2014 SCEC Annual Meeting (7-10 September), Palm Springs California

A 3D seismic velocity model of Canterbury, New Zealand for broadband ground motion simulation

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Abstract

This poster presents the on-going development of a new 3D seismic velocity model of Canterbury, New Zealand. The intention of the model is to provide the 3D crustal structure in the region at multiple length scales for seismic wave propagation simulations, such as broadband ground motion and shallow site response analyses related to understanding the ground motions and site responses during the 2010-2011 Canterbury earthquakes. Basement rock properties are controlled by 3D regional tomographic data with a variable-depth Moho. Basement depth and shallower sedimentary and volcanic rock horizons are calculated based on the reinterpretation of a relatively comprehensive network of seismic reflection surveys from seven different campaigns over the past 50 years, as well as point constraints across an array of petroleum industry drill holes. Particular attention is also given to the representation of shallow (z>250m) stratigraphy in the model. Seismic velocities are obtained from seismic reflection processing (for Vp) and also recently performed active and passive surface analyses (for Vs). Over 1,700 water wells in the region are used to constrain the complex inter-bedded stratigraphy (gravels, sands, slits, organics etc) near the coastline, including urban Christchurch, which has resulted from fluvial deposition and marine regression and transgression in the Quaternary. For the surficial Springston and Christchurch Formation geologic layers in the Christchurch urban area (z<50m), high-spatial resolution seismic velocities (including Vs30) were obtained from over 15,000 cone penetration tests combined with a recently developed CPT-Vs correlation.