Geophysical Research Abstracts
Vol. 14, EGU2012-8568-3, 2012
EGU General Assembly 2012

Slow late quaternary slip rate and long earthquake recurrence time along the Fuyun fault, Xinjiang, China

M. Etchebes (1), P. Tapponnier (1), Y. Klinger (2), J. Van Der Woerd (3), X. Xu (4), S. Xinzhe (4), T. Xibin (4), M. Rizza (1), and T. Lok Hang (1)

(1) Earth Observatory of Singapore, Singapore (metchebes@ntu.edu.sg), (2) IPGP, France, (3) EOST-IPGS, France, (4) Institute of geology, Beijing, China

High-resolution Quickbird satellite images were used to map co-seismic slip distributions along the rupture of the Ms 7.9, 11/08/1931, Fuyun earthquake in Northern Xinjiang. This 160 km long right-lateral surface rupture is divided into 3 main segments. 290 geomorphic offset reconstructions constrain the average, 1931 co-seismic displacement to be 6.3 $\pm$ 1.2m. 263 measurements reveal co-located offsets that are two to five-fold multiples of the 1931 offset and are interpreted as cumulative offsets. Thus, 4 more seismic events with a similar amount of slip can be defined. These results imply that earthquake ruptures on the Fuyun fault follow a characteristic seismic behaviour.

To constrain the Late-Quaternary slip-rate along this fault, which follows the western boundary of the Altai range in a region that accommodates distal deformation related to the ongoing collision between India and Asia, we dated displacements of well-preserved landforms at 4 sites. The Quickbird offsets were validated with terrestrial LIDAR topography and field mapping. Several alluvial surfaces were dated with cosmogenic exposure 10Be dating of Quartz-rich boulder fragments and pebbles. Using the youngest abandonment age (20 $\pm$ 4 ka, 34 $\pm$ 2 ka) of the surface into which the deepest and most offset (23 $\pm$ 0.6 m, 30.6 $\pm$ 1.2 m) stream channels are incised yields a maximum, average horizontal slip rate of 1$\pm$0.2 mm/yr. To a first order, this rate is consistent with rates obtained on other NW-SE trending, dextral strike-slip faults on the other side of the Altai and with the current rate of convergence inferred from GPS across the entire Altai range ($\sim$5 mm/yr). A characteristic slip of 6.3 $\pm$ 1.2 m, combined with the long-term slip rate, implies that great earthquakes rupture this segment of the fault with a minimal return time of 6.3 $\pm$ 2.5 ka, indicative of a remarkable resilience of earthquake generated landforms in a fairly arid climate.

Using high-resolution terrestrial LIDAR topography and fan surface ages (between 56 $\pm$ 3 and 76 $\pm$ 2 ka), we also estimate a vertical throw rate of 0.09 $\pm$ 0.02 mm/yr along the Karaxingar thrust, on the west side of a 1900 m-push-up mountain along the central segment of the fault. This rate is only about 10% of the main horizontal slip component. Profiles across the LIDAR DEM indicate that the maximum uplift of the fan surfaces may have accrued in about 8 seismic events, each with a co-seismic slip of $\approx$ 1 m, again indicative of characteristic slip. Dating at more sites including depth profiles are in progress to test such results.