Geophysical Research Abstracts
Vol. 19, EGU2017-3522, 2017
EGU General Assembly 2017

Direct and array observations for near source dynamic strain during large earthquakes

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The seismic ground motions from the 1999 Chi-Chi Taiwan earthquake (ML=7.6) and it large aftershocks were well recorded by a dense seismic array (named the Hualien Large Scale Seismic Test, HLSST) in near source distances. The HLSST site was situated in the the site of Hualien Veteran's Marble Plant. It included one scaled down reinforced concrete cylindrical containment model (1/4 scale). The radius of this cylindrical model is of about 5.4 meters. The instrumentation of this program consisted of forty-two stations. They were fifteen surface accelerometers, twelve downhole accelerometers and fifteen containment structure response accelerometers. The fifteen free-field stations were installed at three arms. The twelve downhole accelerometers were distributed beneath this array. One delta ground strain gauge was commonly installed in this site and well recorded those events.
In this study, we inferred ground strains by a least-squares fit of array translational ground-motion data using the method proposed by Spudich et al. (1995) and Spudich and Fletcher (2008) and the same as from strain gauge records. We analyzed the main shock and November 1 offshore event for ground rotations and the same as ground strains. We will discuss the relationship of observed spatial ground deformations with source rupture processes and onsite ground translations. We hope to discuss its implications also about earthquake engineering applications.