

The Upper Geyser Basin of Yellowstone National Park in Wyoming, USA consists of active geysers that erupt hydrothermal fluids from subsurface reservoirs, the most famous being Old Faithful Geyser. To image the Old Faithful hydrothermal system, we process 2-D active-source seismic data recorded in November 2016. Our 2-D line is 1039m long trending SW-NE, centered on the Old Faithful Geyser, with 39 receivers and 39 shot locations. Our receiver and shot spacing is ~25m with a ~100m gap in either direction from the Old Faithful Geyser orifice. The source in this experiment was a 12lb sledgehammer striking a metal plate, and we stack 5-6 hammer strikes per shot location. Our receivers are 3-component, 5-Hz Magseis Fairfield Z-Land seismometers. We pick refracted first arrivals and invert the arrivals to create a velocity model and tomographic profiles. Here, we present first arriving P-wave tomographic inversion results from our 2-D seismic line. Our aim is to visualize changes in lithology around Old Faithful Geyser and the subsurface plumbing system that feeds the eruptions. Preliminary results from the 2-D profile show slight differences from previous studies, with the P-wave refraction images allowing for more detailed interpretation. From our initial tomographic inversions we will interpret hydrothermal pathways along the 2-D line. Creating tomographic profiles will contribute to scientific understanding of the Old Faithful hydrothermal plumbing system beneath Old Faithful by allowing us to visualize in 2-D the geometry and structure of the shallow hydrothermal conduits feeding the geyser.

3-D Seismic Grid

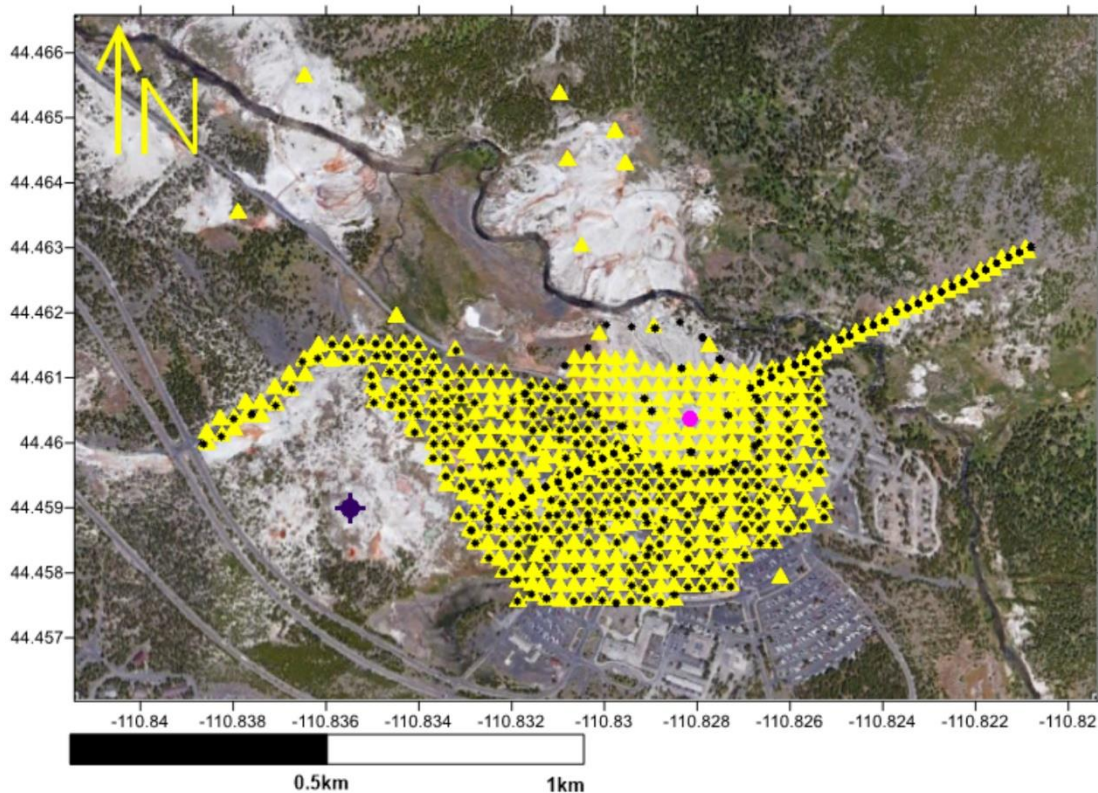


Figure 1 Shows the seismic grid setup, and the locations of Old Faithful Geyser and the C-1 drill hole. Yellow triangles represent our receivers, black stars represent shot locations, the purple circle is Old Faithful, and the navy symbol is the C-1 drill hole.