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# Stress heterogeneity above and within a deep geothermal reservoir: From borehole observations to geomechanical modelling

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Overpressured reservoir conditions, local stress concentrations or a locally rotated stress field can initiate substantial problems during drilling or reservoir exploitation. Increasing geothermal utilization in the Molasse basin area in S-Germany is faced with such problems of deeply seated reservoir sections. In several wells, radial fluid flow systems are interpreted as highly porous layers. However, in nearby wells a combination of linear fluid flow, local stress heterogeneities and structural geology hint to a rather fault dominated reservoir (Seithel et al. 2015). Due to missing knowledge of the stress magnitude, stress orientation and their coupling to reservoir response, we will present a THMC model of critical formations and the geothermal reservoir targeting nearby faults. In an area south of Munich, where several geothermal wells are constructed, such wells are interpreted and integrated into a 30 x 30 km simulated model area. One of the main objectives here is to create a geomechanical reservoir model in a thermo-mechanical manner in order to understand the coupling between reservoir heterogeneities and stress distributions. To this end, stress analyses of wellbore data and laboratory tests will help to calibrate a reliable model.
In order to implement the complex geological structure of the studied wedge-shaped foreland basin, an automatic export of lithology, fault and borehole data (e.g. from Petrel) into a FE mesh is used. We will present a reservoir-scale model that considers thermo-mechanic effects and analyze their influence on reservoir deformation, fluid flow and stress concentration. We use the currently developed finite element application REDBACK (https://github.com/pou036/redback), inside the MOOSE framework (Poulet et al. 2016). We show that mechanical heterogeneities nearby fault zones and their orientation within the stress field correlate to fracture pattern, interpreted stress heterogeneities or variegated flow systems within the reservoir.

REFERENCES

Poulet, T.; Paesold, M.; Veveakis, M. (2016), Multi-Physics Modelling of Fault Mechanics Using REDBACK. A Parallel Open-Source Simulator for Tightly Coupled Problems. Rock Mechanics and Rock Engineering. doi: 10.1007/s00603-016-0927-y.
Seithel, R.; Steiner, U.; Müller, B.I.R.; Hecht, Ch.; Kohl, T. (2015), Local stress anomaly in the Bavarian Molasse Basin, Geothermal Energy 3(1), p.77. doi:10.1186/s40517-014-0023-z