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Fault reactivation in crystalline rock as consequence of glaciation

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One of the most important aspects for Deep Geological Repositories (DGRs) in crystalline rock is the presence and evolution of fractures and faults, since they dominate the subsurface flow regime and thus the possible transport of contaminants. In the considered period of one million years, it is expected that cold and warm period alternate, accompanied by ice sheet progression and regression. The large moving mass of an ice sheet causes a dynamic response of the earth's crust, referred to as glacial isostatic adjustment (GIA). GIA changes the displacement and stress field not only under and near the ice sheet but also in its far-field. In view of the long-term safety assessments for DGRs, we analyze GIA-induced far-field stress and pore pressure changes and their impacts on existing faults.

For that purpose, we use Finite-Element methods (FEM) to simulate the hydromechanical processes around an exemplaric DGR of the Yeniseiskiy Site, Russia, applying boundary conditions derived from established GIA models [1,2]. As result, we obtain the Coulomb failure stress for varying instances of assumed faults.

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References

[1] Patrick Wu. “Using commercial finite element packages for the study of earth deformations, sea levels and the state of stress”. In: Geophysical Journal International 158.2 (2004), pp. 401–408.

[2] G. Spada et al. “A benchmark study for glacial isostatic adjustment codes”. In: Geophysical Journal International 185.1 (2011), pp. 106–132.