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Broadband seismological observations at The Geysers geothermal area, California, USA

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The understanding of structure and dynamics of geothermal reservoirs for geothermal exploration and sustainable use of the resource requires an assessment using a multidisciplinary approach. The Geysers geothermal reservoir in northern California is the largest producing geothermal field in the world and has been exploited for over 50 years. Among other geophysical surveys, numerous seismic studies have been conducted based on data acquired by the LBNL seismic monitoring network over the past 20 years. However, thus far, no continuous seismic data have been recorded at the Geysers, which prevents detailed continuous monitoring in relation to reservoir operation. In February 2012, we deployed a temporary network of 33 broadband seismic stations, including Guralp and Trillium sensors (0.008 – 100 Hz). At present the network is still in operation. Twenty-six stations are located within the perimeter of the geothermal reservoir, while 7 are located on a perimeter around the reservoir at greater distances. While the recordings of larger magnitude events (M>3.5) may be saturated on the local stations, the outer stations are intended to record these events without interruption. We present analyses of a larger magnitude event (M$\sim$3.5) as well as correlations of continuous observations to geothermal operations. Thanks to the high density of instrumentation and the high dynamic range of the broadband sensors, smaller events (microseismicity) can be detected more easily, allowing for better precision in locations and more accuracy in the determination of magnitudes. The increased dynamic range offers an important improvement in the analysis of seismicity as the majority of events at The Geysers have magnitudes of M<2.0.