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Considerations about the choice of geometry and Maxwell viscoelastic rheology in numerical models

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In geosciences many numerical models are made to provide insights in the mechanical behaviour (deformation, stresses) of the lithosphere and the mantle. The mechanical behaviour of a body depends on the body's shape, its material properties, its boundary conditions and the load the body is subjected to. Usually models contain a rectangular geometry and a Maxwell rheology. The rectangular geometry represents the portion of the Earth, that is under investigation. The Maxwell rheology is the simplest description for a viscoelastic material. It describes a material that finally behaves like a fluid.

This work investigates consequences of this kind of modelling. Calculations are made to compare an elastic spherical shell with an incompressible core under selfweight and a box with free slip conditions (movement is restricted perpendicular to each face, except the top face, of the box) under the same elastic properties and an analogous selfweight. The deformation and the stresses of the sphere differ distinctively from the deformation and stresses of the box. By changing the elastic material to a Maxwell viscoelastic material in both cases the stresses change with time to the same hydrostatic state of stress.