



The Structure of the West Sumatran Subduction Zone Revealed by Local Earthquake Travel Time Tomography

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The Sumatran margin hosted three great earthquakes in the last decade (Aceh-Andaman 26 December 2004 $M_w = 9.2$, Nias 28 March 2005 $M_w = 8.7$, Bengkulu 12 September 2007 $M_w = 8.5$), two of which were associated with significant loss of life. Yet, part of the margin near the northern Mentawai islands remains unbroken, and the historical record suggests that only half of the accumulated tectonic strain might have been released by the Bengkulu earthquake in 2007.

Local earthquake tomography techniques are applied on manually picked arrival times from a local network that operated between April 2008 and February 2009. The network consists of 52 continuously recording land stations and 10 OBS covering 325 km of the active margin between 1.5°S and 1.5°N . This segment of the Sumatran margin ruptured last in 1797 and is characterised by the Investigator Fracture zone which subducts beneath the Sumatran mainland near the southern termination of the 2005 Nias event. The subduction of this aseismic ridge appears to influence seismicity down to 200 km depth.

We present 2D and 3D velocity models including focal mechanism based on first motion polarities. The V_p and V_s velocity models resolve the structure of the forearc including the downgoing slab, the sedimentary basins and the volcanic arc down to depths of 75 km. The V_p velocity beneath the outer arc islands is between 5-6 km/s while the region between the Batu Islands and the mainland shows considerably lower V_p velocities of ~ 4.5 km/s. At depths less than 40 km, the upper part of the subducting slab has a velocity of ~ 7 km/s and is located beneath the outer arc islands at a depth of ~ 25 km, dipping at a shallow angle.