Bay Area Geophysical Society Seminar Series

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LBNL

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Elevation 66 in El Cerrito

Fault Leakage and Induced Seismicity Observations and Empirical relations inferred from decametric in-situ experiments

Abstract: Seismicity induced by fluid became a great societal concern mainly since large earthquakes occurred after geothermal injection or waste-water storage. In order to mitigate the risks, and to be able to use microseismicity as a probe for in-depth fluid process, it is of crucial importance to understand the links between seismicity and fluids. To improve near-source and complete (geological, hydrological, mechanical and seismological) observations, we developed in-situ, decameter-scale experiments which aim to reactivate well-identified geological structures by controlled fluid-injection. The uniqueness of these experiments is

to couple borehole pressure-strain monitoring of the activated fault movements to an extensive seismic monitoring. We here focus on the Mw~-4 to -2 induced seismicity recorded during injections in shale and limestone. The spatio-temporal distribution of those events, the energy balance, and the seismic velocity changes of the medium show that most of the deformation observed at the injection point does not actually emit seismic signals although it corresponds to a period of significant leakage of the activated fault zone. We therefore proposed new concepts to describe the relationships between fault leakage and induced seismicity: the seismicity is not directly induced by the fluids, but it may be triggered by the aseismic motion related to fault permeability growth.

Speaker Bio:

Yves Guglielmi is a staff scientist at the Lawrence Berkeley National Laboratory. His principal interests cover fundamental research in the hydromechanics of fractured and faulted rock. He focuses on the in situ understanding of the relationships between hydraulic, elastic and strength properties, rheology and induced seismicity of faults and fractures through field observation. Yves is developing downhole probes to measure fault movements as close as possible to the natural and artificial fluid injection sources. Applications of his research concern giant rock landslides, and geo-energy (nuclear waste disposal, reservoir seal integrity and deep geothermal energy). Prior to LBNL, Yves was a professor at the Universities of Aix-Marseille, Nice, and Franche-Comté, all in France, and supervised 19 PhD students. Yves has authored or co-authored more than 100 peer-reviewed publications.