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Analytical fault and fluid-filled fracture models in viscoelastic media

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Previously obtained analytical expressions for the displacement and stress field generated by elastic dislocations in layered media have been generalised to the correspondent viscoelastic case. We derived solutions for tensile, dip-slip dislocations embedded in a medium composed by two half-spaces with different elastic and viscoelastic parameters, and for strike-slip dislocations in a layered half-space. Maxwell rheology has been employed.

We adopted an analytic technique to integrate the kernels and obtain crack models. For tensile cracks we imposed a time-constant stress-drop on crack plane, in order to model fluid-filled pressurised fractures. For faults models (dip-slip and strike-slip cracks) we conserved dislocation amount on crack plane, as it is generated for $t = 0$, and relaxed stresses in the medium.

Preliminary results are presented: stress maps are plotted for different times and different ratios between elastic and viscoelastic parameters. Rheology is shown to cause the evolution of observed elastic stress concentrations in proximity of layer interfaces. These concentrations may enhance or diminish depending on the ratios between elastic and viscoelastic parameters. Aftershocks distribution and focal mechanisms are predicted to change with the time.

A preliminary applications to the June 2000 earthquakes in the SISZ (Iceland) is outlined.