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Modelling large inter-plate earthquakes in the Hellenic subduction zone

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Numerical modelling of dynamic processes is an important tool to investigate the complex interactions between the subducting and overriding plates as well as the deformation and stress transfer within the participating plates. As various rheological parameters influence the deformation, the aim of regional to local scale numerical models is to investigate the three-dimensional deformation and stress change during a seismic cycle including seismic, inter-seismic, and aseismic (e. g. silent earthquakes, etc.) and their dependency on material properties. Observables like surface deformation, seismic velocities, seismic attenuation, focal mechanisms, densities, stress observations, etc. can be used to constrain the model. The models are based on structural investigation by seismological and gravity methods.

First results of a regional model of the Aegean-Anatolian region can be used to constrain the boundary conditions and the stress state of a smaller scale model. This model suggests that the mantle viscosity below Anatolia is lower by one to two orders of magnitude than in the neighbouring regions and that the mantle viscosity of the Aegean lithosphere is slightly increased. The first of this results is consistent with seismic tomography studies of the area. Nevertheless the origin of the low Anatolian and high Aegean viscosity is still unknown.

The smaller scale model is set up to investigate the co-seismic surface deformation and stress changes of the magnitude 8.3 seismic event in 365 A. D. This earthquake caused a tsunami, which destroyed large areas in the Nile delta, and a co-seismic uplift of more than 9 m in Western Crete. Modelling this event may lead to a deeper understanding of the generation of large inter-plate earthquakes in the Hellenic subduction zone.