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Consequences of Fault Reactivation on Subsurface Flow in Crystalline Rock

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Important aspects for subsurface installations, such as Deep Geological Repositories (DGRs), in crystalline rock are the presence and evolution of fractures and faults, since they control the subsurface flow regime. According to climate extrapolation, it is expected that cold and warm period will 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) [1]. 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 assessments, we apply boundary conditions derived from an established GIA model [2] in order to analyze induced far-field stress and pore pressure changes and their impacts on existing faults in a hydromechanical simulation. As indicator for permeability changes we apply the Coulomb failure stress criteria. To quantify the consequences on the subsurface flow we run a component transport simulation before and another after the fault reactivation, revealing how the faults canalize the radionuclid propagation. For both kinds of simulations, hydromechanical and component transport, we apply Finite-Element methods (FEM) [3].
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