

粘弾性を考慮した海溝型地震サイクルの数値シミュレーションに基づく内陸地震の活動期

Active period of inland earthquakes based on numerical simulation of megathrust earthquake cycle incorporating viscoelasticity

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In the subduction zone, megathrust earthquakes may modulate shallow crustal seismicity in the overriding plate. Historical documents demonstrate that large inland earthquakes frequently occurred for 50 years before and 10 years after megathrust earthquakes along the Nankai trough, southwest Japan. Previous studies suggest that inland earthquakes cannot occur until recovering the stress reduced by a megathrust earthquake on the fault. In this study, we modeled megathrust earthquake cycle in a simple oblique subduction zone and calculated temporal evolution of the Coulomb's Failure Stress changes (ΔCFS) on inland right-lateral strike-slip faults. And we examined the influence of megathrust earthquake cycle on the activity tune of inland earthquake.

Sources for loading inland faults are assumed to be interseismic locking and coseismic slip on the megathrust fault, stress changes due to inland earthquake and interaction between inland earthquake, and creep on a deeper extension of the inland faults. The stress change due to the megathrust fault was computed with numerical code by Fukahata and Matsu'ura (2006), assuming a medium composed of an elastic layer overlying a Maxwell viscoelastic half-space. We focus on ΔCFS depending on the distance from the megathrust fault, not its along-strike variation. In other words, only two-dimensional stress change at the center of a sufficiently long thrust fault plane (length 2000 km) is calculated. The megathrust fault is represented by a single rectangular fault whose depth, width, strike, dip, and rake are 11 km, 108 km, 270°, 10°, and 117°, respectively. We assigned 6 m of coseismic slip at an interval of 100 years and 6 cm/year of back-slip during the interseismic period on the megathrust fault. The inland faults are located at 150 km (hereafter fault A) and 300 km (hereafter fault B) away from the upper edge of the megathrust fault and their depth, length, width, strike, dip, and rake are 4 km, 30 km, 6 km, 110°, 90°, and 180°, respectively. Coseismic slip of 2 m was assigned when ΔCFS at the center of the inland faults exceeded 4.4 MPa. Because the code of Fukahata and Matsu'ura (2006) approximates a rectangular fault by numbers of point sources, a stress change on the fault plane can't be calculated. Therefore, we calculated a coseismic stress change on the fault plane assuming a semi-infinite elastic medium (Okada, 1992). In addition, stress loading by creep on a deeper extension of the inland faults was given to each inland fault at a constant rate.

ΔCFS on both inland faults is negative at the megathrust earthquake. When the stress loading rate is 5 kPa/year, the inland earthquake does not occur for 42 years on fault A and 15 years on fault B after the megathrust earthquake. Our interpretation is that viscoelastic effects of megathrust earthquakes makes these quiescence periods shorter and longer for faults A and B, respectively. Also, when the stress loading rate is 0.5 kPa/year, the quiescence period is 83 and 71 years for faults A and B. It is interesting that the quiescence period is not much dependent on the distance from the megathrust fault if the stress loading rate is small, though ΔCFS on both inland faults is highly dependent on the distance at the megathrust

earthquake.

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