A Dense Seismic Nodal Array for High-Resolution Imaging of the Elgin-Lugoff Earthquake Swarm Sequence in South Carolina

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Abstract

Earthquake swarms are closely-clustered seismic events in space and time without a single main shock. They often occur along plate boundaries or geothermal areas with ample volatiles or fluids. In comparison, swarms at intraplate regions are unique, especially in the Southeast United States, where background seismicity is typically low. A prolonged earthquake swarm sequence started on December 27, 2021, beginning with a magnitude 3.3 earthquake between Elgin and Lugoff in South Carolina (SC). Up to now, 85 microearthquakes have been located in this region, with the largest magnitude of 3.6 occurring on June 29, 2022. These earthquakes occurred near the Eastern Piedmont Fault System (EPFS), but upon closer examination, most events aligned on a trend at a high angle rather than along the EPFS. This swarm sequence was widely felt in the broader region of the Midlands of SC and offers a rare opportunity to study the physical mechanisms of earthquake swarms in intraplate regions. In October 2022, 86 SmartSolo nodes were deployed in a 7 km x 7 km area right on top of the swarm sequence, with one site co-located with a broadband seismometer JKYD. This deployment aims to capture near-field observations of the sequence in high resolution for up to 4 months. The data collected from this deployment enables the detection of additional smaller earthquakes not listed in the existing catalog, which can reveal the spatial-temporal evolution of the swarm and the underlying forces driving this swarm. A preliminary analysis discovered 26 new events with coherent waveforms across the nodal array after applying a single station match-filtered technique using only four cataloged templates. Further analysis of the nodal array will be presented in the meeting.