Active Fault Observation and Research on Earthquake Potential in Taiwan

Lin Chao-Chung
Central Geological Survey, MOEA
E-mail: lincc@moeacgs.gov.tw

Abstract

The Island of Taiwan comprising complex tectonic structures and frequent earthquakes is located at the convergent boundary betwen the Eurasia Plate and the Philippine Sea Plate. Since the Chi-Chi earthquake, considerable amounts of manpower and resources have been allocated to investments for active fault investigation and to enhance international cooperation. It has greatly enriched and enlarged our concept of investigation and vision. The central theme of investigation, which began with detailed mapping of active faults, has been supplanted with relevant attributes of fault characteristics, fault slip rate, and paleoearthquake studies and, recently, integration with several aspects of active fault monitoring research, in order to achieve a holistic comprehension of earthquake geological investigation.

Recent years have seen great improvements in the precision mapping of active faults, resulting in the publication of regional geological strip maps of active faults on a scale of 1 to 25,000. It has been providing important and basic information for large engineering and civil construction projects, migration of hazard reduction, and land demarcation. To monitor fault activity, the Central Geological Survey (CGS) has since 2002 begun to install one thousand plus GPS observation points and 41 approximately 1000 km long baselines which straddle active faults. Every year repeated measurements have been conducted to cover large areas. Since 2004, continuous GPS station networks have been installed, up to 70 thus far. They have been compiling and analyzing data from approximately 200 observation stations (including exchanging station with other organizations), in an attempt to integrate the information from the moving fields of horizontal and precise leveling for a better understanding of surface deformation during pre-seismic, co-seismic, and post-seismic periods. Further information on short term slip rate and fault-slip pattern could also be obtained. In addition, the CGS has also installed 8 geochemical observation stations and 13 underground borehole strainmeter stations to obtain data for integrated analyses. These results could provide important information on the evaluation of fault movement potential and activity.

Analysis of recent geodetic data has shown considerable variation in surface deformation, as a result of plate convergence between the Philippine Sea plate and the Eurasia Plate. The largest value of the horizontal velocity field relative to the Penghu, Peisa stations (S01R) was found in the Huatung area, trending NNW at about 6 to 8 cm per year. In the Kaoping area, the velocity field is about 5 to 6 cm per year with values decreasing from south toward west- and northeast. As for the coastal and northern areas, displacements due to the velocity field are mostly less than 1 cm per year. The I-Lan area, being affected by the expanding Okinawa Trough, has its velocity field swung towards the southeast. On the leveling data, most of the uplifted areas are located at the Central Range and the

southern section of the Coastal Range. In the southwestern coastal area, obvious subsidence could be detected, probably caused by the over-pumping of groundwater.

Based on the distribution of major active faults and their recent slip rate, together with earthquake activities data, the CGS has employed the block faulting model to emulate fault activity in the Taiwan region and to assess the potential of earthquake faulting. In the near future, it will look closely at surface deformation and integrate data from borehole drilling, geophysical exploration, trenching and paleosiesmic investigation, in order to strengthen and to establish a seismic risk assessment model. We look forward to have in place a realistic assessment of the risk of individual active faults and disastrous earthquakes, thereby attaining the goal of earthquake hazards prediction, prevention and reduction.