

Geodetic estimate of convergent plate motion in the Philippines-eastern Indonesia deformation zone

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Convergent plate motion of about 10cm/yr between the Philippine Sea plate (PH) and the Sundaland plate (SU) has been taken up by multiple subductions at several trenches around the Philippines and eastern Indonesia, being accompanied with high seismic activity and internal deformation. We investigate crustal deformation field in this region using displacement rates from yearly GPS campaign measurements in the period from 1997 to 2003. In each campaign measurement, 8-16 sites were occupied for one to two weeks, including small islands on the Molucca Sea between Mindanao and Sulawesi. We applied the Precise Point Positioning module of GIPSY-OASIS II for GPS data processing to avoid long-distance baseline analyses because no global reference stations were present in the vicinity of the local observation network. In estimating displacement rates from coordinate change of the GPS sites, we corrected coseismic jumps of the coordinates due to the occurrence of earthquakes nearby. Coseismic displacements were calculated for 20 earthquakes (M_w larger than 6.5) using seismic moment and focal mechanism on the Harvard CMT catalog and corrected them to the site coordinate change when they exceeded 1mm. Displacement rates of GPS sites thus estimated were converted to those in a SU-fixed reference frame using Euler vector proposed by REVEL (Sella et al., 2002).

We roughly estimate slip partitioning of the convergent plate motion of PH relative to SU assuming that relative displacement rate between two GPS sites may result from plate convergence at the boundary located between two sites. In western off the Philippines, convergence rates decrease from north toward south such as 6.7cm/yr, 3.8cm/yr, and 2.6cm/yr at the Manila Trench, Negros Trench, and Cotabato Trench, respectively. In eastern off the Philippines, on the other hand, convergence rates increase from 4.0cm/yr at the northern Philippine Trench to 5.8cm/yr at the central part. Southern Philippine Trench seems linked to the Halmahera Trench in the Molucca Sea and our estimate shows that convergent plate motion in the southern part is mostly taken up at the Halmahera Trench.