Geophysical Research Abstracts
Vol. 17, EGU2015-5330, 2015
EGU General Assembly 2015

Rotational Deformation near Major Faults: A New Mechanical Approach for Connecting Paleomagnetic and Geodetic Observations

Neta Ginsburg (1,2), Yariv Hamiel (1), and Roi Granot (2)

(1) Geological Survey of Israel, Jerusalem, Israel (yariv@gsi.gov.il), (2) Department of Geological and Environmental Science, Ben-Gurion University of the Negev, Beer-Sheva, Israel

Vertical axis rotations are a significant component of crustal deformation and provide important constraints on the tectonic history of plate boundaries. Geodetic measurements can be used to calculate present-day rotations whereas paleomagnetic measurements can be used for calculating finite long-term (millions of years) rotations. Here we present a new approach for integrating both datasets through mechanical modeling that links these time scales. We test this approach in northern Israel, a region where a tectonic triple junction lies at the intersection between two deformation zones: (1) The Dead Sea Fault, and (2) The Carmel-Gilboa Fault System. We examined the temporal and spatial distribution of crustal deformation and rotation rates near these two major fault zones. First, rotation rates were calculated from current interseismic global positioning system (GPS) measurements that were recorded during 12 years. We analyzed the GPS velocities using a 3D dislocation slip model that takes into account motion on major active faults in the study area. This model was then modified to account for the total deformation of the crust. Rotations from the mechanical modeling were compared against finite rotations determined based on primary magnetic remanence directions from 30 Neogenic basaltic sites. Paleomagnetic results indicate significant (>20º) rotations near the edges of fault segments. These results disagree with interseismic rotations calculated from the GPS measurements; however they are in general agreement with the vertical axis rotations obtained from the mechanical model. The comparison to the modified model suggests that the tectonic setting of the Carmel-Gilboa Fault system was fairly stable during the last 6.5-8 Myr. Furthermore, the new suggested method for comparing interseismic recent deformation with long-term deformation provides important new insights on the timing, magnitude and style of deformation near major faults and can be used for locating fault activity and slip rates.