Progress report for 2011 SCEC Proposal

Title of Project
Geometry of fault slip zones at depth from quantitative analysis of seismic catalogs

Principal Investigator
Yehuda Ben-Zion
Department of Earth Sciences
University of Southern California

***Proposal Categories*:**
Integration and Theory

Science Objectives:
A4, A10, A3

Summary

Studies under this project attempt to develop a quantitative method for estimating the geometry of active fault zones at seismogenic depth using typical entries of earthquake catalogs. In contrast to prior methods that make various assumptions on geometrical properties of the structure (e.g. sets of planes or fractal network), our method does not presuppose any shape. Each recorded earthquake is assigned a Gaussian likelihood function with central coordinates and standard deviations in different directions corresponding to the hypocenter location and errors. The likelihood function is given a weight corresponding to the event size. The sum of the likelihoods of all earthquakes reported for a given region, with normalization to account for different event numbers in different locations, provides a likelihood field for the occurrence of slip patches in the examined volume. High contiguous regions of likelihood values represent large fault zone sections. Synthetic catalogs are used to develop and test normalization methods that account for typical spatio-temporal variations of seismicity, and to identify characteristic likelihood shapes corresponding to typical types of structural heterogeneities (e.g. stepovers, parallel faults). In the present application the method is applied to estimate geometrical properties of the seismicity in the San Jacinto fault zone environment. Preliminary results show high general complexity and a dipping trend with increasing depth of seismic slip patches along a NW-SE direction. The continuing work will add information from focal mechanisms and focus on performing in-depth analysis of segmentation and continuity along different sections of the San Jacinto fault zone, with special attention to the trifurcation area and Hemet stepover region. The study supported a PhD student and led to an AGU abstract.

Publications Supported by this grant

Ozakin, Y. and Y. Ben-Zion, Geometry of fault slip zones at depth from quantitative analysis of seismic catalogs: Method and results for the San Jacinto fault zone AGU, Fall Meet. Suppl., T13G-04, 2011.