CO-Seismic ruptures of the 2001 Ms 8.1 Central Kunlun earthquake, Tibet, revealed by IKONOS imaging data

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The magnitude Ms 8.1 (Mw 7.8) Central Kunlun earthquake occurred on 14 November 2001 in the central Kunlun mountains, north Tibet (Lin et al.,2002). Field observations show that a 400-km-long strike-slip surface rupture zone with a left-lateral strike-slip displacement up to 16.3 m occurred along the pre-existing strike-slip Kunlun fault. Both the rupture length and maximum displacement are the largest in intracontinental earthquakes. However, the details of geometry and spatial distribution of the 400-km-long co-seismic rupture zone are still unclear due to the difficult conditions in the study area located in the remote high mountains at an average elevation of higher than 4500 m where it needs special equipment to do the field investigations. The purpose of this study is to identify the geometric structures, spatial and displacement distributions of the co-seismic surface ruptures by using high-resolution SPOT (10 m-resolution) and IKONOS (1 m-resolution) images taken before and after the earthquake.

Analyses of the high resolution Ikonos images reveal that the co-seismic rupture zone is mainly composed of distinct shear faults, en-echelon extensional cracks, and mole tracks along the pre-existing Kunkun fault, which are distributed in a zone with width raging from a few meters to several km. The extensional cracks concentrated in the rupture zone generally show a right-stepping echelon pattern, and are oblique to the general trend of the rupture zone with 40-70 degree angle, indicating a left-lateral shear sense. The mole tracks were generally developed on the alluvial fans, and river water was frozen to ice capped on the current stream channels, which formed a linkage row with the distinct shear faults and the extensional cracks. The displacements measured from the IKONOS images show a distribution pattern similar to that observed in the field (Lin et al., 2003).

The analytic results of high resolution remote sensing images and geologic and topographic evidence clearly show that spatial displacement distributions and geometry of the co-seismic surface ruptures are controlled by the pre-existing geological structures of the strike-slip Kunlun fault.

References:

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