



The Fine Structure of the Subducted Investigator Ridge in Western Sumatra

Dietrich Lange (1), Frederik Tilmann (1), Andreas Rietbrock (2), Rachel Collings (2), Danny Natawidjaja (3), Bambang Suwargadi (3), Tim Henstock (4), and Trod Ryberg (5)

(1) University of Cambridge, Department of Earth Sciences, Cambridge, United Kingdom (dl385@cam.ac.uk), (2) Department of Earth and Ocean Sciences, University of Liverpool, 4 Brownlow Street, Liverpool L69 3GP, UK, (3) Geotek-LIPI, Bandung, Indonesia, (4) National Oceanography Centre, Southampton, UK, (5) GFZ, Potsdam, Germany

The Sumatran margin played host to three great earthquakes in the recent past (Aceh-Andaman 26 December 2004 Mw=9.2, Nias 28 March 2005 Mw=8.7, Bengkulu 12 September 2007 Mw=8.5). Here we present local earthquake data from a dense, amphibious local seismic network from an unbroken segment of the Sumatran margin where the Investigator fracture zone (IFZ) subducts beneath the Sumatran mainland. The rare occurrence of forearc islands along the Sumatran margin allows the deployment of seismic land stations above the shallow part of the thrust fault. In combination with ocean bottom seismometers this geometry provides high hypocenter location quality for the updip end of the seismogenic zone in an area where geodetic data are also available. More than 1700 local events with magnitudes between 1 to 5.7 MI (41.000 arrivals) were observed between April 2008 and February 2009. We present the seismicity distribution of this segment boundary based on a minimum 1-D velocity model and relate it to the background seismicity. Furthermore we will present first results of local tomography inversion techniques and focal mechanisms.

The downgoing Benioff zone is readily identifiable as a north-east dipping plane down to a depth of 225 km. West of Nias a trench parallel, 25 km wideband of seismicity is observed; this seismicity occurs updip of the 2005 event. South of Nias the spatial distribution of seismicity is irregular: shallow seismicity in seismogenic depths is highly concentrated forming well-defined clusters. Shallow seismicity related to the mega-thrust shows pronounced nests of seismicity below the trench at 0.1°N and 30 km north of the westernmost Batu Islands. Very sparse seismic activity below Siberut island reflects the locked state of the plate interface which ruptured last in 1797. In total, three NNE trending bands of seismicity can be identified in the deeper (<100 km) part of the Benioff zone. These streaks of seismicity are parallel to the prolongation of the subducted ridges and are suggested to reflect the subducted topography of the IFZ. The Batu Islands, which are seen from GPS and coral data to be weakly coupled, are located on the prolongation of the northernmost (and 40 km wide) subducted ridge feature of the IFZ, while the plate interface below Siberut island (where the subducted ridges are only up to 15 km wide) is characterised by almost complete coupling. This might suggest that the amount of coupling resulting from the subduction of a ridge system could be dependent on the width of the subducted ridge system. At least two nests of seismicity within the overriding plate, which extend down to the seimogenic zone have probably been influenced by the subducted IFZ.