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Spontaneous dynamic rupture modeling of 2017 M 5.4 Pohang, South Korea, earthquake, using the slip-weakening friction law

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An M 5.4 earthquake occurred in the southeastern part of the Korean Peninsula in 2017. It is an oblique thrust event that occurred at a relatively shallow depth (~ 5 km) although it did not create coseismic surface rupture. A coseismic slip model was successfully obtained by inverting the ground displacement field extracted by the InSAR data (Song and Lee, 2019). In this study, we performed spontaneous dynamic rupture modeling using the slip weakening friction law. The static stress drop distribution obtained by the coseismic slip model was used as an input stress field. We adopted high performance computing (HPC) using the parallelized dynamic rupture modeling code (SORD, Support Operator Rupture Dynamics). Although our target event is moderate-sized one, we can successfully produce a spontaneous dynamic rupture model using a relatively small initial nucleation patch (radius ~ 1 km) with a relatively small slip weakening distance (~ 5 cm). Our preliminary results show that the rupture creates an asperity near the initial nucleation zone with approximately 4 MPa stress drop, then propagates obliquely upward both in the northeast and southwest directions. Although we assumed a single planar fault plane in our current rupture modeling, it seems worthwhile to dynamically model the rupture process, including complex fault geometry in following studies. Dynamic rupture modeling for a natural earthquake provides an opportunity to understand the dynamic rupture characteristics of the earthquake, including both stress drop and fracture energy.