



***In-situ* frictional properties on seismogenic faults inferred from near-field observations and numerical simulations**

Hongfeng Yang and Suli Yao

The Chinese University of Hong Kong, Earth System Science Programme, Hong Kong (hyang@cuhk.edu.hk)

Frictional strength and slip weakening distance are crucial for earthquake generation and rupture propagation, and may significantly impact ground shaking intensities and tsunami potential during megathrust earthquakes. However, *in-situ* frictional properties remain elusive on natural faults. Even after earthquakes, determination of *in-situ* frictional properties is challenging and is mostly obtained from indirect estimation. Previous approaches are either limited by the lack of near-field observational data, or suffer from strong trade-off between strength drop and the critical slip weakening distance (D_0). Here we constrain the frictional parameters along the megathrust that was ruptured during the 2012 M_w 7.6 Nicoya earthquake, which was well recorded by a local dense network. We conduct spontaneous rupture simulations with constraint from kinematic source models and near-field GPS records. The trade-off between strength drop and D_0 is removed by constraints from near-field displacements and velocities recorded by low- and high-rate GPS, respectively. Our preferred dynamic model indicates a relative low fracture energy: 0.4×10^6 J/m², with the $D_0 \sim 0.2$ m and the strength drop ~ 4.0 MPa. The determined frictional parameters can be applied in deriving future rupture scenarios and thus serve for hazard assessment from physics-based simulations.