Numerical simulation of dynamic rupture and ground motion on a fault non-uniformly loaded along dip

Hideo Aochi, Kenichi Tsuda

EGU22-1672
EGU General Assembly 2022

Numerical simulation of dynamic rupture and ground motion on a fault non-uniformly loaded along dip

Hideo Aochi[1,2] and Kenichi Tsuda[3]
[1]BRGM, Orleans, France (h.aochi@brgm.fr)
[2]Laboratoire de Géologie de l'Ecole Normale Supérieure, CNRS UMR 8538, PSL Research University, Paris, France
[3]Shimizu Corperation, Tokyo, Japan

It is widely accepted that the rupture area of earthquake is controlled by fault geometry and the interaction between segments. Besides, many earthquakes do not rupture the whole seismogenic depth but only some limited depth zone. It is not so often to observe that a moderate earthquake such as the 2019 Mw4.9 Le Teil, France, earthquake shows a clear surface rupture and the very shallow rupture area limited at the first 1-2 km depth. Aochi and Tsuda (EGU, 2021) propose the concept that the fault is not uniformly loaded along dip due to the 1D layered structure. Namely, the stress is loaded mainly on the stiff layers, while the soft layers play a role of barrier. We use a boundary element method and a spectral element method for simulating the dynamic rupture propagation and wave propagation. We then demonstrate that the shallowest soft layer can be slipped if the rupture at deeper portion is sufficiently developed. On the other hand, a depth soft layer is difficult to be ruptured, mainly because the absolute stress level is high. In our synthetic scenarios, we compare the ground motions around the fault. In the usual model where the stress is uniformly loaded on all the depths, we observe a strong coherent pulse as the rupture progresses fast to the ground surface. However, we observe more than one pulse in our setting. Such heterogeneous condition along dip should be important to investigate the causality of the seismic asperity and the influence on the resultant near-field ground motion.