ULTRA-LONG DURATION OF SEISMIC GROUND MOTION ARISING FROM A THICK, LOW VELOCITY SEDIMENTARY WEDGE

Yoshihiro KANEKO [1], ***Yoshihiro ITO*** [2], ***Bryant CHOW*** [3], ***Laura WALLACE*** [1], ***Carl TAPE*** [4]

[1] Tectonophysics, GNS Science, Lower Hutt, New Zealand

[2] DPRI, Kyoto University, Uji, Japan

[3] School of Geography, Environment and Earth Sciences, Victoria University of Wellington, Wellington, New Zealand

[4] Geophysical Reserach Institute, University of Alaska - Fairbanks, Fiarbanks, USA

Sedimentary basins are known to amplify and increase the duration of ground motions that accompany earthquakes. A similar phenomenon is expected but not as well documented in low seismic-velocity accretionary prisms along subduction margins. In this study, we report anomalously long duration of long-period ground motions observed in the North Island of New Zealand during seismic wave propagation from the M7.8 Kaikoura earthquake 600 km away. Unique waveform data captured by strong-motion, high-rate GPS, and ocean bottom pressure sensors reveal that long-period ground motions lasted longer than 450 seconds in the northeastern North Island. These waveforms indicate one of the longest durations of long-period (10 seconds and longer) ground motions ever recorded at similar epicentral distances for comparable, large earthquakes. To understand the underlying mechanism, we use numerical simulations of seismic wave propagation. We find that a velocity model that includes an accretionary prism, modeled as a large-scale (approximately 30,000 km x km) wedge characterized by extremely low seismic wavespeeds, can explain the observed long durations of long-period ground motions, as the reverberations of seismic waves within the low-velocity wedge. We show that the long duration of long-period ground motions leads to prolonged dynamic stressing on the plate interface, likely accentuating the triggering of slow slip that occurred following the Kaikoura earthquake. Accretionary prisms characterized by extremely low seismic velocities may enhance the generation of tsunami earthquakes and dynamic triggering of slow slip events observed in the northern Hikurangi and other subduction margins.