TOMOGRAPHY OF THE NORTH AMERICAN UPPER MANTLE USING GLOBAL AND REGIONAL DATASETS

Meredith Nettles, Adam M. Dziewonski • Harvard University

We use a hybrid global-regional approach to combine currently available regional and global datasets for tomography of the North American upper mantle, incorporating data from the IRIS GSN with data from the U.S. National Seismograph Network (USNSN), the Canadian National Seismograph Network (CNSN), and several IRIS PASSCAL deployments, including the MOMA, BEAAR, RISTRA, and FLED arrays. We use a large dataset of surface-wave phase-delay measurements at periods of 35--350 s to determine a regional model of the three-dimensional radially anisotropic shear velocity structure under North America that is consistent with long-wavelength, global models of the upper mantle. The model we retrieve resolves structure on a wavelength of a few hundred kilometers throughout most of the continent. The correspondence between major geological features and those imaged in our mantle model is generally good. Radial anisotropy is observed to vary regionally, with systematic differences in anisotropy between oceanic and cratonic provinces. Radial anisotropy is observed to be strong under the Basin and Range, where the amplitude of the anisotropy reaches 4--6%.

The figure shows cross sections through the isotropic (top) and anisotropic (bottom) velocity structure of the upper mantle under North America. Note the rapid transition between slow and fast wavespeed in the isotropic structure, and the difference in anisotropic structure under the Pacific plate and the Canadian craton. Yellow dots in the map mark 10-degree intervals along the cross section (red line).