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Three-dimensional finite element calculations of co- and post-seismic displacement and stress fields for hazard evaluation in the South Iceland Seismic Zone

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In June 2000, two magnitude 6.5 earthquakes ruptured two faults 17 km apart in the South Iceland Seismic Zone (SISZ). In addition to the co-seismic recordings , two geodetic datasets have recorded the resulting post-seismic deformation on two different time scales: InSAR data over months and GPS over years. To explain the observed deformation, earlier models have made simple assumptions about the rheology and the geometry, such as an homogeneous elastic half-space for the coseismic model and horizontal visco-elastic layers for the post-seismic model. However, previous seismic studies have underlined the heterogeneous rheology and geometric complexity of the SISZ. Here, we attempt to account for these issues realistically using the finite element method (FEM). Extending recent FEM modeling on subduction zones to the transform zone SISZ, we use the TECTON code. By comparing our modeled displacement fields with observations, we evaluate the sensitivity of our model to parameters such as rheological characteristics (shear modulus, Poisson's ratio and viscosity) for the different lithospheric layers as well as to geometrical considerations (e.g., the dip of the interfaces between these layers). Our approach can also map static Coulomb stress for hazard evaluation as part of EU projects on risk management (PREPARED, RETINA and FORESIGHT).