

TexNet Seismic Monitoring Network and Seismology Research

A state-wide seismological network in Texas, USA



Figure 1. An Example of a seismic station in the TexNet network.

Summary

The state of Texas has a history of natural earthquakes as well as increasing levels of induced seismicity. The increase in induced seismicity largely results from activities undertaken by the oil and gas industry in the state, which are also vital to the Texan economy.

TexNet was established to locate and determine the origins of earthquakes throughout Texas. The network aims to distinguish between naturally occurring and manmade events and help mitigate and prevent future induced events.

Subsurface installations provide a cost-effective method of improving the Signal to Noise Ratio (SNR) of the data captured by the sensors which is important for improving hypocentre reporting accuracy. For this reason TexNet were keen to deploy posthole seismometers which are buried beneath the surface.

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Background

TexNet works closely with private companies, State agencies, and universities.

By increasing understanding of natural and induced seismicity in the state, TexNet can provide State Agencies, tasked with mitigating the seismic hazard, with reliable data to make decisions on injection activity. This in turn helps the oil and gas industry to operate safely within the State.

One of the objectives of TexNet is to increase the confidence of local communities, affected by seismicity, in the decisions made by authorities on the basis that they are grounded on high quality data and sound science.

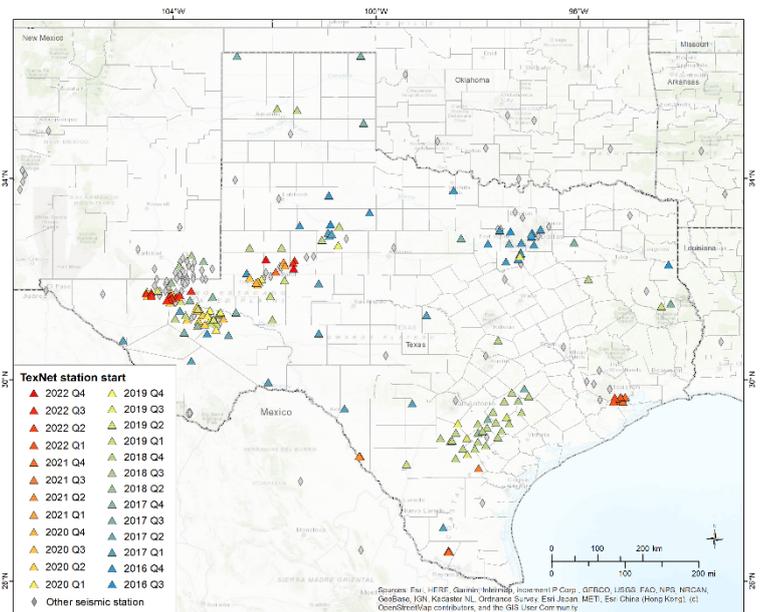


Figure 2. Map showing deployment of TexNet stations over time

Güralp Posthole Solution

Güralp equipment was selected for part of the primary permanent network as well as for portable deployment arrays.

Two permanent stations are equipped with a Radian seismometer, (one borehole and one posthole). The portable stations house eleven 40T posthole seismometers and one Certimus burial seismometer deployed in postholes that are three to five feet deep.

Subsurface installations offer a cost-effective method for increasing the Signal to Noise Ratio of the sensors. Güralp posthole instrumentation is designed with high pressure connectors to improve system robustness and facilitate ease of deployment.

All data from the stations are streamed back to the TexNet data-centre at the Bureau of Economic Geology, where SeisComP is used for the real-time data analysis before being archived with IRIS.



Figure 3. Certimus; Figure 4. 40T posthole; Figure 5. Radian posthole.

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Figure 6. Example 40T posthole station, a solar panel powers the batteries.



Figure 7. The secure cabinet houses the Minimus digitiser, the modem and the solar-powered batteries.



Figure 8. 6TD seismometer.

Six 6TD instruments form part of the rapid-deployment pool to provide flexibility and allow TexNet to deploy denser arrays around areas of particular interest. Minimus digitizers from the University of Texas Institute of Geophysics (UTIG) are also utilised as part of the network.

Güralp provided installation services for the Radians deployment and continuing technical support with TexNet’s networking requirements, including on-site training on instrument and software operation and field installation.

Outcome

The TexNet project commenced in 2015 and continues to operate and grow year on year.

A number of different stakeholders access and analyse the data collected from TexNet including the Texas Railroad Commission, the Texas Division of Emergency Management, the Texas Department of Transportation, the Texas Commission on Environmental Quality, the academic research community, and state media.

Güralp equipment continues to perform well within the network providing valuable real-time data to improve understanding of seismicity across the state, and enable informed decisions relating to oil and gas activities.

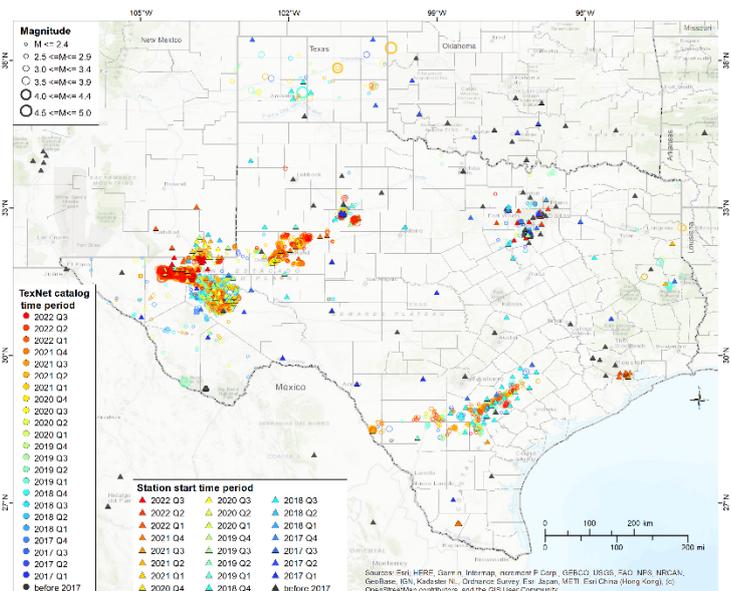


Figure 9. Current TexNet station map and TexNet event catalogue Q1, 2017 to Q3, 2022.