Geophysical Research Abstracts
Vol. 15, EGU2013-5024, 2013
EGU General Assembly 2013

Constitutive models of faults in the viscoelastic lithosphere

Louis Moresi (1), Hans Muhlhaus (2), John Mansour (3), and Meghan Miller (4)

(1) School of Geosciences, Monash University, Clayton, Victoria, Australia (louis.moresi@monash.edu), (2) Hans Muhlhaus, Earth Sytems Science Computational Centre / School Of Earth Sciences The University of Queensland, St Lucia, QLD, Australia, (3) Monash eResearch Centre, Monash University, Clayton, Victoria, Australia, (4) Department of Earth Sciences, University of Southern California, Los Angeles, CA, USA

Moresi and Muhlhaus (2006) presented an algorithm for describing shear band formation and evolution as a coallescence of small, planar, fricition-failure surfaces. This algorithm assumed that sliding initially occurs at the angle to the maximum compressive stress dictated by Anderson faulting theory and demonstrated that shear bands form with the same angle as the microscopic angle of initial failure.

Here we utilize the same microscopic model to generate frictional slip on prescribed surfaces which represent faults of arbitrary geometry in the viscoelastic lithosphere. The faults are actually represented by anisotropic weak zones of finite width, but they are instantiated from a 2D manifold represented by a cloud of points with associated normals and mechanical/history properties. Within the hybrid particle / finite-element code, Underworld, this approach gives a very flexible mechanism for describing complex 3D geometrical patterns of faults with no need to mirror this complexity in the thermal/mechanical solver.

We explore a number of examples to demonstrate the strengths and weaknesses of this particular approach including a 3D model of the deformation of Southern California which accounts for the major fault systems.

L. Moresi and H.-B. Mühlhaus, Anisotropic viscous models of large-deformation Mohr-Coulomb failure. Philosophical Magazine, 86:3287–3305, 2006.