

Seafloor geodetic survey in Taiwan

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Taiwan is located within complex subduction boundaries with different polarities and a collision front with a convergence rate of about 80 mm per year or more. In the northeast of the region, the Philippine Sea plate is subducting from the Ryukyu trench while a backarc basin is rifting along the Okinawa trough with a high rate of 2-3cm per year. Moreover, on the southwest of Taiwan Eurasia plate is subducting beneath the Philippine Sea plate. Between these two subduction zones, the Philippine Sea and the Eurasia plates are colliding and large deformation has been absorbed in the eastern coastal zone of Taiwan. Hence, the internal deformation has been anticipated in the Philippine Sea Plate fronting the collision region. However, although Taiwan is comparable to Kyushu Island, its deformation rate and seismic activity are several times higher than the average of Japanese Islands. Considering Taiwan tectonic location and known high rate of deformation, records of large tsunami damage over the region in the last hundred years is almost nothing. However, large tsunami inundation reports in historical documents are found in southern Taiwan in 1781 and in the northwestern part in 1867 (CWB). These events could be very large earthquakes that had occurred under the sea with very long recurrence interval. These earthquakes are most probably low-angle reverse fault in the interface of subduction zone. To move a step forward from these hypotheses, this study proposes the use of the seafloor crustal deformation observation to solve this issue effectively.

In order to monitor crustal deformation around Taiwan areas, a set of three seafloor units was installed at each of two sites in the fall 2008. The 1st site is at an intermediate point between the Yilan plain and Yonaguni Island at depths of 1000 to 1300 m on the ridge of the western extension of Ryukyu Islands. The 2nd site is 85km east of Hualian at depths about 3700m. Seafloor units were installed at three vertices of a regular triangle with a distance of 700m (first site) and 2500m (second site). Due to a malfunction on one of the three seafloor units, only two sets are utilized at each site. The research vessels of OR1 and OR2 are most suitable for the present purpose. In particular, OR1 is equipped with a hull-mounted transducer. However, since both vessels schedules are extremely hectic, other pressure fishing boats were utilized for the present purpose. To complete the observation system, an onboard transducer and three dual-frequency GPS antennae were attached to the vessel or a buoy to measure slant ranges and to monitor the vessel or the buoy position and attitude. In case of pressure boats, the observation time is limited since it must return to their mother port within 48 hours after the departure as the law requires.

At this moment, a third unit will be deployed at each of the above two sites to complete the triangle array. In addition, a plan to deploy another site is underway in southern Taiwan to complement the two existing setup.