The Mw7.6, Manyi (Tibet) Earthquake: Co-seismic Slip Solution and Post-seismic Relaxation Processes From ERS InSAR Data

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ERS2 radar data acquired before and after the Mw7.6, Manyi (Tibet) earthquake of November 8, 1997, provide geodetic information about the surface displacement produced by the earthquake and post-seismic processes occurring in the 2 years following the event. The co-seismic data reveal a smooth, N78E, ~170 km long surface rupture following the trace of a quaternary fault visible on satellite images. The inferred sense of slip is left-lateral, consistent with slip on the EW plane of the Harvard CMT solution. The fault slip distribution derived from the interferometric map is bimodal: a main event ruptured the 130 km-long eastern section of the fault with a maximum slip of 7 m, a sub-event ruptured the western 40 km-long section of the fault with up to 2.6 m of slip. Fault slip solutions obtained by inversion of interferometric map using the simulated annealing and the singular value decomposition approaches indicate that the rupture extended to a depth of ~15 km with a maximum slip of 7 to 8 m occurring between the depths of 4 and 8 km. SAR interferograms spanning intervals 0.38 yr, 0.67 yr, and 1.92 yr after the earthquake show up to 3.4 cm, 4.0 cm, and 6.7 cm of relative range displacement between the two sides of the fault, respectively, in a direction consistent with left-lateral slip on the fault. The data could be fit almost equally well with logarithmic and exponential time functions, implying relaxation times of ~100 and ~210 days, respectively. We interpret the observed post-seismic displacement field as the result of afterslip on deep sections of the fault, visco-elastic relaxation in the lower crust and upper mantle, and poro-elastic rebound in the near-field of the fault.