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Nonlinear effects during post-seismic visco-elastic deformation

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Evidences of power law during post-seismic deformation are recently identified. A part of the total deformation is elastic andan investigation nto the nonlinear elastic effects is carried out. The geometrically nonlinear effects are included by taking into account the nonlinear part of the elastic strain tensor.This can predict the deformation more accurately, in particular, close to irregularities of fault boundaries where stress concentrations appear. The governing quasi-static FEM equationand the effective viscosity coefficient are of the form(Kev + Kct + Kg)Δq = Q - F, η = A(-1/n)dot(E)(1/n-1)exp(H/nRT)where Kevis the elasto-viscous stiffness matrix, Kctis the current contact stiffness andKg the "geometric" stiffness which includes the effect of the (linearized) nonlinear part of the strain tensor,Δq is the displacement increment,Q is the external loading vector and F is the internal forces vector.The visco-elastic model employs power law viscosity function where dot(E)is the second strain rate invariant, T is the temperature, R is the universal gas constant, A and H are the experimental material constants. The numerical examples that will be presented concern the displacements applied along the fault and observations of the displacements on the surface.The computational model is 3D and includes contact relations between the moving plates in the fault. The problem is described in the updated Lagrangian frame and the FE equation is solved using Newton-Raphson technique. The calculations are performed using the newly developed visco-elastic version of the program "Oregano". We examine a simplified conceptualmodel in which a surface traction simulating the coseismic slip is applied to a vertical fault causing displacements of the upper surface of a crustal block. We demonstrate the effectof geometrical non-linearity in this problem.Acknowledgement:The Engineering and Physical Sciences Research Council provides the funding for the research project under the contract EP/D03728X/1.

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