

ASSESSING VARIATIONS IN SHEAR WAVE SPLITTING MEASUREMENT DUE TO SCATTERED WAVES USING SIMULATED WAVEFORMS

Kenny Graham¹, Martha K Savage¹ & Richard Arnold²

¹Institute of Geophysics, SGEES, VUW, NZ ²School of Mathematics and Statistics, VUW, NZ

Email address of presenting author: Kenny.Grahan@vuw.ac.nz

It has long been presumed that the ability to monitor changes in stresses within the Earth's crust might assist in hazard prediction and resource extraction. Measuring seismic anisotropy through shear wave splitting, SWS, is a potential tool to infer these stress changes. Thus changes in stress can be related to changes in average delay-time or orientation of SWS parameters. However, this potentially powerful tool has yet to be realized in part because measurements on local earthquakes are sometimes challenging and gives varying results. Many studies have attributed these variations to scattering of seismic energy (which could interfere with the direct waves and cause apparent anisotropy variations) by inhomogeneities in the wave's propagation path and other possible effect (such as; horizontal layers of anisotropy, dipping symmetry axes, lateral variations in anisotropy, and other sources of noise). To explore the effects of these proposed mechanisms of variation in SWS measurements, we generate synthetic waveforms using 1-D reflectivity and 3-D finite difference techniques. Mfast, an automatic shear wave splitting algorithms was used to estimate SWS measurements of the simulated waveforms. The 1-D technique allowed for cake layer models, which assisted in testing the effect of multiple layers on the splitting measurements. We also tested whether isotropic 3-D finite difference simulated waveforms with heterogeneity would yield apparent splitting, but we only retrieved null measurements even when heterogeneity and elongated aligned structures were used. The 1-D reflectivity and the 3-D finite difference simulated waveforms couldn't explain all the proposed physical mechanisms affecting SWS measurements. Hence, more realistic 3-D simulated waveform algorithm like the SpecFEM3D, which allows for an anisotropic Earth models and accounts for topography and heterogeneity, will be essential.