Adjoint tomography of the North American continent

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We use adjoint tomography to iteratively invert for crust and upper mantle structure beneath the North American continent. 180 earthquakes with magnitudes ranging from 5 to 6.5, and 4,516 seismographic stations are used in this study. For the first iteration, we manage to make 460,539 frequency-dependent phase measurements by comparing synthetic and observed seismograms. Crustal model EPcrust2.0 combined with mantle model S362ANI comprise the initial 3D model \textsc{US}00. Before the iterative structure inversion, earthquake source parameters (i.e., centroid moment tensor and location), are re-inverted using 3D Green’s functions and Frechét derivatives. Radially anisotropic (frequency-dependent) sensitivity kernels are employed in the structure inversion to image anisotropic features within the upper mantle. Higher frequency signals are gradually incorporated in the inversion in order to resolve small scale heterogeneities. Statistical assessments of traveltime anomalies and waveform differences enable us to validate the inverted sources and structural parameters. Our current model, \textsc{US}22, shows numerous interesting features for the North American continent, for instance, significant contrast between eastern and western America, slab features beneath the Cascadia subduction zone and Caribbean, slow anomalies related to the Astenosphere beneath the North Atlantic ocean, etc. Figure 1 shows the comparisons of current model with previous studies at approximately 80 km.

Figure 1: Comparisons of current model \textsc{US}22 with previous studies at approximately 80 km.