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Shear-velocity structure of the southern Taupo Volcanic Zone, a continental backarc spreading region in New Zealand

Yannik Behr (1), John Townend (1), Martha Savage (1), and Stephen Bannister (2)
(1) Institute of Geophysics, SGEES, Victoria University of Wellington, New Zealand, (2) GNS Science, Avalon, New Zealand

Using ambient seismic noise as a pervasive energy source has become an established strand of seismology during the last few years. The approach requires relatively short instrument deployment times and no artificial sources, thereby providing an economical and low-impact way of gaining new insights into crustal and upper mantle structure. The Taupo Volcanic Zone is a complex tectonic region characterized by extension, high heat flow and active volcanism. Information on shear-velocity structure derived from short-period surface wave analysis fills a geophysical gap between previous teleseismic and active source studies. Furthermore the analysis of three-component data has revealed intriguing differences between vertically and horizontally polarized S-waves, and will help to unravel the causes of high anisotropy in the region.

Here we reprocess three-component data from a temporary seismic array (Central North Island Passive Seismic Experiment, CNIPSE) deployed in 2001 in the central North Island of New Zealand using ambient noise correlation techniques. As CNIPSE was a heterogeneous deployment involving different types of broadband instruments and the necessary instrument response information is in some cases incomplete or ambiguous, we use teleseismic events and the noise-correlation techniques suggested by Stehly et al. [GJI, 2007] and Sens-Schoenfelder et al. [GJI, 2008] to determine the correct instrument responses. We then calculate Rayleigh and Love wave dispersion curves from ambient noise correlation results for CNIPSE and nearby permanent GeoNet stations and invert the dispersion curves for a pseudo-3D shear-velocity model of the upper and middle crust.

As noise correlations can be biased by heterogeneous noise source distributions, we have conducted preliminary plane wave beamforming experiments to examine the azimuthal distribution of noise sources. This will enable us to correct noise-correlation functions for azimuthal bias, as suggested by Yao et al. [GJI, 2009].