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# Development of the measuring method for the deformation by photogrammetry, A case study of the Chelungpu fault, Taiwan

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We have tried to estimate the amount of coseismic displacements on a fault, analyzing the tectonic geomorphology along an active fault. We tried to measure topography profiles on photogrammetry method in order to compare the deformation pattern and amount of the surface rupture and long term geomorphology, and then calculate the coseismic deformation. However, coordinates of GCP positions before the earthquake which are very important for accurate measurement are unknown. We tried to orient the GCP on aerial photograph before the earthquake by following three methods.

The 1999 Chichi earthquake was selected as a case study. We used aerial photograph taken in 1987 and stereoscopic SPOT satellite imagery taken in 2004.

Method 1: Reading coordinates on large scale photographic map.

We measure GCPs positions on the 1/5,000 photographic map by hand. Because the photographic map is based on 1987 aerial photograph, it has good resolution for vertical. But it has poor accuracy for horizontal coordinates, because it is difficult to indicate the exact location of GCP on the map.

Method 2: Reading coordinates on SPOT satellite imagery.

Since there is little distortion in each SPOT satellite image as compared with an aerial photograph, we can read coordinates on Spot image relatively accurate. However these data are coordinates of after the earthquake and it include coseismic deformation. In order to decrease the error of measurement near by the active fault, we set the GCP far away from the active fault.

3: Reading coordinates on SPOT satellite imagery and then correct it with observed deformation data.

As for this method, GCPs in the method 2 are added offset by observation data, which are measured across the surface rupture or crustal movement by GPS observation.

The aerial photograph was oriented by each method, and the surface profile on the same line was measured on each oriented aerial photograph and compared. There is not much difference between the three. Next, the same profile was measured on the SPOT image and calculated difference between aerial photograph and SPOT profiles. The displacement values are largely similar to observed displacement in the field.

Then, distribution of the amount of displacement along a Chelungpu fault was measured by this method, and the amount of average slip rate was estimated.

Keywords: active fault, surface rupture, Chelungpu fault, photogrammetry, SPOT image, Taiwan