Crustal anisotropy from mode-converted body waves at the Moho discontinuity

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Crust is the shallowest and the most accessible part of the solid Earth. It is highly deformed and contains strong lateral variations. Of various physical properties of the crust, seismic anisotropy is perhaps the most uncertain due to poor depth resolution of long period shear waves such as SKS and limited availability of direct S waves from local seismic activity. In contrast, P-to-S converted waves at the Moho discontinuity offer almost ideal data coverage and depth sampling in the crust. Since these mode-converted waves arrive within the energetic P-wave coda, it is almost impossible to identify them on original recordings, hence the need to calculate receiver functions.

Over the last two decades, receiver functions have become a standard tool for seismologist to study crustal structure by removing the P wave energy from the recordings in horizontal directions, which contain primarily the P-to-S converted waves. Most of the receiver function studies targeting crustal anisotropy rely upon forward modeling procedures to extract anisotropic parameters. We developed an effective technique based on the cross-convolution method to obtain complete set of anisotropic parameters including fast polarization direction, delay time, tilt of the symmetry axis, and percent anisotropy without forward waveform modeling. Our technique also yields average P wave speeds above and below the Moho discontinuity, average S wave speed in the crust, strike and dip of the Moho discontinuity (in case of non-horizontal boundary) and the crustal thickness beneath seismic stations. This approach is relatively easy and straightforward to be extended for multiple anisotropic layers, or to simultaneous analysis of different shear wave types such as PKS and SK{K}S. Below we present our preliminary results from receiver functions for stations around southern California. In general, fast polarization direction lies parallel to the strike of the main faults, which is consistent with previous estimates from direct S-waves from local seismic activity.

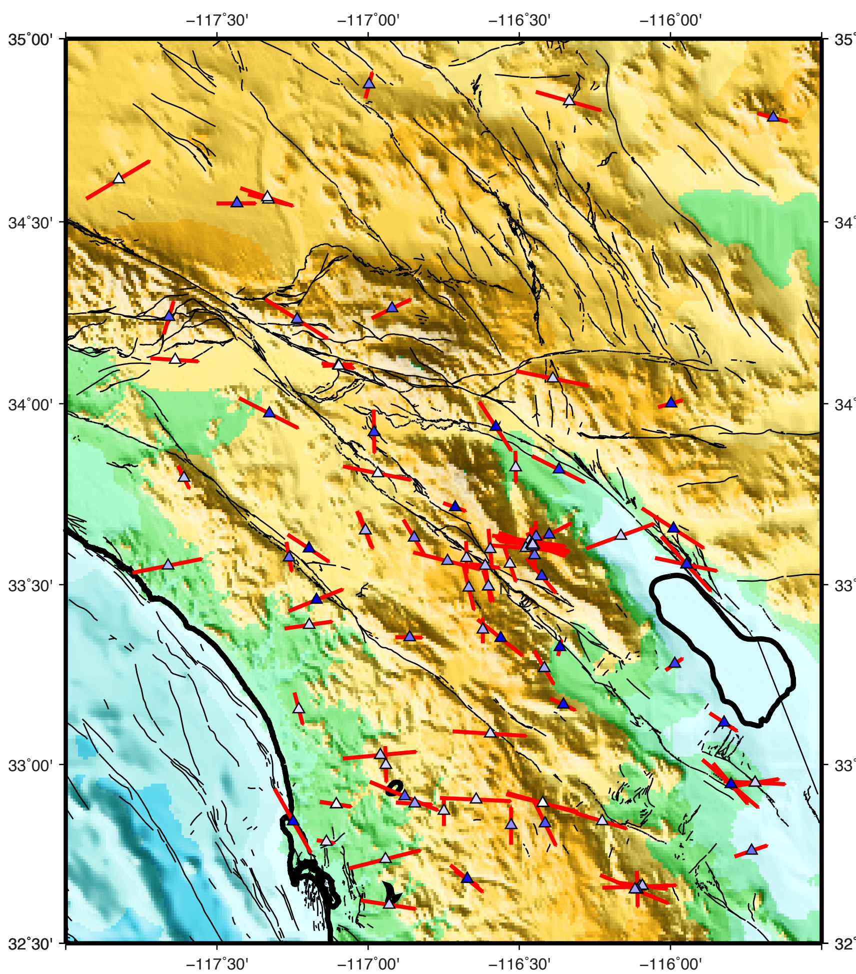

Figure 1. Preliminary results showing the fast propagation directions (red bars), tilt of the symmetry axis (color of the triangles), and the delay times (length of the bars) in southern California. Three second long splitting analysis windows are centered on the P-to-S converted wave arrival times reported in EARS (Earthscope Automated Receiver Survey) database of IRIS *(http://ears.iris.washington.edu)*.