Seismic structure of the lithosphere and upper mantle of North America from the inversion of Surface and S waveforms.

Andrew Schaeffer and Sergei Lebedev

The evolution, stability, and dynamics of continental lithosphere remain a central focus of Earth Science research. Seismic studies over the last decades have discovered numerous features of past and present deformation; yet many questions remain, particularly in regard to fine-scale structure at whole-continent scales. The continued deployment of the US Array is producing a massive new dataset that samples North America at scales from tectonic units to continent-wide domains and enables resolution of structure and deformation of the lithosphere previously possible only at regional scales. With this resolving power come new challenges relating to efficient management and processing of such large data volumes. In this study, we have assembled a dataset comprising over 3.5 million three-component broadband seismic waveforms from more than 3400 stations. We augment available US Array stations with ~600 additional North American stations of the GSN and affiliates, Canadian National Seismograph Network, regional arrays, past PASSCAL experiments, and other stations from Iceland, Greenland, Central and South America, the Caribbean, and several Mid-Atlantic Islands. We exploit the resolving power of this unprecedentedly large dataset using the Automated Multimode Inversion of surface- and S-wave forms. The waveforms are inverted for path-averaged linear constraints on elastic structure along the source-receiver paths. The linear equations are then simultaneously solved for a high-resolution 3D upper mantle shear velocity model of the continent. Our initial model reveals variations in fine-scale lithospheric structure across North America's tectonic domains.