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Can we estimate fault instability from prior phase of nucleation?

Yuta Mitsui (1,2) and Kazuro Hirahara (1)

(1) Department of Geophysics, Graduate School of Science, Kyoto University, Kitashirakawa-Oiwakecho, Sakyo-ku, Kyoto 606-8502, Japan, (2) Istituto Nazionale di Geofisica e Vulcanologia Sismologia e Tettonofisica, Roma 1 Via di Vigna Murata 605 00143 Rome, Italy (mitsui@kugi.kyoto-u.ac.jp)

We investigate the relation between interseismic stress accumulation and fault instability by numerically modeling of nucleation processes on a two-dimensional finite fault in a three-dimensional body. We assume an isolated circular homogeneous fault and the rate and state dependent friction law with both the aging and the slip types of the state evolution law. The parameter range in which we tried setting is $a/b \geq 0.5$. To focus on the “prior” phase of nucleation, we define S_c as a relative size of the locking center area to the whole fault, when the slip velocity on the inward creeping front reaches ten times as large as the loading rate. For the ordinary slip events, S_c can be expressed as a function of non-dimensional stability parameters, l_b and l_{b-a}. Both parameters are proportional to the product of rigidity and L, and inversely to the product of effective normal stress and fault radius. The former l_b is inversely proportional to b, and the latter l_{b-a} is to $b-a$. S_c is approximately given by $0.35(l_b)^{-1}$ and $0.35(l_{b-a})^{-2}$ in case of the aging law and $0.003(l_b)^{-3}$ in case of the slip law. It implies that we can certainly estimate the fault instability (particularly l_b) from the area of the prior phase of nucleation. However, considering the results of the slow events in case of the aging law with $1.8 < l_{b-a}[b/(b-a)]$, the relation may not be rather simple, to our regret. For the same size of S_c, there always appear two possibilities of the ordinary event and the slow event.