Journal of Geophysical Research – Solid Earth

Supporting Information for

The role of fluid pressure-induced aseismic slip in earthquake cycle modulation

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Introduction

The supplementary figures in this document support the content in section 3 and 4 of the main text.

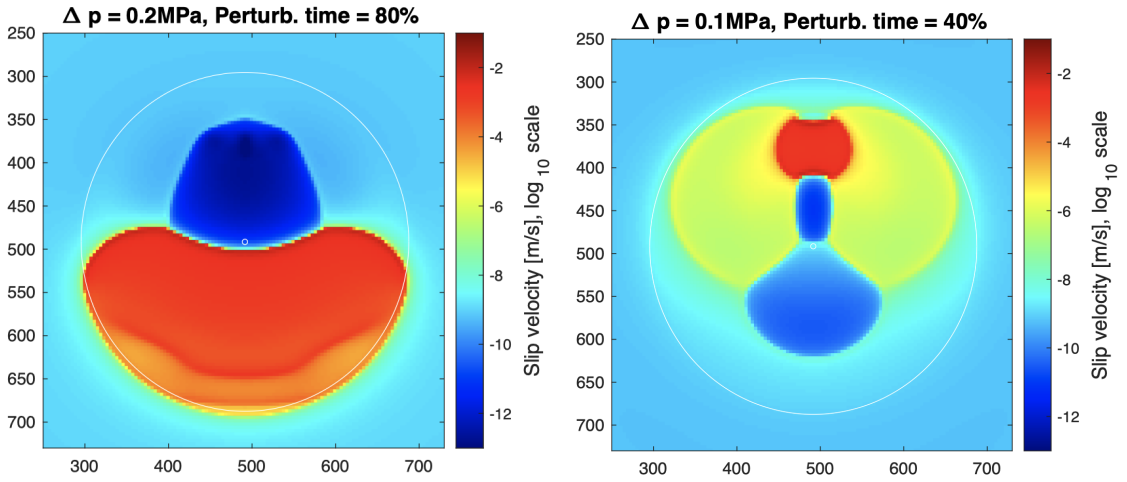

Figure S1. The onset of dynamic rupture in two cases with different Δp and T_p. (a) h^* here is 160% of h^* of an unperturbed case. A substantial area of the VW region has slipped at an accelerated rate and released a significant amount of stress, resulting in a relatively smaller event. (b) h^* here is 40% of h^* of an unperturbed case. Stress released prior to the event is much smaller than that in (a), a condition that favors a larger seismic event.

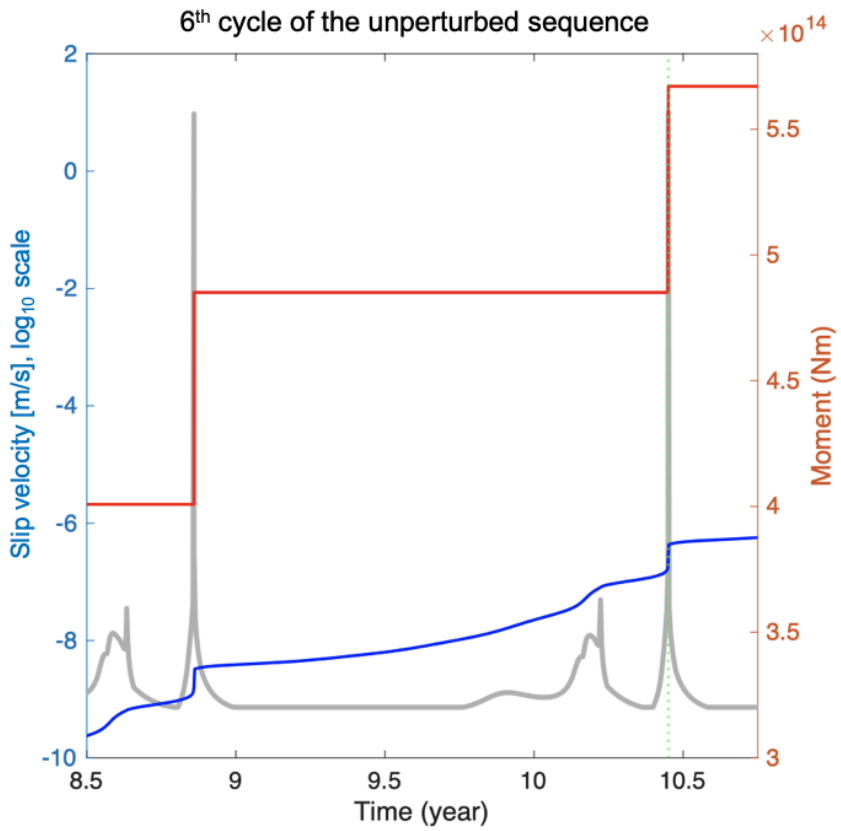

Figure S2. Seismic and aseismic moment release, and maximum slip rate of the unperturbed tectonic sequence during its 6th seismic cycle. Red and blue lines indicate seismic and aseismic moment release, respectively. The grey line represents the maximum slip rate on the fault at a given time. Green dotted line represents the timing of the 7th event at the end of the 6th cycle.

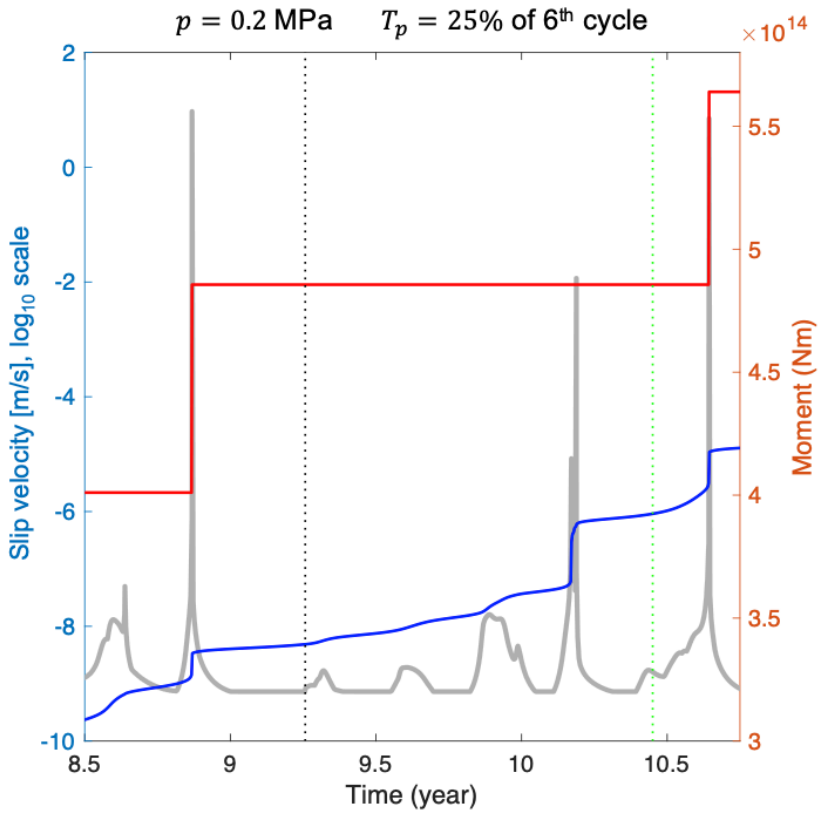

Figure S3. Seismic and aseismic moment release, and maximum slip rate of a perturbed sequence during its 6th seismic cycle, with pore pressure perturbation magnitude = 0.2 MPa and T_p = 25%. Red and blue lines indicate seismic and aseismic moment release, respectively. The grey line represents the maximum slip rate on the fault at a given time. Green dotted line represents the timing of the next event in the unperturbed sequence. Black dotted line represents the time of pore pressure perturbation. In this case the induced event is delayed in time.

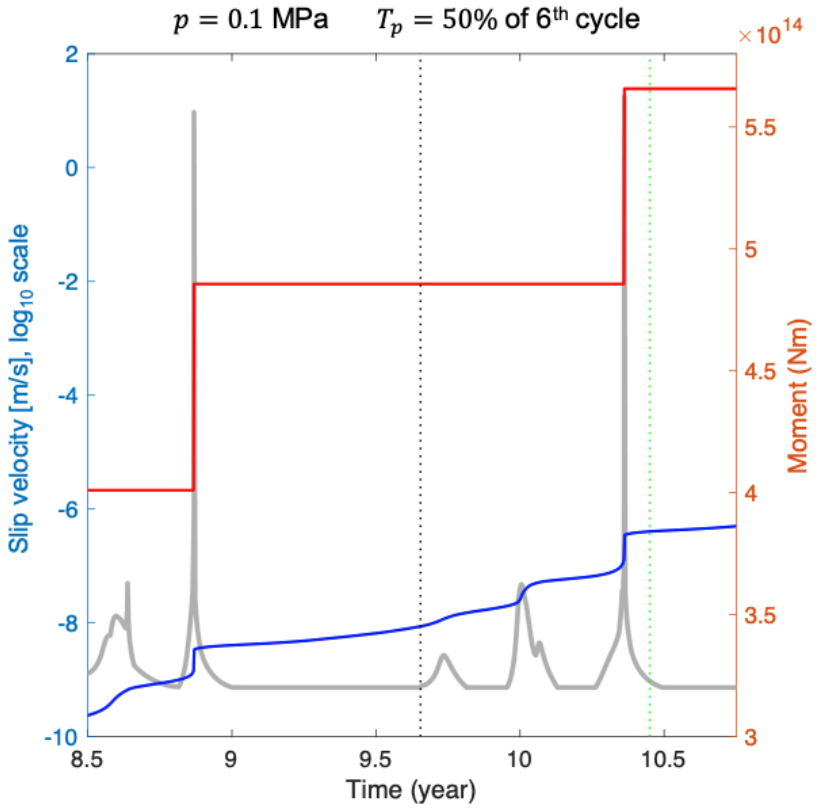

Figure S4: Seismic and aseismic moment release, and maximum slip rate of a perturbed sequence during its 6th seismic cycle, with pore pressure perturbation magnitude = 0.1 MPa and T_p = 50%. Red and blue lines indicate seismic and aseismic moment release, respectively. The grey line represents the maximum slip rate on the fault at a given time. Green dotted line represents the timing of the next event in the unperturbed sequence. Black dotted line represents the time of pore pressure perturbation. In this case the induced event is advanced in time.

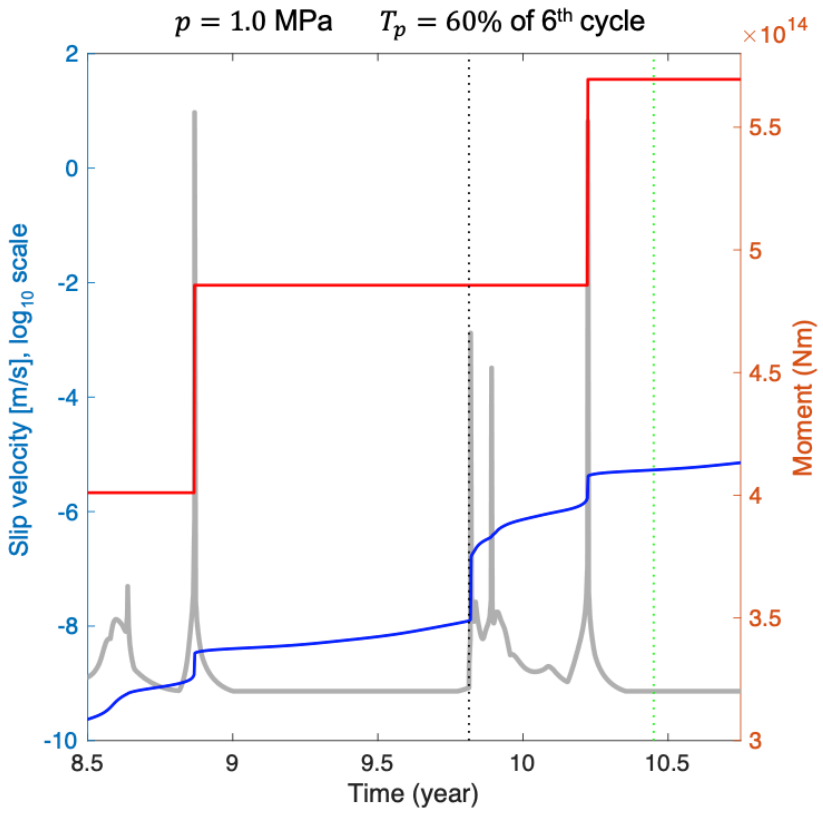

Figure S5: Seismic and aseismic moment release, and maximum slip rate of a perturbed sequence during its 6th seismic cycle, with pore pressure perturbation magnitude = 1.0 MPa and T_p = 60%. Red and blue lines indicate seismic and aseismic moment release, respectively. The grey line represents the maximum slip rate on the fault at a given time. Green dotted line represents the timing of the next event in the unperturbed sequence. Black dotted line represents the time of pore pressure perturbation. In this case the induced event is advanced in time.

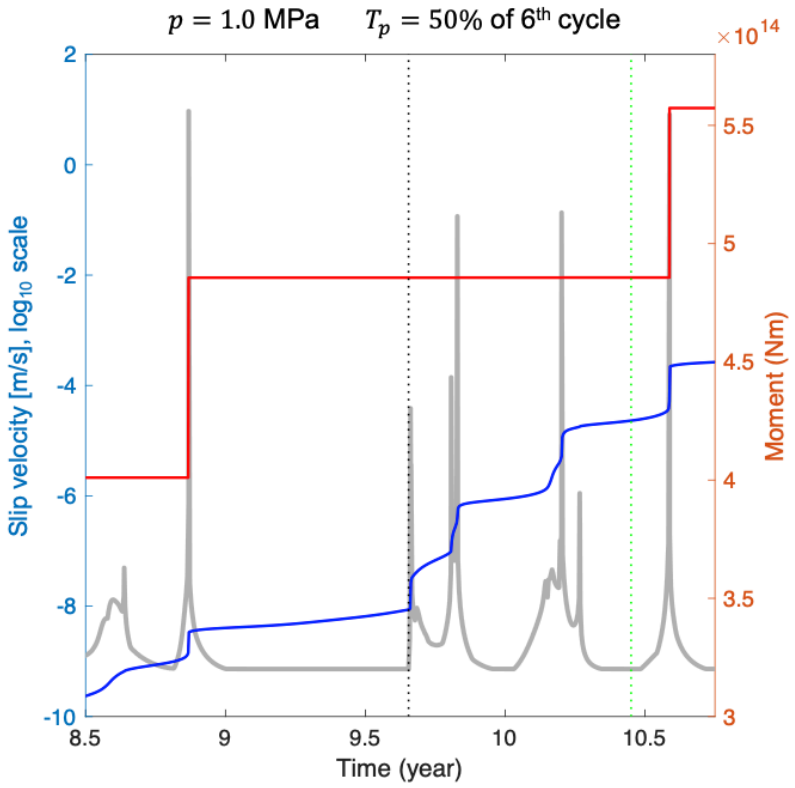

Figure S6: Seismic and aseismic moment release, and maximum slip rate of a perturbed sequence during its 6th seismic cycle, with pore pressure perturbation magnitude = 1.0 MPa and T_p = 50%. Red and blue lines indicate seismic and aseismic moment release, respectively. The grey line represents the maximum slip rate on the fault at a given time. Green dotted line represents the timing of the next event in the unperturbed sequence. Black dotted line represents the time of pore pressure perturbation. In this case the induced event is delayed in time.

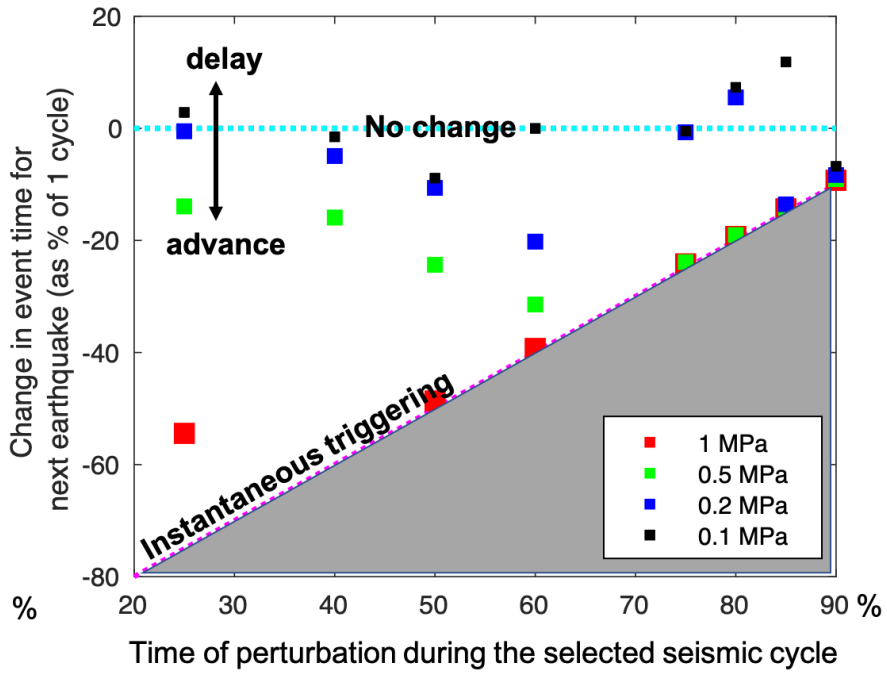

Figure S7: Change in the remaining time to instability with respect to shear stress perturbed at different times during the selected seismic cycle. Each data point represents one simulation within the tested model space. Markers falling on or very close to the dashed edge of the grey triangle are events that are instantaneously triggered.

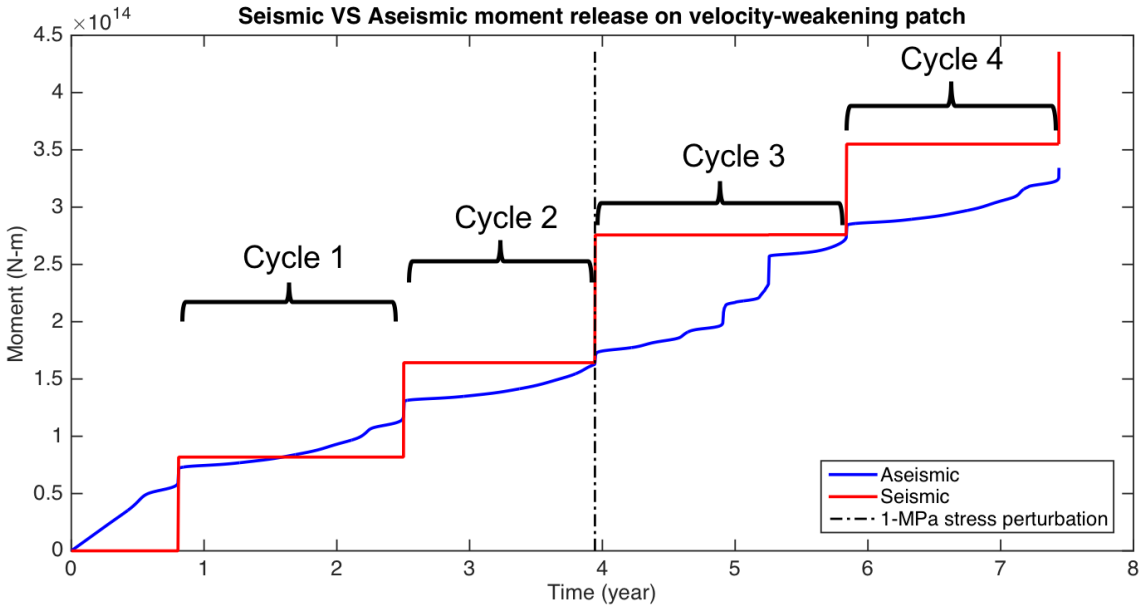

Figure S8: Simulation with shear stress perturbation of 1 MPa at T_p = 90% of Cycle 2. The blue and red graphs are aseismic and seismic moment released in the velocity-weakening region, respectively. After the instantaneously triggered earthquake at the end of cycle 2, there are two significant aseismic transients during cycle 3, which substantially delay the subsequent earthquake.