

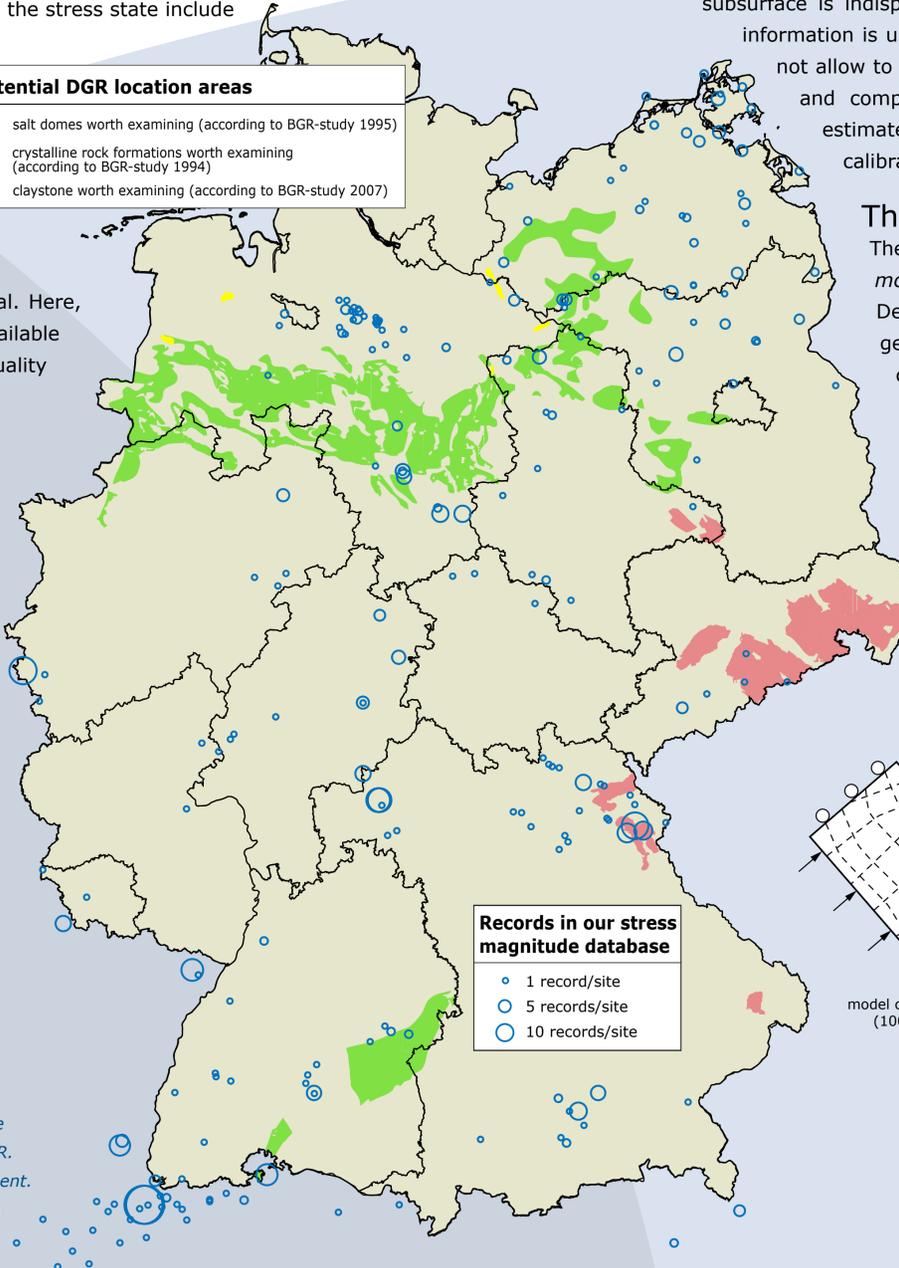
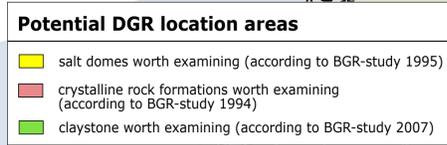
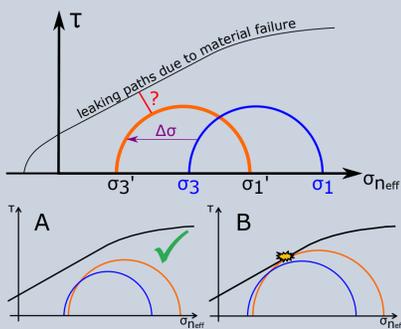
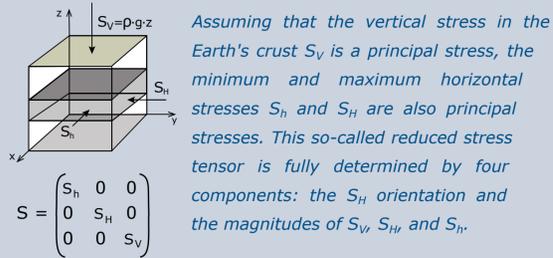
Data-Driven Geomechanics for Nuclear Waste Disposal

In Search of a Deep Geological Repository for Germany

The crustal stress field plays a central role in the characterization of a deep geological repository (DGR) for nuclear waste. Factors influenced by the stress state include

- the excavation damage zone,
- hydraulic permeability of the host rock,
- the self-sealing ability,
- the impact of seismic events, or
- the potential reactivation of faults as migration paths for fluids and radionuclides.

With the World Stress Map (WSM), there is already a database of stress orientations, but to assess the underground stability stress magnitude data are essential. Here, we present the first comprehensive and publicly available stress magnitude database for Germany including 567 quality ranked data records.



The Role of Geomechanical-Numerical Modelling

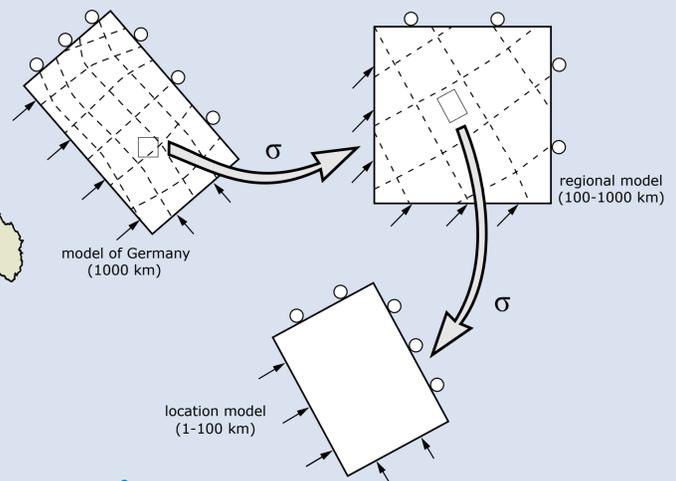
In the assessment of potential DGR sites, the estimation of stress in the upper subsurface is indispensable. However, the available point-wise stress data information is usually incomplete, since most of the stress indicators do not allow to derive the complete 3D stress tensor. Thus a continuous and complete description of the 3D stress state can only be estimated using a 3D geomechanical-numerical model that is calibrated using existing stress information.

The Project

The main goal of the project "SpannEnD" (*Spannungsmodell Endlagerung Deutschland, Stress Model Final Deposition Germany*) is the development of a 3D geomechanical-numerical model for Germany. The compiled magnitude data are the precondition for a meaningful model calibration.

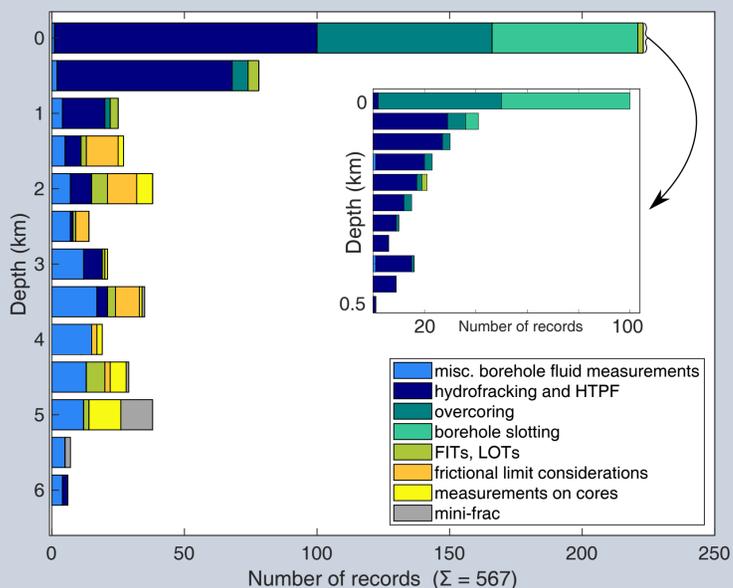
Multi-stage Approach

Yet, due to the general low stress data density, a model calibration on the scale of a DGR model is not feasible. The large-scale model will therefore provide initial stress conditions for regional and local models in a later stage of the DGR site selection process. The large-scale model will in turn be calibrated with available stress data.

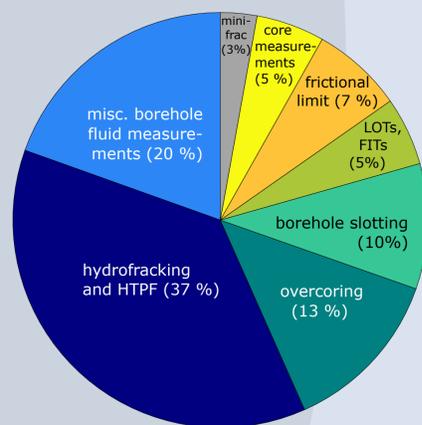


Current State of the Stress Magnitude Database for Germany

Data Distribution with Depth

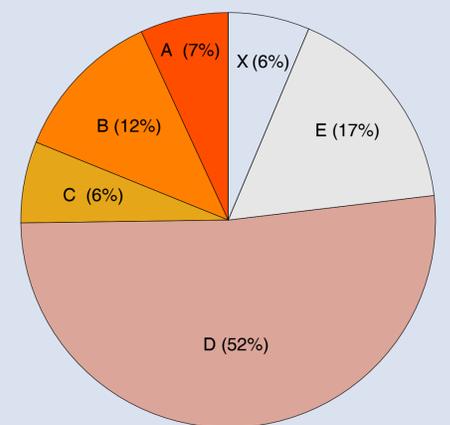


Stress Magnitude Indicators



Abbreviations:
LOT - leak-off test; FIT - formation integrity test;
HTPF - hydraulic testing of pre-existing fractures;
BO - borehole breakouts; DIF - drilling induced fractures

Quality Assignment



Quality rank depending on both stress magnitude indicator and quality of referenced data source. decreasing quality from A to E; E - lowest quality or no indicator information; X - no access to reference.