Effects of fault interactions on formation of fault system considering spontaneous dynamic rupture propagation

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We discuss the effects of interactions between fault segments, and high rupture velocity, on the formation of fault systems and their dynamic rupture process. While non-planar geometry of fault systems is considered an important parameter of dynamic rupture process, the formation process of the geometry is still not clear. Dramatic mechanical changes, the large scale stressing, occur on fault system during co-seismic ruptures. This fact suggests that fault geometry can be evolved caused by recurrences of faulting.

In order to get basic understandings on this evolution process, we carry out simulation assuming that fault tips extend in the direction of maximum shear traction. We use an elastodynamic boundary integral equation method, allowing the fault tip path to be dynamically self-chosen. We assume interacting two parallel faults, one of them being pre-existing and stationary. In our previous qualitative study, a constant rupture velocity and an abrupt stress release at the fault tips are assumed. For the sake of quantitative study, here, we assume a slip-weakening friction low instead of these two assumptions and spontaneous rupture is simulated.

We, now, obtain following preliminary results. We show that the coalescence occurs when newly grown fault segment is non-overlapped, or partly overlapped, with the pre-existing one and the strike slip offset is smaller than about the half-length of the pre-existing one. This property is similar to the result obtained in our previous qualitative study. Farther, the inclination of fault bending possibly depends on not only the rupture velocity but also the process zone size. The rupture can be transferred from the newly grown one to pre-existing one after the coalescence; we find the rupture is much easier to be transferred in this case than the case that the fault bending is prohibited. Natural examples seem consistent with the concepts we present.