Local stress perturbation around fault zones

Characterisation of the stress state in the Earth's crust is essential for many geological engineering applications such as underground excavation, geothermal production and hydrocarbon extraction. The state of stress in the crust is mainly governed by far-field stresses (typically uniform over the lithospheric scale) and local perturbations (having much smaller wavelengths). Extensive field data have suggested that geological structures, such as faults and fractures, play an important role in perturbing the regionally uniform far-field stresses and resulting in locally variable near-field stresses.

This bachelor's thesis aims to investigate the relationships among far-field stresses, near-field stresses and fault zone structures based on a comprehensive geological dataset of a granitic rock mass at the Grimsel Test Site (Krietsch et al., 2018) and state-of-the-art computer modelling. First, an existing geological model (Fig. 1), which describes the geometrical characteristics of fault zones and mechanical properties of rock masses, will be imported into computer software (COMSOL Multiphysics) to numerically calculate the stress field in the crystalline formation. The simulation results will be then compared with existing field measurement data. The model will be further employed to explore the key factors (e.g. fault geometry, frictional property, rock mass quality or far-field stress state) that govern local stress perturbation around the fault zones.

Supervisors: Dr. Qinghua Lei (qinghua.lei@erdw.ethz.ch) and Dr. Hannes Krietsch (hannes.krietsch@sccer-soe.ethz.ch)

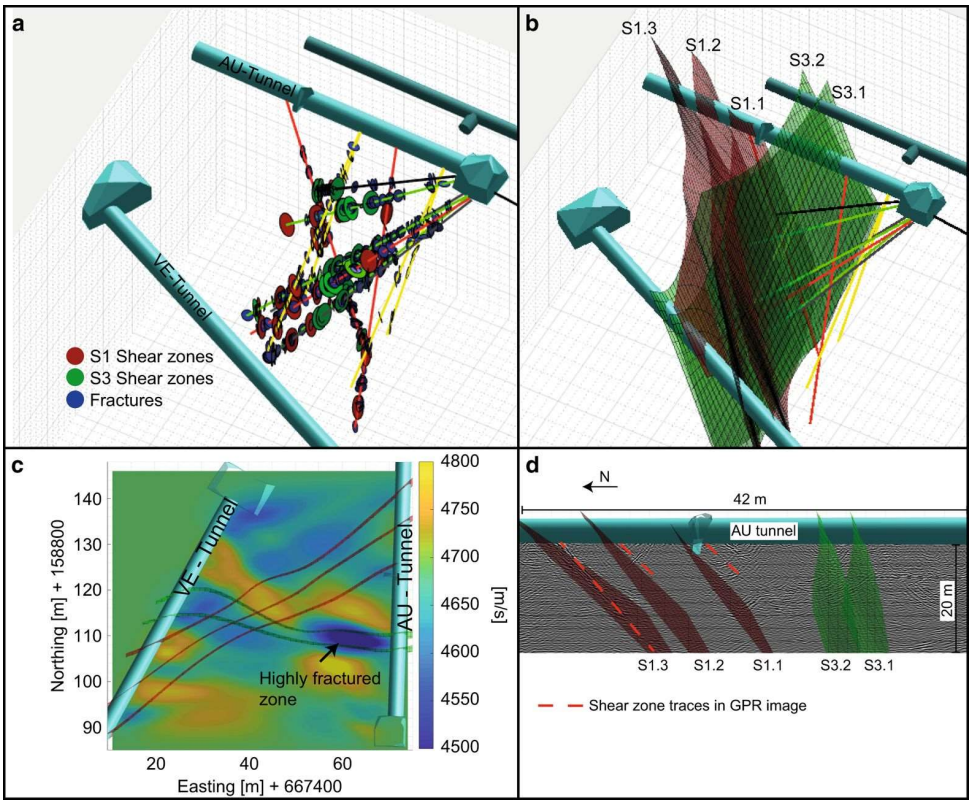

Figure 1. Visualization of the geological model including (a) geological raw data, (b) interpolated shear zones and (c-d) geophysical data (Krietsch et al., 2018).

Reference:

Krietsch, H., Doetsch, J., Dutler, N., Jalali, M., Gischig, V., Loew, S., & Amann, F. (2018). Comprehensive geological dataset describing a crystalline rock mass for hydraulic stimulation experiments. *Scientific Data*, *5*, 1–12. https://doi.org/10.1038/sdata.2018.269