a stratigraphic framework that delineates geological boundaries in three-dimensions. Expertise in building and delivering geological models is world-leading within Europe. This expertise is mostly concentrated within geological surveys such as the surveys of the Netherlands, Denmark and Greenland, Britain and France, but there is also significant expertise in some universities such as Freiberg and Bonn in Germany and Nancy in France. The leaders in geological modelling within Europe are well-connected and meet biannually to compare methodologies and best practice. Whilst well-connected and aware of each other’s activities, the approaches to geological modelling and delivery of geological models are highly diverse. This is a result of numerous factors for example, the geology of each country, the type and availability of geological data that underpins models, historical use of modelling systems, modelling expertise, governance and in one case, even legislation. The diversity means that geological modelling is performed using numerous systems and approaches that are very different. These approaches are described by Berg et al (2011) and can be briefly described as:

- **Cross-section approach (GSI3D).** This approach uses interpreted boreholes and maps, images, point data and digital terrain models to iteratively construct cross-sections and areal unit extents, akin to traditional methods of geological mapping. Surfaces are generated between manually digitised points.
- **Surface interpolation approach (Gocad, Isatis and Move).** Borehole, geophysical and surface observational data are interpreted stratigraphically to create picks that define geological boundaries. Surfaces are generated via interpolation between picks of identical stratigraphic coding using proprietary software algorithms.
- **Statistical modelling approach.** Geological models are generated by stochastically analysing geological data to predict the properties between data, e.g. borehole data. Typically, the output is a 3D grid. Petrel, SKUA, Isatis and Gocad all have capabilities to generate statistical geological models.
- **Hybrid approaches.** Many geological surveys use a combination of approaches and software tool in conjunction. GEUS (who are using GeoScene3D) are investigating ‘manual voxel modelling’ where a statistically generated models can be iterated by Geologists (Jørgensen et al. 2013).

In most Geological Survey Organisations some combination of these methods will be used during a project and many use middleware such as FME ([http://www.safe.com/fme/fme-technology/](http://www.safe.com/fme/fme-technology/)) is deployed to transfer datasets between software systems.

This Work Package explores the technical requirements necessary for delivering geological models in Europe. It considers the developments ongoing across Europe and considers how these could be developed and/or standardised to provide European-wide solutions.
The drivers for developing methodologies and standards to share 3D geological model data across Europe are the same as those for sharing geological map data (D3.2, D3.3). These drivers include facilitating the ability to make environmental decisions that have implications across national boundaries. Examples include:

- Disaster planning
- Minerals planning
- Flood risk
- Geological hazard assessment
- Aquifer management

As part of this Task, a survey was distributed to all European geological surveys. The survey was distributed at EGDI meetings and via the EuroGeoSurveys magazine and direct mailing lists. A total of 22 organisations responded, which included the majority of organisations with significant active 3D modelling projects. A further 23 surveys did not respond. Throughout this document the results of this survey are reported.

Table 1  Organisations who contributed to the statistics in this Work Package*

Organisations
Federal Institute for Geosciences and Natural Resources (BGR)
Geological Survey of Austria
Geological Survey of Slovenia
Geological Survey of Denmark and Greenland
Geological Survey of Ireland
Geological Survey of Finland
Geological Survey of the Netherlands
State Geological Institute of Dionýz Stúr (Slovakia)
Geological Survey of Norway
Geological Survey Baden-Württemberg
State Authority for Mining, Energy and Geology, Geological Survey of Lower Saxony (LBEG)
Polish Geological Institute — National Research Institute
Thuringian State Institute for Environment and Geology
Federal Office of Topography — Swiss Geological Survey
Hessisches Landesamt für Umwelt und Geologie (HLUG) (Hessian Agency for Environment and Geology)
Saxon State Office for Environment, Agriculture and Geology
Geologisches Landesamt Hamburg
Geological Survey of Bremen
Bavarian Environment Agency — Geological Survey
Geologischer Dienst NRW
Czech Geological Survey
British Geological Survey

* several German states responded independently

The options for the delivery of geological models varies greatly from static printed maps and sections to interactive stand-alone viewers and web-based systems, Chapter 5 examines all options for model delivery in detail and gives real examples from Geological Survey Organisations across
Europe.

References


Category:
- OR/14/072 Scoping study for a Pan-European geological data infrastructure: D 3.4: technical requirements for serving 3D geological models

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