

A Shallow Interplate Coupling Model in The Java Trench, Off The Western Coast of Java, Indonesia, Revealed from GPS Data

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Shallow thrust earthquakes producing tsunami earthquakes have been occurring along the Java subduction zone, for example the 1994 M7.8 Banyuwangi Earthquake and the 2006 M7.7 Pangandaran Earthquake. We investigate whether interplate coupling is apparent in the shallow part of the Java Subduction off the western coast of Java, Indonesia, where no large interplate earthquake ($M > 7$) are recorded. We use 3 years data of 13 stations of the Indonesian Permanent GPS Station Network (IPGSN) in 2008-2010. We processed GPS phase data using Bernese GPS Software 5.0 and derive the site velocities by linear fitting of the coordinate time series. The majority of the calculated horizontal and vertical velocities show 2.4 to 14.7 mm/yr and -7.0 to 14.5 mm/yr, respectively, with an average white noise error of 0.3 and 0.9 mm/yr, respectively, at 95% confidence level. We interpret the main source of the observed velocity in West Java resulting from contribution of interplate coupling on the main thrust zone and the contributions postseismic effects from the 2006 Pangandaran Earthquake. With current results, we estimate (1) an interplate coupling in the shallow part of the subduction plate, adjacent to the western boundary of the 2006 Pangandaran Earthquake, with a slip deficit rate of ~ 5.8 cm/yr, length ~ 300 km, in depth with a range of 6 \sim 20 km, which is equivalent to 87% coupling; and (2) an afterslip with a rate of 7.8 cm/yr, length ~ 300 km, in depth with a range of 20 \sim 35 km, adjacent to the deeper boundary of the ruptured area of the 2006 Pangandaran Earthquake. The shallow coupling might indicate a plausible occurrence of a tsunami earthquake such as demonstrated by the 2006 Pangandaran Earthquake. It is also not impossible to occur a megathrust earthquake such as the 2004 M9 Aceh-Andaman and the 2011 M9 Northeast Japan Earthquake.

Keywords: Shallow subduction earthquake, Interplate coupling, Afterslip, Slip deficit, Java Trench, GPS measurement