

# The 3D crustal wavefield for imaging earth structure and sources

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Seismic characterization of crustal and upper mantle structure— $V_P$ ,  $V_S$ , and density—is a formidable challenge, especially in regions of active tectonics, which tend to have the greatest variations in crustal structure. For example, the presence of large sedimentary basins result in velocity variations of more than an order of magnitude within the upper 60 km. The complexity of crustal structures, combined with the paucity of available broadband stations for imaging these structures, warrants the use of 3D wavefield simulations in order to exploit as much of the recorded three-component seismograms as possible. I will highlight developments in the field of iterative seismic inversions using wavefield simulations and adjoint methods, with an emphasis on earthquake data and ambient noise data targeting crustal scales. Key challenges remain: (1) constructing a detailed 3D reference model based on all available data, (2) navigating the complex workflow for the inversion, and (3) assessing model quality, uncertainty, and resolution. I will provide an overview of ongoing efforts to image the crust and upper mantle in Alaska, where flat-slab subduction imparts a 1000 km swath of crustal seismicity and active faulting and basin development. Two regions of interest—currently instrumented with PASSCAL/FlexArray stations—are Cook Inlet forearc basin in southern Alaska, adjacent to the  $M_w$  7.1 Iniskin earthquake in 2016, and Nenana transtensional basin in central Alaska. Regarding outreach efforts, movies of earthquake simulations and the frequent occurrence of earthquakes provide excellent opportunities to connect earthquake science with online viewers and local communities.

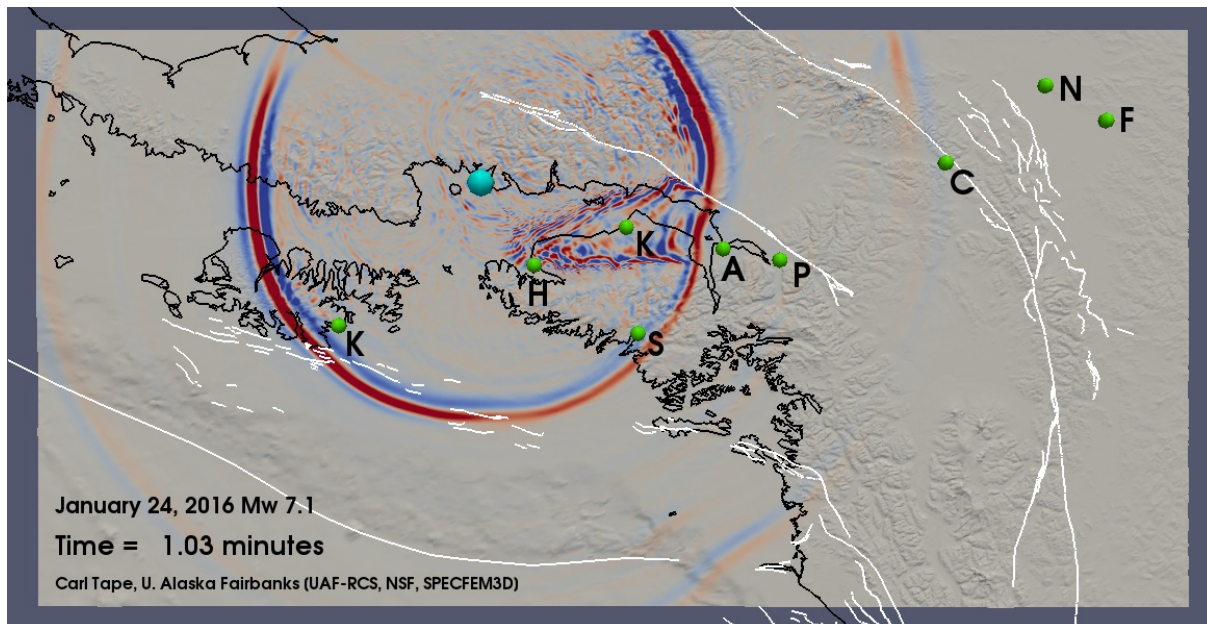


Figure 1: Snapshot of a wavefield simulation for the  $M_w$  7.1 Iniskin, Alaska, earthquake, 1.03 minutes after the origin time. This is a 1200 km by 600 km oblique view of southern Alaska; some cities are labeled for reference: Kodiak (K), Homer (H), Kenai (K), Seward (S), Anchorage (A), Palmer (P), Cantwell (C), Nenana (N), and Fairbanks (F).