Geophysical Research Abstracts
Vol. 16, EGU2014-10962, 2014
EGU General Assembly 2014

Deciphering cumulative fault slip vectors from fold scarps: relationships between long-term and co-seismic deformation at the piedmont of the Taiwan fold-and-thrust belt

Maryline Le Beon (1,2), John Suppe (1), Manoj Jaiswal (1,3), Yue-Gau Chen (1), and Michaela Ustaszewski (1)

(1) Department of Geosciences, National Taiwan University, Taipei, Taiwan (mlebeon@gmail.com), (2) Institute of Earth Sciences, Academia Sinica, Taipei, Taiwan, (3) Department of Earth Sciences, Indian Institute of Science Education and Research, Kolkata, India

We document the 30-ka cumulative slip history and long-term slip vector azimuth on the Northern Chelungpu fault based on a series of fault-bend folded alluvial terraces and draw quantitative relationships between geological structure, deformation observed from the geomorphology, and coseismic displacements during the 1999 Mw=7.6 Chi-Chi earthquake. In our study area, three main terrace levels show progressive folding by kink-band migration in relation to the underlying fault geometry, forming a main N-S fold scarp up to $\sim$193 m high and secondary E-W scarps. Detailed analysis using 5-m resolution DEM allows us to characterize the scarp morphology and quantify the deformation parameters, namely terrace heights, fold scarp relief, and fold limb width and slope angle. The 3D deformation of the highest terrace, OSL-dated at 30.2 $\pm$ 4.0 ka, enables to simultaneously determine amplitude and azimuth of the long-term slip vector based on scarp relief. The long-term slip vector, oriented N338° $\pm$ 6°, is found to parallel the Chi-Chi coseismic displacements in this area. Cumulative slip and dating results yield a constant slip rate of 17.7 $\pm$ 2.2 mm/a in the direction N338° $\pm$ 6°, which represents $\sim$16% of total shortening across the mountain belt. Late Quaternary shortening rates observed at four sites vary along-strike in similar proportion to Chi-Chi coseismic displacements. Together with the colinearity of long-term and coseismic slip vectors at our study site, this suggests that Chi-Chi earthquake is a characteristic earthquake for the Chelungpu thrust with recurrence interval $\sim$440 years. We also discuss implications for the regional and long-term distribution of shortening in the central Western Foothills.