

Coherent Processing of Raspberry Shake Data from the Washington D.C. and Boston Areas

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Raspberry Shake (RS) seismographs have gained wide acceptance over the past two years as an inexpensive, IoT solution for seismic monitoring. There are nearly 2000 installed RSs across the globe. These “Shakes” are providing additional coverage for existing seismic networks, educational experiences for students in schools, and citizen science seismographs for the interested public. Many of these Shakes are installed in homes and are subject to noise sources that are usually avoided. But where RSs are densely distributed their sensitivity, bandwidth, and interstation coherence enable the application of seismic processing that is normally used for quiet networks. Here we demonstrate coherent processing for Shake networks around the Washington D.C. and Boston areas.

There are 15 Shakes operating around the Washington D.C. area. The geometry is near-ideal for coherent processing of teleseismic body and surface waves. The network routinely records global earthquakes above M6. The Feb. 22, 2019 Ecuador earthquake (M7.5) provides a test case for coherent processing. The event was 4600 km south of the network. Frequency-wavenumber (fk) processing of the P-wave data results in a back-azimuth estimation that is in error by only 0.1 deg. There are few local earthquakes but the western portion of the network includes a number of small quarries. Rg waveforms provide an efficient means of detection and localization and is a test case for data processing in noisy areas. There are 26 Shakes in southern New England. Most are in schools and other public venues as part of the Boston College Educational Seismology Project. This greater station density, and a higher rate of seismic activity, provides an excellent test case for coherent processing. Combining fk solutions from this and the DC network, along the 650 km baseline, enables global event location and other types of coherent processing for teaching concepts of seismology for students and citizen scientists of all ages.

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