

## Quantifying the seismic response of slopes: observed and modelled amplification from the Port Hills of Christchurch

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**ABSTRACT:** Before the Christchurch 2010/11 earthquake sequence the influence of site effects on landslide triggering during earthquakes was reported in many studies, but evaluating these effects has been difficult through lack of high-resolution data, especially the lack of local ground motion instrumental observations. As a result of the Christchurch 2010/11 earthquake sequence we now have high temporal and spatial resolution data, including subsurface geotechnical and geophysical information that allows quantification of the amplification relationships between the near surface geology, topography and seismic inputs.

This paper presents preliminary results on site effects in the Port Hills of Christchurch caused by near surface material impedance contrasts and slope morphology. Results from small scale temporary arrays installed on several of the large rock slopes that failed repeatedly during the earthquakes suggest amplification factors of up to 300% of peak ground acceleration when compared to free field rock outcrop peak ground accelerations. These are corroborated not only by two dimensional seismic site response analyses using synthetic earthquake motions as inputs to the models but also by comparing recorded ground motions from borehole and surface seismometers.

Based on these findings it is apparent that particular slope shapes and material contrasts can significantly amplify peak ground accelerations during earthquakes. At present in New Zealand such amplification effects are not routinely taken into account when designing earthworks or structures on slopes or in landslide risk assessments.

**Keywords:** Earthquake induced landslides, topographic amplification, earthquake hazards