Bay Area Geophysical Society Seminar Series

Three-Dimensional Fault Displacement and Potential Link with Seismicity Induced by Fluid Injections: from Field to Laboratory Scales

Dr. Yves Guglielmi

Senior Earth Scientist, Energy Geoscience Division, Lawrence Berkeley National Laboratory

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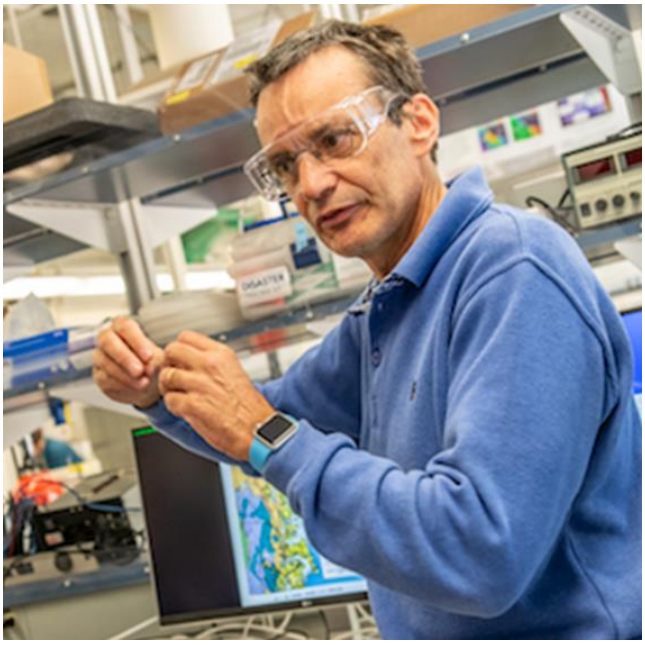
Room 265, UC Berkeley, McCone Hall,
and on Zoom

Abstract:

Seismicity induced by fluid injections is a great societal concern since moderate to large magnitude earthquakes occurred after geothermal injection, waste-water storage and CO2 storage around the world. For several years, we have developed field scale fault activation experiments to explore the mechanisms of induced seismicity in the source near-field and in three dimensions. New technologies (SIMFIP, CASSM, DTS-DSS-DAS fiber-optics) were combined for continuous monitoring of fault pore pressure, 3D-displacement, seismic events, and to image changes in seismic waves propagation caused by the movements and the fluid circulations. Recently, we have downscaled these experiments into a true triaxial laboratory press, keeping the possibility to probe the 3D displacements and acoustic emissions while injecting in a fault affecting a granite block. At both scales, we observe that fault activation initiates at or beyond the Mohr-Coulomb failure criterion with a large volumetric dilation at the pressure source before eventually evolving into a slip dominated regime. Induced seismic events localize outside

the maximum pressure source and they are associated with large aseismic fault 3D deformations. The geometrical and rheological roles played by fault asperities are discussed at both scales to explain these observations. Moreover, these experimental results highlight the importance of failure driven by aseismic slip coupled to the fault hydromechanical response in mechanisms of induced seismicity.

Author:



Yves Guglielmi is a senior staff scientist at the Lawrence Berkeley National Laboratory. His principal interests cover fundamental research in the hydromechanics of faulted rocks. He focuses on the in situ understanding of the relationships between hydraulic, elastic and strength properties, rheology and induced seismicity of faults through field observation. Yves Guglielmi is developing downhole probes to measure fault movements as close as possible to natural and artificial fluid injection sources. He is coordinating the LBNL-NRAP group and he is the PI of several national and international projects related to fault leakage and induced seismicity.

Zoom meeting information:

Zoom ID: 867 0211 5149
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