Shallow ambient-noise 3D tomography in the concepción basin, Chile: Implications for low-frequency ground motions

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Forecasting surface seismic intensities is the main objective of much of the research in seismic engineering. The seismic demand for tall buildings, bridges, wind farms, and other existing slender structures is predominantly at low frequencies, but these structures are usually outside the range of the design spectra prescribed by codes. This article presents a 3D tomography model of the Concepción basin, Chile, where the shear-wave velocity structure is estimated to 500-m depth. The maximum basin thickness is approximately 160 m, but the average is about 100 m. The underlying bedrock is composed of two different units. The interface between the two bedrock units, at a depth of about 460 m, causes a low-frequency resonance at 0.5 Hz. The two bedrock units have shear-wave velocities close to 1000 and 3700 m/s, respectively. The resonance in the neighborhood of 0.5 Hz is controlled by the thickness and V S value of the first bedrock unit from roughly 100 to 460 m. This frequency coincides with the surface intensities recorded at the basin during the 2010 M w 8.8 Maule earthquake. Shear-wave velocity (V S) tomography models from dispersion curves show heterogeneities in half-space stiffness that predict the observed differences in low-frequency (long-period) ground motions.