S43B-07 - Imminent Seismic Velocity Changes in Earthquake Cycle Simulations

Thursday, 16 December 2021

14:18 - 14:23

Convention Center - Room 335-336

Abstract

Earthquake prediction is the holy grail of seismology. Many previous studies have searched for robust precursory signals to inform us of imminent earthquakes, the most significant of which are seen in laboratory experiments as temporal changes in pressure and shear wave velocities during the seismic cycle. Similar changes are seen in natural faults and the surrounding structurally complex network of fractures with nested hierarchy of localized deformation, referred to as fault damage zone. However, little is known whether such temporal changes in material properties contains any precursory signals for imminent earthquakes. Conversely, the effect of precursory velocity changes on the seismic cycle is not well understood.

By imposing shear wave velocity changes in fault damage zones, we investigate the effects of these precursors on multiple stages of the seismic cycle, including nucleation, coseismic, postseismic, and interseismic stages. We perform 2D fully dynamic earthquake cycle simulations with a fault-parallel damage zone for strike-slip fault systems with antiplane geometry. The fault is governed by rate-state-dependent friction laws, and the fault damage zone material is considered elastic. Our preliminary results show that the temporal onset of shear wave velocity drop causes a reduction in earthquake recurrence intervals over the seismic cycle. Furthermore, a dynamic earthquake rupture within the seismic cycle terminates much faster and abruptly in models with precursory velocity changes. We will also discuss how the precursory velocity changes affect the fault-slip behavior, including fast-slip, slow-slip, and aseismic creep, for different amplitudes of shear wave velocity changes at different compliance contrast of the fault damage zones. Our results highlight the importance of short and long-term monitoring of fault zone structures for better assessment of regional seismic hazard.

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13:45 - 15:00

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Seismology

Similar

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***Yihe Huang**, University of Michigan Ann Arbor, Ann Arbor, MI, United States and Prithvi Thakur, University of Michigan Ann Arbor, Earth and Environmental Sciences, Ann Arbor, MI, United States*

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***Yesim Cubuk Sabuncu**[1], Kristin Jonsdottir[1], Thora Arnadottir[2], Corentin Caudron[3], Thomas Lecocq[4] and Aurélien Mordret[5], (1)Icelandic Meteorological Office, Reykjavik, Iceland, (2)University of Iceland, Nordic Volcanological Center, Institute of Earth Sciences, Reykjavik, Iceland, (3)University of Grenoble Alpes, University Savoie Mont Blanc, CNRS, IRD, University Gustave Eiffel, ISTerre, Grenoble, France, Grenoble, France, (4)Royal Observatory of Belgium, Seismology-Gravimetry, Brussels, Belgium, (5)ISTerre Institute of Earth Sciences, Saint Martin d'Hères, France*

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***Ahmed E Elbanna**, University of Illinois at Urbana Champaign, Department of Civil and Environmental Engineering, Urbana, IL, United States and Mohamed Abdelmeguid, University of Illinois at Urbana Champaign, Urbana, IL, United States*

Investigation of the Tsunami Earthquake Mechanism Based on Dynamic Rupture Simulations

***Kenichi Tsuda**, Shimizu Corporation, Tokyo, Japan and Bunichiro Shibazaki, International Institute of Seismology and Earthquake Engineering,Building Research Institute, Ibaraki, Japan*

Upper plate rigidity and shallow subduction zone slip stability in data-constrained seismic-cycle models of the central Hikurangi margin, New Zealand

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