Geophysical Research Abstracts
Vol. 13, EGU2011-14231, 2011
EGU General Assembly 2011

The Christchurch M_w 6.3 earthquake: Rupture processes play a strong role in high Peak Ground Acceleration

Bill Fry, Rafael Benites, Martin Reyners, Caroline Holden, Stephen Bannister, Anna Kaiser, Charles Williams, Matt Gerstenberger, and John Ristau

GNS Science, Lower Hutt, New Zealand (b.fry@gns.cri.nz, r.benites@gns.cri.nz, m.reyners@gns.cri.nz, c.holden@gns.cri.nz, s.bannister@gns.cri.nz, a.kaiser@gns.cri.nz, c.williams@gns.cri.nz, m.gerstenberger@gns.cri.nz, j.ristau@gns.cri.nz)

On September 4, 2010, a surface-rupturing crustal earthquake (M_w 7.1) struck the Canterbury Plains region in New Zealand's South Island (Gledhill et al., 2011). The Canterbury Plains is a region of relatively low seismicity in New Zealand and the structure that ruptured was a previously unmapped fault. Compared to the average New Zealand aftershock decay model, the aftershock sequence was relatively under-productive for the first 5 months.

On February 22, 2011, an M_w 6.3 aftershock occurred within kilometers of the city of Christchurch. The earthquake resulted in about 3 meters of oblique-thrust slip on a south dipping fault beneath a volcanic edifice that defines the southern extent of the city. It occurred on a fault that experienced a slight (approx. 0.15 MPa) Coulomb failure stress increase as a result of the M_w 7.1 event. Recorded peak ground acceleration (PGA) in the city exceeded 2g. Many of the poorly consolidated, low shear-wave velocity soils liquefied during the shaking. The dense strong motion network recorded numerous sites that liquefied with less than 0.5g peak horizontal accelerations. A number of factors contributed to the strong shaking. However, most of the observations can be explained by the combination of a few dominant source effects: 1) the high amount of energy released in the earthquake, 2) the direction of energy release combined with the effects of high rupture velocity 3) a trampoline effect, and 4) the proximity of the earthquake to the city. We will present results of seismological observations and numerical simulations to support these claims.

The dense data from the February 22^{nd} earthquake has provided us with the valuable opportunity to study the rupture process in fine detail and understand its relative effects on recorded ground motions. To this aim, numerous ongoing studies aim to use novel numerical techniques to better define the physics of the rupture, the effects of wave propagation through a heterogeneous earth, and the near surface processes that contribute to wave amplification in the frequency bands that affect the build environment.