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The Application of InSAR and Other Geodetic Observation for Crustal Deformation Induced by Chi-Chi Earthquake, Central Taiwan

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The Mw=7.6 Chi-Chi Earthquake occurred on September 21, 1999 in Central Taiwan and made surface rupture along the Chelungpu Fault. We apply InSAR technique to measure the coseismic and postseismic deformation in the footwall of the Chelungpu Fault after Chi-Chi Earthquake. The 2-pass method is used to obtain interferograms form DEM data and 8 ERS-1/2 SAR images passing central Taiwan between February 1999 and August 2000. The result of D-InSAR (Differential-InSAR) reveals the significant coseismic deformation on the footwall area of the Chelungpu Fault along the line of sight of ERS satellites, which is named as the slant range displacement (SRD). The coseismic SRD on the footwall of the Chelungpu Fault demonstrates a difference of 33.6 cm form the coastal area to the western side of the fault. This observation shows the maximum coseismic uplift is close to the west side of the fault. The postseismic interferogram shows no significant postseismic slip on the footwall of the Chelungpu Fault. However, a significant land subsidence area of 10 mm is detected near the Changhua County. In addition, we recalculate the coseismic GPS observations on the footwall of the Chelungpu Fault into the SRD in order to compare with the deformation pattern of D-InSAR. We also try to exploit 3-D dislocation models based on Poly3D code by using the same fault geometry of a ramp-décollement model suggested by Johnson et al. (2003). Thus the coseismic deformation inferred from this dislocation model can be transferred into the deformation pattern so as SRD. The results of the simulated intergerograms show the same trend as those from our results from D-InSAR, which can be interpreted the geological structure beneath this area.