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Monitoring induced seismicity in urban environment: assessing the performance of low-cost stations within Dense Semi-permanent Seismic Networks

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Obtaining high-resolution seismic catalogs from seismic data requires long-term monitoring and a sufficient number of sensors. Permanent seismic networks are usually limited to a small number of sensors, while very dense seismic networks (thousands of sensors) are typically installed for a limited period of time (days to a few weeks) and represent a large investment.

In the framework of the PrESENCE project, we test the performance of a Dense Semi-permanent Seismic Network (DSSN) deployed in an urban environment (Strasbourg Eurométropole). This network, made up of Raspberry Shake seismographs, allows to record data over long periods (years) and from dozens of sites, thanks to the use of low-cost seismic stations operated by non-seismologists.

The study aims to determine the advantages and limitations of these stations in urban environment, especially for the monitoring of induced seismicity. This is done by quantifying their impact on magnitude of completeness and location accuracy, as well as their contribution in detecting events with techniques such as template matching. The analysis was carried out on data recorded from January 2018 to September 2023 in the Strasbourg (France) area, which includes a seismic crisis that culminated in a M3.6 earthquake that led to the closure of the Geoven deep geothermal energy site operated by Fonroche-Geothermie. We conclude that these low-cost stations have provided a significant and valuable impact on the induced seismicity monitoring.