TO Brownbag Seminar
February 12, 2013
Marion Thomas

Spatial and temporal evolution of fault slip on the longitudinal valley fault, Taiwan

The Longitudinal Valley Fault (LVF) in Eastern Taiwan is an exceptional example of a fault with high slip rate that produces both seismic and aseismic slip. This particular fault accounts for more than a third of the 9 cm/yr oblique convergence rate across Taiwan. Deformation of anthropogenic features shows that aseismic creep accounts for a significant fraction of fault slip near the surface whereas a fraction of the slip is also seismic since this fault has produced large earthquakes (Mw>6.8) in 1951 and 2003. In this study, we analyze a dense set of geodetic and seismological data around the LVF including campaign-mode GPS measurements, times-series of daily solutions for continuous GPS stations (cGPS), accelerometric records of the 2003 Chenkung earthquake, and levelling data. To enhance the spatial resolution provided by these data we complement them with inSAR measurements produced from a series of ALOS images processed with the permanent scatter technique. The data, which cover the entire LVF and span the period from 1994 to 2010 are inverted for the temporal evolution of fault slip a depth using the Principal Component Analysis base Inversion Method (PCAIM). The technique allows the joint inversion of these diverse data, thus taking the advantage of the spatial resolution given by the inSAR data and the temporal resolution afforded by the cGPS data. We find that 1- seismic slip during the 2003 Chengkung earthquake occurred on a fault patch which had remained locked to a certain degree in the interseismic period; 2- the seismic rupture propagated partially into a zone of shallow aseismic interseismic creep but failed to reach the surface; 3- that aseismic afterslip occurred around the ruptured area. The study allows estimating the fault slip budget (the fraction of aseismic and seismic slip) over the seismogenic depth range, and placing constraints on the fault frictional properties and their variations with space.