

Coseismic Deformation of the 2010 Yushu Earthquake from PALSAR Interferometry

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We present a map of the coseismic displacement field resulting from the 2010 April 14 Yushu, Qinghai, China earthquake. Raw radar signal data from the ALOS PALSAR acquired before and after the earthquake are used to generate a high-resolution, wide area map of the displacements by the two-pass differential interferometry method. We developed some programs, which enable GISAR to process PALSAR ScanSAR data in Level 1.0. A ScanSAR - ScanSAR interferogram as well as an FBS (Fine beam single polarization; Strip-map mode) - FBS interferogram shows line-of-sight (LOS) displacements, respectively (Figures 1 and 2). We find: (1) crustal deformations are concentrated in the area between Yushu and about 65 km WNW of Yushu; (2) the maximum LOS displacement is about 56 cm between 10 km and 20 km WNW from Yushu; (3) the maximum left-lateral relative displacement is 136 (preliminary) cm calculated from the 2.5D analysis using the two interferograms; (4) earthquake source fault reached to the surface along a line between Yushu and about 30 km WNW of Yushu. We created an interferogram using 17/04/2010 and 02/09/2010. This interferogram has good coherence and indicates that the magnitude of postseismic deformation is less than ~1 cm of noise level.

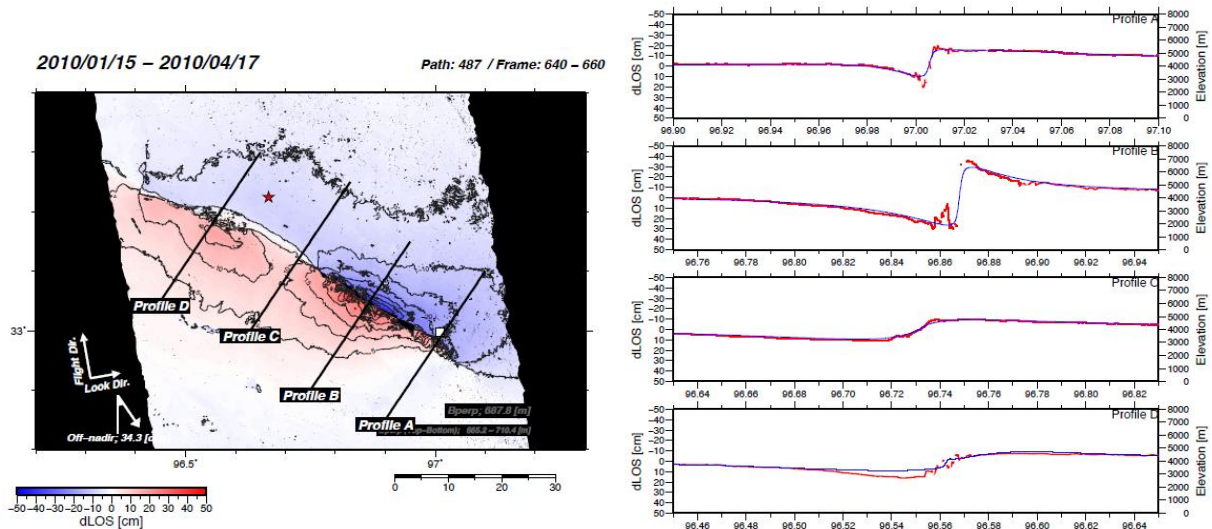


Fig. 1. Comparison between calculated and observed profiles of ascending data. (left) four profiles and unwrapped interferogram of the FBS data, (right) calculated profiles in blue and observed in red.

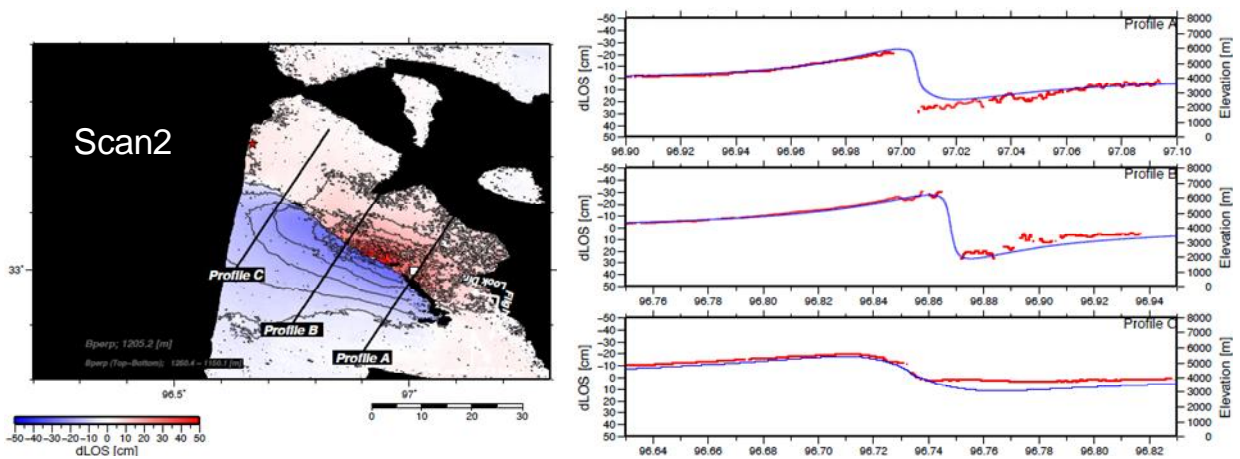


Fig. 2. Comparison between calculated and observed profiles of descending data. (left) three profiles and unwrapped interferogram of the ScanSAR data, (right) calculated profiles in blue and observed in red.

We inverted the two interferogram data to estimate slip distribution (Figure 3). The fault geometry is assumed to be a vertical segmented fault by trial-and-error fitting the surface break in the interferograms. A preliminary fault model suggests 1) a total fault length of ~ 70 km; 2) a left-lateral strike slip; 3) two slip peaks near the epicenters and Yushu; and 4) a maximum slip amount of ~ 2.6 m. Calculated fringe patterns and profiles (Figures 1 and 2) along nearly perpendicular lines to the fault from the model are consistent with the observed ones. We will also present comparison with field studies.

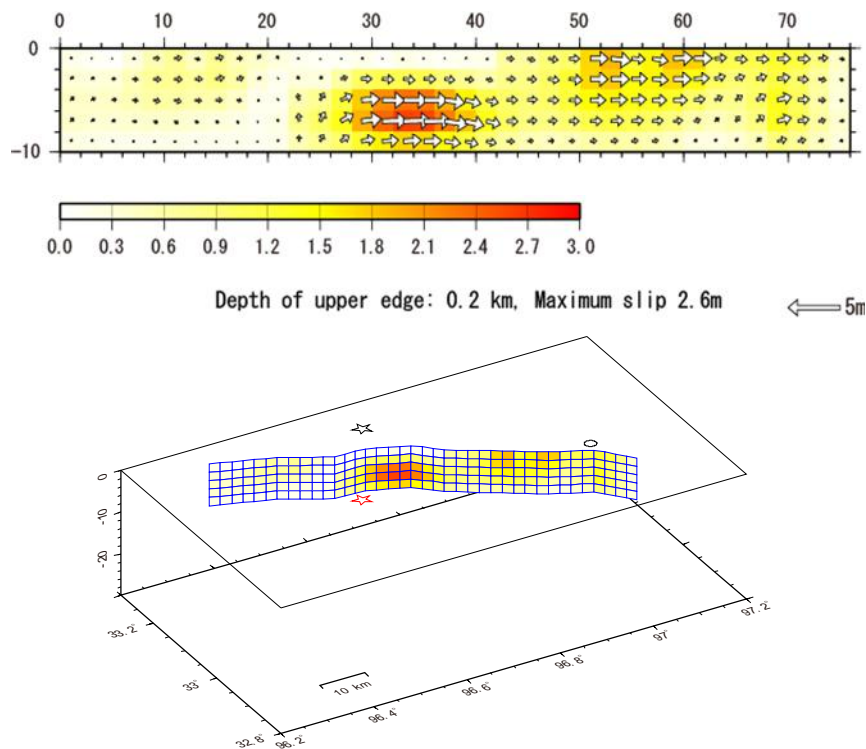


Fig. 3. Fault model and slip distribution of the 2010 Yushu earthquake inferred from PALSAR interferograms.