Geophysical Research Abstracts
Vol. 12, EGU2010-3035, 2010
EGU General Assembly 2010

Patterns of fault interactions triggered by micro earthquake activity

Vasiliki Mouslopoulou and Dionisis Hristopulos

Department of Mineral Resources Engineering, Technical University of Crete, Greece (vasiliki@mred.tuc.gr, dionisi@mred.tuc.gr)

Historical earthquakes are often strongly clustered in space and time. This clustering has been attributed to static stress triggering associated with tectonic fault interactions and/or fluid migration. Discrimination between these two models requires detailed information on the timing, location and size of earthquakes. The Matata earthquake sequence, which occurred within the active Taupo Rift in New Zealand, provides a unique opportunity to chart spatial and temporal patterns of earthquakes along individual faults, between neighbouring faults and within the entire fault system over timescales of days to years. This is due to the accurate relocation of 2563 small to moderate size earthquakes (1<Mw<4.7) that ruptured c. 20 km2 of the rift's crust during 4 years (Jan 2005 – Jan 2009) of continuous earthquake activity. Data show that these earthquakes collapsed onto well-defined sub-parallel faults which were active over discrete periods of time. Although microearthquake occurrence at the scale of successive earthquakes on individual faults appears to be a highly complex process, data show that, when the entire system is considered, the locations of earthquake epicenters are correlated in time, with spatial correlation of a minimum of 8 successive earthquakes. The system-wide kinematic coherence is achieved when about 76 % of the total elements in the system are considered and requires the interaction of neighbouring faults over short timescales (e.g. tens of days). This mechanism is consistent with tectonic (as opposed to fluid-triggered) fault interactions that have been established for larger magnitude earthquakes (e.g. Mw>5.5) that occurred over thousand-year timescales (e.g. <60 kyr). Therefore, if the origin of small-to-moderate-sized earthquakes in the rift is indeed tectonic and fault interaction is a scale invariant process, it may be possible to constrain better the occurrence of large earthquakes by analysing widely available microearthquake data.