## **COSEISMIC, POSTSEISMIC, AND INTERSEISMIC DEFORMATION, AND LONG-TERM SEGMENTATION** NEAR THE BOUNDARY OF THE 2004 AND 2005 SUNDA MEGATHRUST RUPTURES

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## ABSTRACT

Simeulue Island, off the west coast of northern Sumatra, straddles the boundary of the 2004 and 2005 Sunda megathrust ruptures. The 2004 and 2005 earthquakes nucleated northwest and southeast of Simeulue, respectively, and each ruptured bilaterally toward the 100-km-long island. Cumulative uplift was 1.5 m at both the northwest and southeast tips of the island but diminished toward the island's center, where uplift was 0.5 m or less. Hence, although the 2004 and 2005 uplifts overlapped, there was an uplift deficit, or saddle, on central Simeulue.

In addition to enabling observations of coseismic Porites coral microatolls enable uplift, measurements of postseismic and interseismic elevation changes. Whereas uplift in the year after May 2005 was negligible (< 10 cm) at the northwest and southeast ends of Simeulue, 30 cm of postseismic uplift occurred during that period in central Simeulue. Moreover, analysis of microatoll morphology indicates that, averaged over decades and longer, interseismic strain accumulation rates are lower in central Simeulue than at the island's ends.

Historical intensity data imply that prior to 2005 the last great earthquake caused by rupture of the megathrust under Nias island, to the south, occurred in A.D. 1861; initial U-Th dates from uplifted fossil microatolls suggest that, like the 2005 rupture, the 1861 rupture extended north to southern Simeulue, but that uplift did not extend to northern Simeulue. Additional preliminary U-Th dates from uplifted fossil microatolls suggest that earlier earthquakes, in A.D. 1843 and some time around A.D. 1799, also involved rupture of Nias and southern Simeulue. Thus it appears that the ~1799, 1843, 1861 and 2005 ruptures were similar in that they extended into but not through the Simeulue Saddle. However, at sites in southeastern Simeulue, uplifts in ~1799 and in 1843 were much smaller than in 2005, and the ~1799, 1843, and 1861 events may be regarded as a triplet.

North of the Simeulue Saddle, the most recent event apparently occurred around A.D. 1440, and it may have been preceded by one or two other earthquakes in close succession (analysis is still very preliminary). Altogether, these observations suggest that the Simeulue Saddle is a poorly coupled segment of the megathrust that serves as a persistent barrier to rupture.











Strong IOD event — 2 Nov 2002 EQ late 1948 | late 1950 | late 1956 | late 1961 | late 1972 | late 1979 | late 1982 | late 1986 | late 1991 | late 1997 | late 2002 | late 2003 | late 2004 | early 2 large die-down