



4D stress and strain field of the Marmara Sea from numerical modelling

T. Hergert (1), **O. Heidbach** (1), A. Bécel (2), A. Hirn (2)

(1) Geophysical Institute, Universität Karlsruhe (TH), Germany, (2) Institute de Physique du Globe de Paris (IPGP), France, (oliver.heidbach@gpi.uni-karlsruhe.de)

The 1999 Izmit earthquake is supposed to be a precursor of an expected future earthquake beneath the Sea of Marmara about 20 km south of the city of Istanbul. During the last decade earthquake hazard in this region has been investigated by several approaches based on Coulomb failure stress changes, earthquake recurrence rates, geodetic analyses, seismic moment-frequency relationships, and others. In our work we present for the first time a structurally complex 3D numerical model that simulates the absolute stress tensor. Our model results are consistent with a number of model-independent constraints such as stress observations, GPS data, fault-slip data, basin evolution, and tectonic regime. The model geometry includes the 3D fault system with Coulomb friction, topography, bathymetry, water load, basement, and Moho structure. The model is driven by gravity and kinematic boundary conditions on the model sides and from below accounting for the tectonic loading. Our results give a detailed picture of the kinematic pattern below sea level and at the fault segments. It reveals that slip-rates along the main fault in the Marmara Sea vary significantly and that they are smaller (8-15 mm/a) than previously anticipated from existing GPS data analysis (16-20 mm/a). This is mainly due to slip partitioning and internal distributed deformation of the blocks between the major faults. The modelled tectonic regime is consistent with earthquake focal mechanism solutions. Furthermore, it shows that, even though strike-slip regime prevails, at a number of sites normal faulting occurs.