FAULT SLIP DYNAMICS IN SUBDUCTION ZONES: INSIGHTS INTO FAST FLUID PRESSURE TRANSIENTS

Avinash GUPTA [1], ***Nikolai M. SHAPIRO*** [1], ***Jean P. AMPUERO*** [2], ***Gaspard FARGE*** [3], ***Claude JAUPART*** [4]

[1] Institut de Sciences de la Terre, CNRS, Université Grenoble Alpes, Grenoble, France
[2] Université Côte d'Azur, CNRS, Observatoire de la Côte d'Azur, IRD, Valbonne, France
[3] Department of Earth and Planetary Sciences, University of California Santa Cruz, Santa Cruz, CA, USA
[4] Institut de Physique du Globe de Paris, Université de Paris, Paris, France

contact: aviggupta0123@gmail.com

This study delves into the dynamic interaction between fluids and fault slip transients within subduction zones experiencing slow earthquakes. It focuses on the permeable subduction interface saturated with fluids derived from metamorphic dehydration reactions in the descending plate. Drawing from the framework established by Farge et al. (2021), the research employs a model featuring a heterogeneous subduction channel containing low-permeability plugs that act as fault-valves. This system exhibits intermittent fluid transport and rapid pressure fluctuations, which influence fault friction and can lead to transient slip accelerations. Numerical simulations in a 2D in-plane shear geometry are utilized to explore the effects of rapid fluid pressure variations on fault slip behavior. The fault dynamics are governed by rate-and-state friction laws with velocity-strengthening characteristics, while pore fluid pressure varies both temporally and spatially. Initial tests demonstrate that periodic pore pressure oscillations can accelerate fault slip, resembling observed slow slip events. Subsequent analyses delve into more complex pore pressure histories generated by the dynamic permeability model proposed by Farge et al. (2021). The results underscore the critical role of fluid flux and permeability structure in modulating variations in fault slip, particularly in facilitating slow slip events.