S044-009 Room: Convention B Time: May 29 16:00-16:15

Dependency of similarity and scale of slip events on frictional parameters

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1. Introduction

We developed numerical simulation from 2D model to 3D, and found that frictional parameters as well as the aspect ratio of asperity has an influence on the property of slip events in the last fall meeting. In this presentation, we investigate and report the relation between the frictional parameters and the property (interval, slip amount, etc.) of cyclic earthquakes.

2. Models

We apply our 3D numerical simulation model. The model is a three-dimension elastic half-space with a thrust fault, which is regarded as a plate boundary. The frictional stress on inner parts of the fault obeys a rate- and state- dependent friction law, while stable sliding with a slip rate of 9 cm/yr is assumed on outer parts. To deal with simple cases, we assumed single patch(a-b is negative) on the flat plate boundary, where the dip angle is 20 degrees, and scalar friction (slip has only shear component along dip).

Critical size, which is minimum length for nucleating unstable slip, is expressed as

(critical length) = [c*G*dc]/[(b-a)*N](G=rigidity, N=normal stress, c=constant for each cell).

Taking it into account, and to evaluate the instability for a patch, we use the criterion of instability for dip component expressed as below

F= (size of patch==L) / (average of critical length==Lc).

Assuming the lithostatic load and the hydrostatic pore pressure, N(normal stress) is proportional to the depth. We formulate several models with a single patch on the inner parts of plate boundary, changing a-b, dc and N(depth) so as to keep F constant. We quantitatively compare the properties of seismically cyclic events from the simulated results.

3. Results

Our results are listed as below.

[Model]	[long axis of patch(km)]	[dc(cm)]	[depth of patch(km)]	[(a-b) in the center of patch]	[interval(yr)]
[A]	[45]	[2]	[78]	[0.7e-3]	[20]
[B]	[45]	[1]	[39]	[0.7e-3]	[11.6]
[C]	[22.5]	[2]	[156]	[0.7e-3]	[19.0]
[D]	[45]	[2]	[39]	[1.4e-3]	[23.4]
[E]	[90]	[4]	[79]	[0.7e-3]	[43]

[cf. A-B] When spatial distribution of frictional parameters are changed as keeping (depth of asperity)/(dc) constant between both models, the spatial distributions of slip are nearly the same, and the amounts of slip and the periods of cyclic earthquakes are approximately proportional to (dc).

[cf. A-C] Keeping (depth)*(size of asperity) constant, the spatial distributions of slip are nearly similar, and the amounts of slip and the periods of cyclic earthquakes are nearly the same.

[cf. A-D] Keeping (depth)*(frictional parameters, a & b, over the whole) constant, the spatial distributions of slip, the amounts of slip, and the periods of cyclic earthquakes are nearly the same.

[cf. A-E] As expected, keeping (size of asperity)/(dc) constant, the results are the same as results [cf. A-B].

From all results, we found that the interval of cycle and to the amount of slip is proportional to dc on the condition that the instability of patch (in another way, coupling) is the same. We conclude that investigating the relation between the distribution of frictional parameters and the scale of cyclic earthquakes is essential to estimate the frictional parameters on the actual faults.