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Imaging of an Uncollapsed Nuclear Explosive Test

We present data and analysis of a seismic data collect at the HADDOCK underground nuclear explosive test in Yucca Flat, a sedimentary basin on the Nevada National Security Site, USA. HADDOCK was conducted in 1964 with an announced yield of less than 20 kt and depth-of-burial of 364 meters. The test is unusual in that the collapse of the test cavity did not reach the ground surface. As such, HADDOCK represents an opportunity to test advanced geophysical methods for detection and characterization of nuclear explosions that result in little-to-no surface expression. As part of the experiment (called Frey-Chimney), new high-resolution seismic and gravity data were acquired. The seismic experiment consisted of a hybrid 2D/3D array of approximately 1,000 2-Hz, 3-component geophones recording over 250 source points with two different seismic sources. The two seismic sources were the Seismic Hammer™ (SH, a prototype 13,000 kg weight-drop) and a much smaller accelerated weight-drop (AWD) used to supplement the SH-derived data with higher frequencies. In addition to the active-source data collection, pre-experiment ambient noise was collected on the array. Planned data analyses include processing for seismic reflections, body-wave and surface-wave velocity tomography, body-wave attenuation tomography, ambient noise tomography, and seismic cavity resonance detection.

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