



Geomechanical challenges of geothermal projects in the Molasse basin – practical insights from Stadtwerke München

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Open questions from geothermal development in the Molasse basin

- 1 Overview of geomechanical challenges for SWM
- 2 Is induced seismicity triggered in the Malm or in the crystalline basement?
- 3 Is induced seismicity triggered at faults?
- 4 Is the Malm reservoir critically stressed?
- 5 How big is the uncertainty from interpreter bias and fault interpolation algorithms?



What are the geomechanical challenges during project development and operation?

- We want to minimize risks and operate our projects safely
- Multi-well projects in the vicinity of small and big faults in an urban environment
- Risk assessment using:
 - GRID-analysis
 - Static geomechanical analysis of the reservoir (slip tendency)
 - Dynamic geomechanical analysis of the reservoir (THM-simulation)
- Geomechanical optimization is challenging and increases e.g. drilling risks due to longer trajectories
 - Trajectory optimization is a multi-objective problem with conflicting objects



Example for a trajectory optimization

Initial planning

TD: 3741 m MD 900 m vertical section on top reservoir



After geomechanical optimization TD: 4367 m MD 200 m vertical section on top reservoir





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- Geomechanical optimization is challenging and increases e.g. drilling risks due to longer trajectories
 - Trajectory optimization is a multi-objective problem with conflicting objects
- When do we start with reservoir management?



Is induced seismicity triggered in the Malm or in the crystalline Basement?

- What are the controlling mechanisms and what are the implications on risk assessment?
 - Overburden dampening is higher if events occur in the crystalline
 - Is a risk assessment of faults in the reservoir the right approach?



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Is induced seismicity triggered at faults?

- Only few operational sites with seismic events (predominantly very low to low magnitudes << 1.0)
- Most events occur near the trajectories of cold-water injection wells
- Not necessarily in the vicinity of known faults



Is the Malm reservoir critically stressed?





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How big is the uncertainty from interpreter bias and fault interpolation algorithms?

- Manual interpretation of faults is influenced by individual bias \rightarrow uncertainties
 - Smaller structures may be overlooked
- Interpolation of fault surfaces depends on chosen method \rightarrow uncertainties







Thank you for your attention!