DEPSS Hiroshima
Department of Earth and Planetary Systems Science
Hiroshima University, JAPAN

HiPeR
Hiroshima Institute of Plate ConvErgence Region Research

広島大学

HiPeR Special Symposium

Fluid flow and fault slip evolutions in fault zones
断層帯中の流体移動と地震性断層すべり

Wednesday, December 18, 2024
Lounge (A606)
ZOOM ID: 864 0274 2193, Passcode: 788203

1. Flush talks by students (15:30-16:30)

◆ Fluid-rock reaction of olivine and granite gouge by frictional heating associated with fault slip: Miku Hidaka
◆ Experimental investigation on effects of diagenesis on frictional and hydraulic properties of incoming sediments from Tohoku subduction zone: Hayato Ito
◆ Permeability of fractured peridotites and implication for water penetration into the mantle: Yuichiro Naruse
◆ Rheological property of pelitic schists and its relationship to the Nankai Trough seismogenic zone: Suzuka Yagi

2. HiPeR Special Seminar (16:30-17:00)
"Development of rock physics models of characterizing fluid flow in faults"
Prof. Kazuki Sawayama (IGS, Kyoto University, Japan)

3. HiPeR Special Seminar (17:00-18:00)
"Pore fluid pressure and fault slip coupling in dynamic rupture and earthquake sequence models"
Prof. Yajing Liu (McGill University, Canada)

Abstract: Pore fluid pressure plays a crucial role in the source processes of earthquakes and episodic slow slip events. In a fluid-infiltrated fault zone with highly compacted granular materials, pore pressure increases due to strong shear heating during rapid slip, leading to a thermal pressurization dynamic weakening effect which promotes further rupture propagation and larger coseismic slip. On the other hand, accelerated slip can also increase fault zone porosity, temporally reduces pore pressure hence clamps the fault (dilatancy strengthening), before pore pressure re-equilibrates with the ambient level. In this presentation, I will discuss numerical simulations that couple pore fluid pressure and fault slip evolution in the framework of the laboratory-derived rate-state friction law, with applications to earthquake ruptures and slow slip sequences in subduction zones and oceanic transform faults. In particular, strong dilatancy can effectively inhibit seismic slip in frictionally unstable (velocity-weakening) regions, resulting in aseismic slip transients which not only serve as a rupture barrier to earthquakes but may also drive episodic seismic swarms as observed along the East Pacific Rise transform faults. Preliminary results from our recent dynamic rupture model of the 2008 Wenchuan magnitude 7.9 earthquake indicate that 3D fault geometry has a first-order control of the coseismic slip distribution whereas thermal pressurization mainly influences the near-field peak ground motion.

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