Dynamic rupture simulation of two cascading foreshocks of the 2016 Kumamoto earthquake

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The 2016 Kumamoto earthquake sequence, including two major foreshocks (Mw 6.2 and 6.0) and the main shock (Mw 7.0), hit the Kyushu island of southwest Japan. The foreshocks have a temporal separation of approximately 2.5 hours; the latter one has apparently been triggered by the former one by its change in static stress, dynamic stress, or both. We assumed that those foreshocks had ruptured subparallel but different faults on the Hinagu fault system, and constructed a dynamic model to gain insights into the mechanism of such consecutive events by computing the temporal evolution of stress and slip rate on both faults using Boundary Integral Equation Method. Our results show that, under circumstances satisfying local stress field constrained by an independent information of spatial variations of earthquake focal mechanisms, the rupture of former foreshock dynamically triggered the second foreshock. In addition, parameter studies gave us indication of the relationship between local frictional properties and stress filed. Our result is also consistent with observed ground deformation from the ALOS-2 Synthetic Aperture Radar satellite.

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