DYNAMIC SLIP TRANSFER FROM THE DENALI TO TOTSCHUNDA FAULTS, ALASKA: TESTING THEORY FOR FAULT BRANCHING

Harsha S. Bhat[1]; Renata Dmowska[2]; James R. Rice[2]; Nobuki Kame[3]

[1] Div. Engineering and Appl. Sci., Harvard University; [2] Div. Engnr. and Appl. Sci., and Dep. Earth Planetary Sci., Harvard University; [3] Dept. of Earth and Planetary Sci., Kyushu Univ.

We analyze dynamic slip transfer from the Denali to Totschunda faults during the Mw 7.9, November 3, 2002, Denali, Alaska, earthquake. This adopts the theory and methodology of Poliakov et al. [2002] and Kame et al. [2003], in which it was shown that the propensity of the rupture path to follow a fault branch is determined by the preexisting stress state, branch angle and incoming rupture velocity at the branch location. Here we check that theory on the Denali-Totschunda rupture process using 2D numerical simulations of processes in the vicinity of the branch junction.

The maximum compression direction with respect to the strike of the Denali fault near the junction has been estimated to range from approximately 73 (deg.) to 80 (deg.). We use the values of 70 (deg.) and 80 (deg.) in our numerical simulations.

The rupture velocity at branching is not well constrained but has been estimated to average about 0.8cs throughout the event. We use 0.6cs, 0.8cs, 0.9cs and even 1.4cs as parameters in our simulations.

We simulate slip transfer by a 2D elastodynamic boundary integral equation model of mode II slip-weakening rupture with self-chosen path along the branched fault system. All our simulations except for 70 (deg.) and 0.9cs predict that the rupture path branches off along Totschunda without continuation along Denali. In that exceptional case there is also continuation of rupture along Denali at a speed slower than that along Totschunda and with smaller slip.