Interseismic strain accumulation along the Sumatran Subduction Zone seismic gap.

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AB: The south equatorial segment of the sumatra subduction zone (the Mentawai segment) is known to have produced giant earthquakes in 1797 and 1833 (Mw higher than 8.5). The northern adjacent segment (Nias) that broke in 1861 and again in March 2005 (Mw=8.7) highlights the potential of a future giant earthquake in the Mentawai segment. Paleogeodetic and GPS data from the Sumatran subduction zone provide an unusual opportunity to understand the physical parameters that control the behavior of a subduction interface. Interseismic strain measurements recorded over the last several decades by coral growth rings and GPS instruments are fit well by a simple model that assumes lateral variations in the depth of the updip and downdip limits of the locked fault zone (LFZ). The minimum width of the LFZ is about 100 km near the Equator and increases to about 200 km farther south. Near the Equator, where the width of the LFZ is about 100km, smaller earthquakes occurred (Mw=7.7 in Mw=1935 7.2 in 1984) than the area farther south where giant earthquakes happened in 1797 and 1833. The background seismicity also fit very well with the downdip end of the LFZ. This difference in both the seismic behavior and width of the LFZ might be related to the to the thermal structure of the plate interface and so to lateral variations in both the age of the subducting plate and the normal plate convergence rate. We find that the downdip end of the LFZ is everywhere between the 300C and 400C isotherms, corresponding to the stable sliding activation of quartzo-feldspathic rocks. If we extrapolate the last 50 years of strain accumulation in the Mentawai segment back to 1833, the seismic moment potential is found to be higher than $1.5*10^{2}$2 N.m, the equivalent of a Mw higher than 8.7 earthquake.