Resolving Lithospheric Structure beneath southern New England with Multiple Seismic Imaging Techniques

We apply multiple seismic imaging techniques to a dense broadband seismic array deployed across northern Connecticut to study lithospheric expressions of past tectonic processes associated with the Paleozoic Appalachian orogenesis. Stackings of Ps receiver functions at single stations and common-conversion-points (CCP) revealed a ~15 km offset in depth to Moho roughly beneath the surface boundary between Laurentia and accreted terranes. The CCP image also resolves several other discontinuities in the crust and upper mantle, which may relate to Paleozoic terrane accretion and subduction episodes. We also applied the scattered wavefield migration technique, which extends traditional 1-D receiver function analysis to 2-D model space, to better resolve discontinuities with complicated geometries. We found that the shallower Moho extends further west into Laurentian crust than previously imaged and overlies above the deeper Moho over a considerable distance, which suggests that the shallower Moho at the offset may belong to a piece of rifted Laurentian crust instead of accreted terranes. The migration technique also delineated clearly the slab-like shape of a west-dipping feature in the lithospheric mantle. Both the CCP stacking and the migration technique do not have constraints on the anisotropic structure, which may shed light on lithospheric deformations associated with past tectonic events as well as present-day asthenospheric flow. We explore backazimuthal variations of receiver functions and extract anisotropic components as harmonic terms using the harmonic decomposition method. Our preliminary results show prevalent two-lobed and four-lobed anisotropic signals beneath the entire array, both in the crust and in the upper mantle. In particular, we observe strong two-lobed anisotropy at 2-5 km depth beneath station CS07, which was deployed on the Hartford basin, as well as significant four-lobed anisotropy at 80-120 km depth beneath station CS15, where SKS splitting measurements return near-null splitting. A comprehensive picture of lithospheric structure resolved with multiple seismic analysis techniques can provide important implications to the tectonic history of southern New England.