Characterizing lithospheric structure beneath Connecticut using Sp receiver functions

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The structure of the mantle beneath the eastern United States has been, arguably, understudied relative to other regions within the U.S., such as the more tectonically active western margin. From 2004-2013, Earthscope's Transportable Array (TA) swept across the continental U.S., illuminating previously hidden and/or under-sampled mantle structure. Recent work (e.g., Porter et al., 2016) indicates the presence of a slow S-wave velocity anomaly within the asthenosphere beneath New England. While evidence of the anomaly existed prior to Earthscope (e.g., Levin et al., 1995; Li et al., 2003), the new results are better able to constrain the geometry of the anomaly. Superimposed upon this Northern Appalachian Anomaly (NAA) sits the New England lithosphere, which has its own complex tectonic history, the result of modification over several Wilson cycles. Geology in the region indicates the presence of several accreted orogenic terranes, and a failed rifting center that attempted to open during the breaking up of Pangea, beginning around 175 Myr ago.

The purpose of our study is to characterize the structure of the southern New England lithosphere and underlying asthenosphere, in order to better understand the tectonic evolution of southern New England. Analysis of the lithosphere-asthenosphere boundary (LAB) is being conducted in the study region using Sp receiver function analysis. Data from 39 seismic stations, including data from TA, permanent stations, and the recently completed SEISConn seismic experiment (2015-2017), were downloaded for analysis. For our analysis, we have calculated individual Sp receiver functions using events of Mw 5.8 and greater, and epicentral distances of 30-90 degrees. Waveforms were culled based on signal-to-noise ratio. In total, 2,076 waveforms were used in the analysis, with an average of 59 waveforms per station. Waveforms were rotated into a P-SV-SH reference frame and deconvolved using an extended time multitaper deconvolution technique. A combination of Crust1.0 (Laske et al. 2013) and S-wave ambient noise tomography model (Porter et al. 2015) were used to correct for move-out and to migrate the receiver functions to depth. Calculated single station stacks show considerable variability. In some instances, such as at permanent stations and several TA stations, our results agree well with the work of others (e.g., Rychert et al., 2005). Future work to perform common conversion point (CCP) stacking will help to more fully illuminate LAB structure in the region.

Stations used in our study. Networks used: LD, NE, N4, TA, US, XO, XA, and SEISConn's XP. SEISConn stations are shown in dark purple below while other networks are lighter purple. SEISConn is composed of 15 seismometers, set out linearly across Connecticut, with a station spacing of approximately 10-20 km.