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Comparative Noise Performance of Portable Broadband Sensor Emplacements

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IRIS PASSCAL has supported portable broadband seismic experiments for close to 30 years. During that time we have seen a variety of sensor vaults deployed. The vaults deployed fall into two broad categories, a PASSCAL style vault and a Flexible Array style vault. The PASSCAL vault is constructed of materials available in-county and it is the Principle Investigator (PI) who establishes the actual field deployed design. These vaults generally are a large barrel placed in a $\sim$1 m deep hole. A small pier, decoupled from the barrel, is fashioned in the bottom of the vault (either cement, paving stone or tile) for the sensor placement. The sensor is insulated and protected. Finally the vault is sealed and buried under $\sim$30 cm of soil. The Flexible Array vault is provided to PIs by the EarthScope program, offering a uniform portable vault for these deployments. The vault consists of a 30 cm diameter by 0.75 cm tall piece of plastic sewage pipe buried with $\sim$10 cm of pipe above grade. A rubber membrane covers the bottom and cement was poured into the bottom, coupling the pier to the pipe. The vault is sealed and buried under $\sim$30 cm of soil.

Cost, logistics, and the availability of materials in-country are usually the deciding factors for PIs when choosing a vault design and frequently trades are made given available resources. Recently a third type of portable broadband installation, direct burial, is being tested. In this case a sensor designed for shallow, direct burial is installed in a $\sim$20 cm diameter by $\sim$1 m deep posthole. Direct burial installation costs are limited to the time and effort required to dig the posthole and emplace the sensor. Our initial analyses suggest that direct burial sensors perform as well and at times better than sensor in vaults on both horizontal and vertical channels across a range of periods (<1 s to 100 s). Moving towards an instrument pool composed entirely of direct burial sensors (some with integrated digitizers) could yield higher-quality data at lower cost.

Until recently vault performance for portable installations supported by the PASSCAL program was anecdotal. A formal comparison of these various installation techniques is the subject of this poster. We've selected a suite of experiments that are representative of the three installation techniques and compare their noise performance by using PSD probability density functions (McNamara and Buland, 2004).