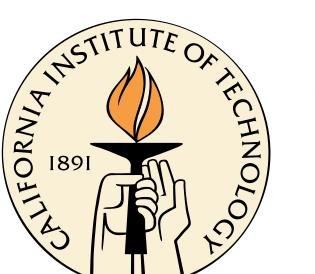
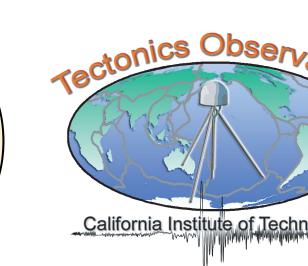
THE "SIMEULUE SADDLE": AN ASEISMIC PATCH OF THE SUNDA MEGATHRUST?

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INTRODUCTION: THE QUESTIONS

The December 2004 and March 2005 Sunda megathrust earthquakes nucleated northwest and southeast of Simeulue island, respectively, and each ruptured bilaterally into the 100-km-long island. Uplift at the northwestern tip of Simeulue was 1.5 m during the 2004 earthquake, and uplift at the southeastern tip in 2005 was 1.5 m or more. Uplift associated with each earthquake diminished toward the center of the island, as did slip on the underlying megathrust, according to slip inversions. Cumulative uplift was as little as 0.5 m along the west coast of central Simeulue. Hence, although the 2004 and 2005 uplifted regions overlap, there is an uplift deficit, or saddle, on central Simeulue. Rupture during an M_W 7.3 earthquake in 2002 produced up to ~20 cm of uplift on the west coast of central Simeulue, near the sites of lowest uplift in 2004-2005, but even including that uplift, the saddle persists. No events similar to 2002 can be found in the historical record for at least the previous 94 years.

The occurrence of the 2002, 2004, and 2005 earthquakes, their relative locations and timing, and their associated patterns of uplift raise important questions about rupture boundaries, earthquake triggering, and long-term behavior of these patches of the fault. Why didn't the 2004 earthquake continue southward to encompass the future 2005 rupture? Why didn't the 2002 earthquake continue farther onto the 2004 or 2005 rupture planes? It does not appear that the 2002 and 2004 ruptures extended into regions of recent high slip. Could the rupture terminations have been controlled by permanent structural boundaries?

Preliminary analysis of survey data from our 2005 and 2006 field seasons and of x-rays of slabbed *Porites* coral microatolls, coupled with a paucity of large historical earthquakes in the region, suggests that the central Simeulue region may experience occasional aseismic slip events, or that moderate earthquakes (M<7) may account for a significant fraction of the uplift during a 2004- or 2005-type earthquake cycle.

