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MEMS Accelerometers Mini-Array (MAMA) - initial results and lessons learned

Ran N. Nof[1], Angela I. Chung[2], Horst Rademacher[2], and Richard M. Allen[2]
[1]The Geological Survey of Israel, Geological Hazards, Israel (ran.nof@gmail.com)
[2]Berkeley Seismology Lab, UC Berkeley, Berkeley, CA, USA

Most operational earthquake early warning systems (EEWS) consider earthquakes to be point-sources and have difficulty providing imminent and robust source locations and magnitudes, especially at the edge of the seismic network or where seismic stations are sparse. Mini-arrays have the potential to estimate reliable hypocentral locations by beam forming (FK-analysis) techniques. They can also characterize the rupture dimensions and account for finite-source effects, leading to more reliable estimates of ground motions for large magnitude earthquakes. In the past, the high price of multiple seismometers has made creating arrays cost- prohibitive. Here, we present a setup of two mini-arrays of a new low-cost (<$150) seismic acquisition unit based on a high-performance MEMS accelerometer around conventional seismic stations. The expected benefits of such an approach include decreasing alert-times, improving real-time shaking predictions and mitigating false alarms.

We will present our new 24-bit device details, benchmarks, and results from two MAMAs deployed at the UC Berkeley and Humboldt State University campuses. The new device shows lower noise levels than the currently available off-the-shelf 16-bit sensors, commonly used by several citizen-science projects (e.g. QCN, CSN, MyShake, etc.). This lower noise level enables us to record and process lower magnitude events. We show examples of back-azimuth calculations of M>=2.5 events at a range of <100km from the MAMA center and discuss some of the limitations and considerations of the MAMA deployments.