Geophysical Research Abstracts
Vol. 15, EGU2013-10866, 2013
EGU General Assembly 2013

Remotely triggered micro-earthquakes in the Larderello-Travale Geothermal Field (Italy) following the 2012 May 20, Mw 5.9 Po-plain earthquake.

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We report observations of remotely-triggered earthquakes at the Larderello-Travale Geothermal Field (Italy), following the Mw=5.9 Po-Plain earthquake on May 20, 2012. Four distinct triggered events are recognised within a short ($\sim$25s) time interval accompanying the sweeping of $\sim$10s Rayleigh waves. Triggered sources are clustered at depths in between 4 km and 6 km. The magnitude and distance of the mainshock agrees well with the triggering threshold previously proposed for The Geysers, California. The first three and last triggered earthquakes occur in conjunction with peak and null ground displacement, respectively. At the triggered hypocentral depths, the Rayleigh wave dynamic stresses are estimated to range up to 5KPa, and they are mostly associated with the orthogonal vertical (Szz) and shear (Sxz) stress components. According to particle motion and slowness analysis, the direction of ground motion is roughly perpendicular to the strike of the main fault system of the area, thus maximising the triggering potential of the Rayleigh-wave dynamic stress perturbations. Our data suggest that at least two different triggering mechanisms might have been at work, involving either Coulomb failure of critically-stressed fault, or fault weakening via increased fluid pore pressure. Failure occurrence in response to dynamic stresses as low as 5 KPa requires that faults are already maintained close to failure by high pore fluid pressures. This consideration is buttressed by the fact that our triggered events occurred at depths compatible with the location of the K-horizon, a reflector which is thought to represent a level of fractured, silica-rich rocks hosting fluids in a supercritical state.