Computational modelling of seismic anisotropy due to stress in the crust at Mount Asama

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Using shear wave splitting to examine stress changes in the crust has been proposed as a way to monitor volcanic activity and predict eruptions. We have created a forward model to investigate the proposed link between processes that alter the state of stress in the crust and seismic anisotropy. With it we expect to analyze the effect of crustal stress on surface shear wave-splitting measurements. A finite element method is used to create a stress model through which ray paths are traced. We use the 3D analytical solution for stress-induced elastic anisotropy caused by the preferential closure of microscopic discontinuities created by Gurevich \textit{et al. (in prep)}. Synthetic shear wave splitting measurements are created by tracing ray paths through the stressed medium and applying a splitting operator to the waveforms at each grid point, using a code modified from that used by Abt and Fischer (2009). The model is able to handle the interactions between ray path and stress orientations. We apply this method to Mount Asama, an andesitic volcano in central Japan, using shear wave splitting data and source parameters determined for the eruption in 2004.

Figure: Modelled fast directions for a dyke at Mount Asama. The raypaths in this example are vertical, originating 20 km below the surface.