



Active Fault Motion and Deformation of the Taiwan Orogen

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Understanding active fault motion and associated surface deformation is fundamental for analyzing seismic hazards and inferring seismotectonics. In the Taiwan area, crustal faults and other active structures basically accommodate full plate convergence, resulting in fast fault-slip rates and rapid crustal deformation. Therefore, it is indeed an important task to assessing fault motion and surface deformation in the Taiwan area. Before 90s', the studies for such topic were rather preliminary, and the techniques were also limited to mostly terrestrial geodesy. With the significant developments of geodetic and geospatial approaches since 90s' as well as the emergent need after the 1999 Chi-Chi earthquake, scientists have started to characterize the motion and deformation of active faults in Taiwan based on various datasets with high spatial and temporal resolution, which enabled exciting progress in recent decades.

In the last three decades, varied geodetic approaches has demonstrated powerful ability to characterize surface deformation associated with active faults and other non-tectonic motion. about 500 continuously GNSS stations installed by Academia Sinica, Central Weather Administration, Geological Survey and Mining Management Agency, and the ministry of Interior as well as more than 1,000 campaign GNSS stations provide high-precision 3D observations on surface deformation. Vertical observations from precise leveling also provide constraints on surface uplift and subsidence. In addition to ground observations, imaging geodesy from optical and synthetic aperture radar (SAR) images. Interferometric SAR (InSAR) and image analysis algorithms can help estimate surface displacements for earthquakes and other events. By integrating displacement observations by using different methods, we are able to resolve high-resolution 3D surface displacement fields. On the other hand, multi-temporal InSAR techniques provide line-of-sight (LOS) observations on surface velocities with high spatial coverage. By combining the LOS and GNSS observations, the integrated velocities and geodetic time series reveal steady and transient deformation within the interseismic period. The great development of the geodetic and remote sensing techniques in Taiwan has shown strong applications in active tectonics and seismic hazards.