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Slip Distribution of Recent Sunda Trench Earthquakes: Reconciling 3D GPS Inversions with Seismological and Ocean Measurements

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Three-dimensional inversion of GPS near- and regional-field observations for the slip distribution of the great 2004 Mw=9.2 Sumatra-Andaman earthquake is performed using a Greens's function approach. To this purpose, a covering of the relevant part of the subduction zone with rectangular patches is generated automatically in a layered earth model. Inversion results in two distinct slip models, depending on the relative weighting in the cost function of moment minimization and smoothing on one hand, and conformance to GPS data on the other hand. Both models fit GPS data very well, but differ in amount of seismic moment released in the southernmost part of the rupture near the epicenter (at 3Ãƒâ€šÃ‚°N Ãƒ¢Ã¢â€š¬Ã¢â‚¬Å“ 5Ãƒâ€šÃ‚°N). This Ãƒ¢Ã¢â€š¬Ã‹Å“extra' moment makes about 10 per cent of the total moment release. We test these two alternative models against independent observations which include seismological, tide gauge and satellite ocean altimetry data. The slip model with maximum moment release close to the epicenter is more consistent with the seismological tracking of co-seismic energy release by Ishli et al. (2005) and Krueger and Ohrnberger (2005). The same model also shows more consistency with Jason satellite altimetry as well as with tide gauge records, provided the finite velocity of rupture propagation is taken into account. The July 2006 Mw=7.7 Java earthquake excited an unusually large tsunami when compared to the earthquake's magnitude itself. Forward tsunami modeling shows that the finite fault model based on teleseismic broadband data strongly underestimates wave run-ups at Java coast. We employ regional GPS data to derive an alternative fault model of the Java earthquake that better fits observed coastal run-ups References Ishli et al. (2005) Nature, 435, 933-936 Krueger and Ohrnberger (2005) Nature, 435, 937-939