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Coseimic and postseismic deformation of the Chi-Chi earthquake revealed by SAR interferometry and geodetic observations

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The Mw = 7.6 Chi-Chi Earthquake occurred on 21^{st} September 1999 in Central Taiwan and resulted in a $\sim$100 km surface rupture along the Chelungpu Fault. We apply InSAR technique to measure the coseismic deformation in the footwall and postseismic both in footwall and hanging wall of the Chelungpu Fault. The 2-pass method is used in this study in order to obtain 9 interferograms from 11 ERS-2 SAR images that passing through 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 in the line of sight direction of the 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 $\sim$22 cm from the coastal area to the western side of the Chelungpu Fault. And this observation also shows that the maximum coseismic uplift is close to the western side of the fault. The post-seismic interferogram shows no significant post-seismic slip on the footwall of the Chelungpu Fault. However, there were more than 20 cm SRD uplift at the hanging wall in about 320 days after the Chi-Chi Earthquake. These uplifts can be observed on the Shinshou, Tsaotun, and Chi-Chi towns, which are located on the northern, middle, and southern parts of the Chelungpu Fault, respectively. In addition to the SAR interferograms, we recalculate the coseismic GPS observations on the footwall of the Chelungpu Fault into SRD so that can be compared with D-InSAR. In order to obtain a surface deformation field in stead of the pointwise GPS observations, we tried to exploit 3D dislocation models based on Poly3D code by assuming the ramp-décollement Chelungpu Fault 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. And the results of the simulated interferograms show the same trend as those from our results from D-InSAR, which can be interpreted the geological structure beneath this area.