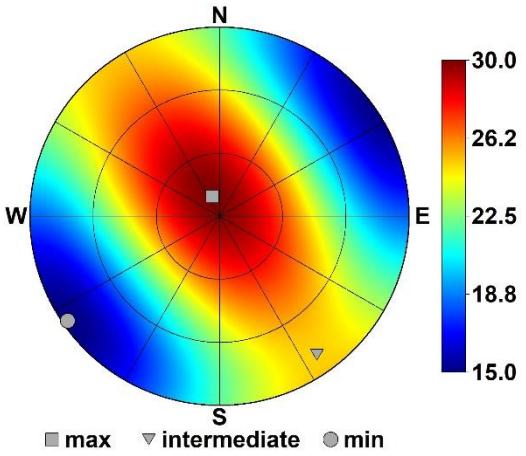
Up-to-date rock-mechanical bore path optimisation

An essential prerequisite for the successful execution of research, exploration and production drilling is the optimisation of the borehole path. This mostly relate to the borehole stability (a) and on the inflow conditions to the borehole (b). Both objectives can be realized relatively easily by own numerical 3D BOREHOLE calculations based on drilling specifications and parameters from RACOS® drill core analyses.

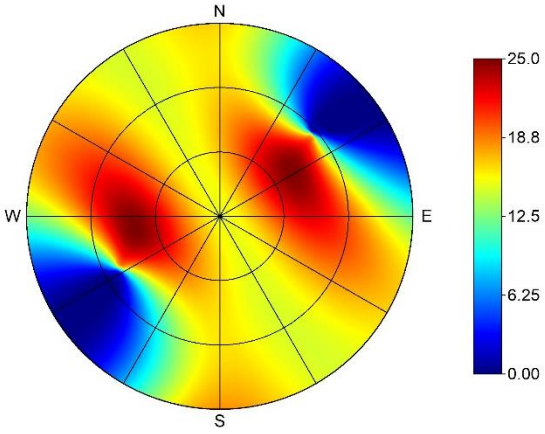
a: Since the stability of the borehole depends essentially on the 3D in situ rock loads, the corresponding estimations require a complete knowledge of magnitudes and orientations of the effective 3D in situ stresses. With the RACOS® analysis method, these can be determined directly on drill core samples without further on-site activities and without the formulation of constitutive laws. In addition to the 3D rock stresses at the time of core removal, the paleo stress conditions relevant for the formation of the rock structures can also be determined on the same core samples.

Example for the spatial dependence of the borehole stability on the 3D rock load

Effektive stress in MPa



Failure intensity in %



By coupling with experimentally determined rock strengths and of possible fault zones, the BOREHOLE analyses enable the evaluation of possible stability and failure situations both qualitatively and quantitatively. This can also include an optimization of the drilling mud conditions.

b: The realisation of fluid-relevant projects (geothermal energy, oil & natural gas production, pore space storage, etc.) also requires an optimal drilling orientation with regard to the borehole-related inflows and thus the hydraulic rock mass conditions. These are documented in the 3D pore pressure effectiveness (3D Biot coefficient). In RACOS® analyses, they can also be determined on the core samples of the location of interest. Their reservoir mechanical quantification can be carried out on the basis of experimental flow tests of drill core samples in the corresponding directions.

The investigations described above initially refer to the drill location developed. However, the conclusions can also be extended to the environment. In addition, available data from wells in a larger regional environment can be integrated.