A three-dimensional seismic velocity reference model for Alaska

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EarthScope Annual Meeting, May 2013
Raleigh, North Carolina

We assemble a catalog of moment tensors and a three-dimensional seismic velocity model for Alaska, in preparation for an iterative tomographic inversion using spectral-element and adjoint methods. The primary geometrical interfaces in the model are the Moho surface, the basement surface of major sedimentary basins, and the topographic surface. The Moho is constructed from existing data, including receiver functions, active source surveys, and gravity measurements. The crustal and upper mantle tomographic model is from Eberhart-Phillips et al. (2006), but modified by removing the uppermost slow layer, then embedding models for two major sedimentary basins. We compute 3D synthetic seismograms using the spectral-element method. We demonstrate the accuracy of the initial three-dimensional reference model by comparing 3D synthetics with observed data for several earthquakes originating in the crust and underlying subducting slab. Full waveform similarity between data and synthetics over the period range 4 s to 30 s provides a solid basis for an iterative inversion. The target resolution of the crustal structure is 4 km vertically and 16 km laterally. We use surface wave and body wave measurements from local earthquakes to obtain moment tensors that will be used within our tomographic inversion. Local slab events down to 180 km depth, in additional to pervasive crustal seismicity, should enhance resolution.

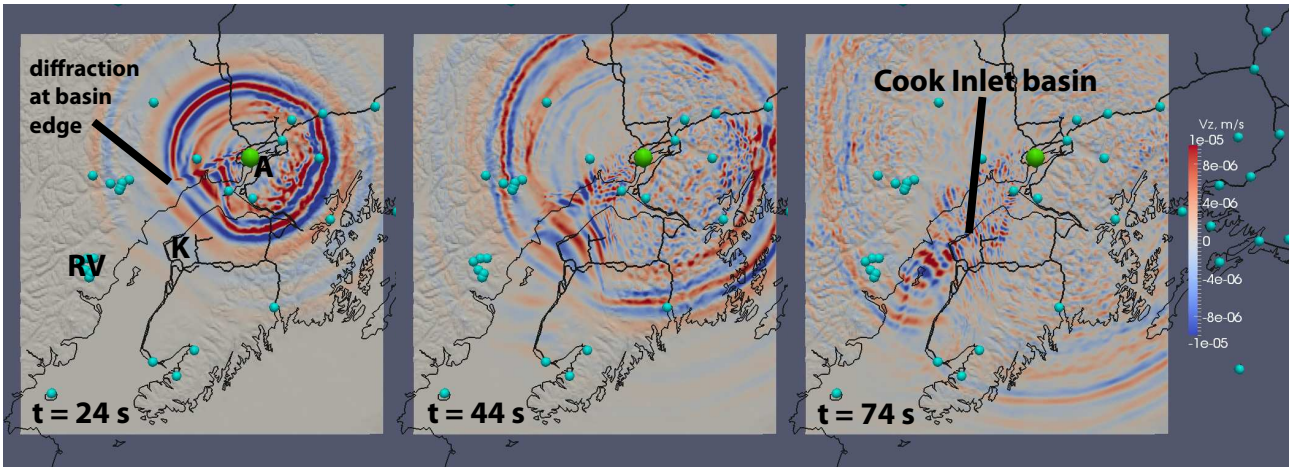

Figure 1: Snapshots of a 3D wavefield simulation, showing the strong influence of the Cook Inlet basin on the wavefield. Blue circles denote permanent broadband stations. A = Anchorage, K = Kenai, RV = Redoubt volcano.