Searching for evidence of mantle deformation within the Wyoming Craton: A comparative study of Sp receiver function methods

Beth Shallon[1], Heather A. Ford[1], Maximiliano J. Bezada[2], Joseph Byrnes[3], Andrew Birkey[4]

[1]Department of Earth and Planetary Sciences, University of California – Riverside, [2]Department of Earth and Planetary Sciences, University of Minnesota – Twin Cities, [3]School of Earth and Sustainability, Northern Arizona University, [4]Department of Earth Sciences, University of Delaware

Cratons are often described as being resistant to tectonic deformation over extended periods of time. While this appears to be broadly true, evidence for deformation in some cratons indicates that this is not always the case. In addition to surface deformation, seismic tomography suggests that the mantle lithosphere of the Wyoming Craton may have either been significantly modified during the Laramide Orogeny, and/or may still be experiencing ongoing deformation due to the presence of small-scale mantle convection. Key to determining the extent of impacts on the lithosphere is determining present day lithospheric thickness beneath the craton. Using publicly available data from the EarthScope/IRIS Data Management Center, including data from the EarthScope Transportable Array, Bighorn Arch Seismic Experiment, and the CIELO array, we aim to image the seismic structure of the upper mantle beneath the Wyoming Craton via Sp receiver function analysis. In our analysis we utilize two different deconvolution methods—the extended time multi-taper method and a time-domain iterative deconvolution—before performing common conversion point (CCP) stacking and migrating to depth. An important component of this work is the comparison of results between the two deconvolution methods and encouragingly, we find that the two sets of results are largely consistent with each other, although occasional differences exist. Our results are also largely consistent with results from earlier published work using Sp receiver functions (Hopper and Fischer, 2018). We do not appear to image the base of the lithosphere, but rather observe numerous discontinuities within the lithosphere. In our analysis we focus on the most salient features of our results to better understand the relationship between them and the tectonic and geologic evolution of the Wyoming Craton.