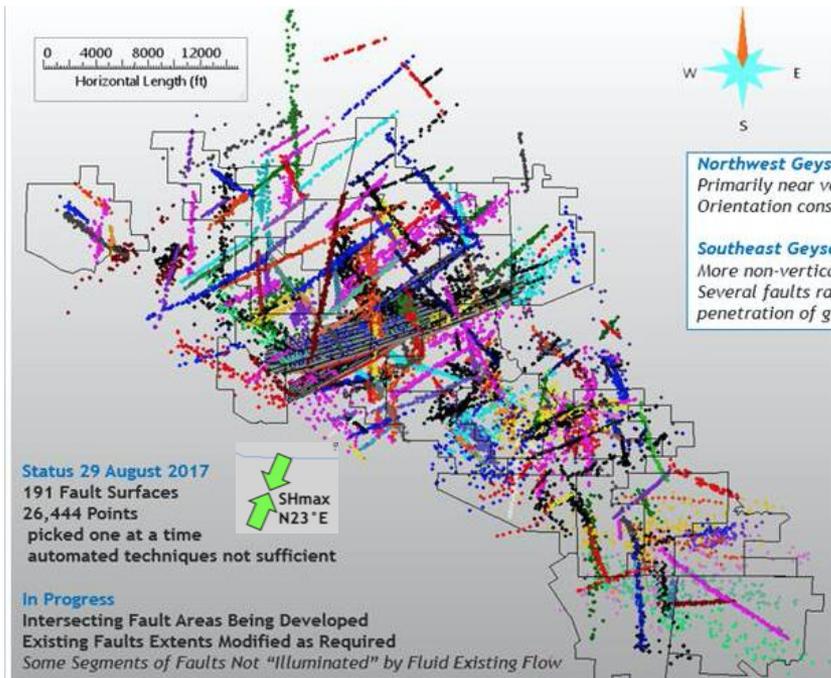
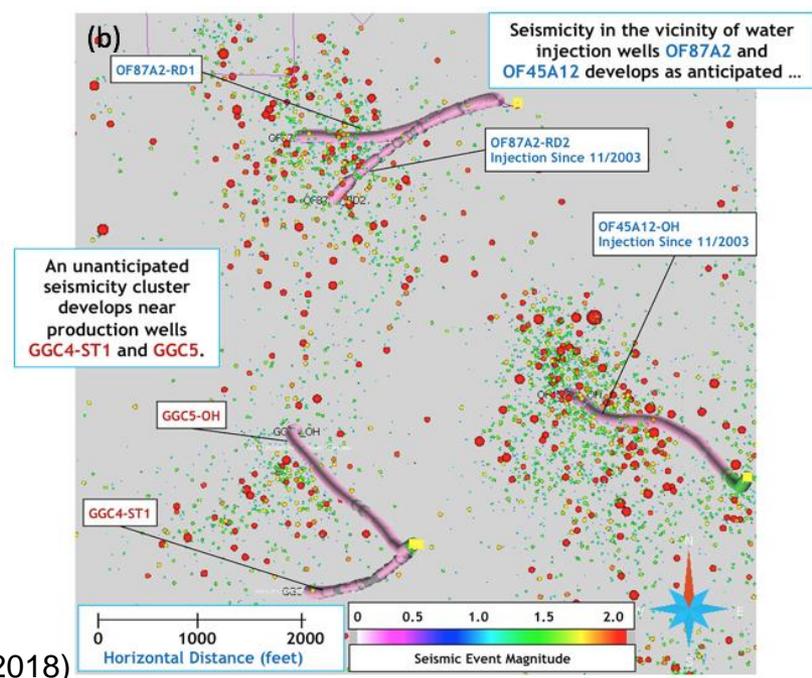




Project Focus: Where is the injected water flowing?



Hartline et al. (2018)



Hartline et al. (2015)

Microseismicity is not a complete proxy for fluid movement in the subsurface -

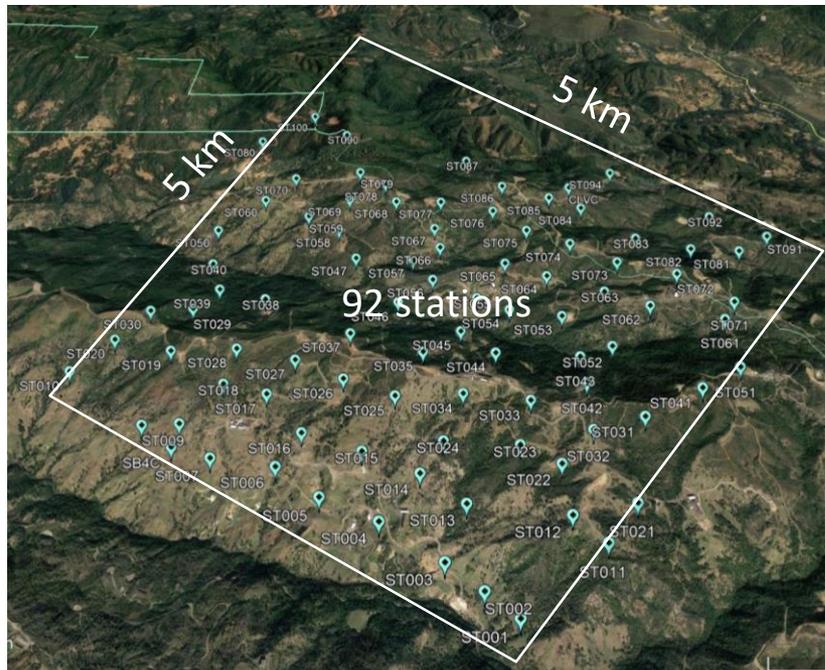
- Water and steam have been observed to move through the fractured rock mass without triggering microseismicity.
- Microseismicity has been observed to be triggered without fluids.

→ Can seismic tomography provide additional information about fluid movement at The Geysers?

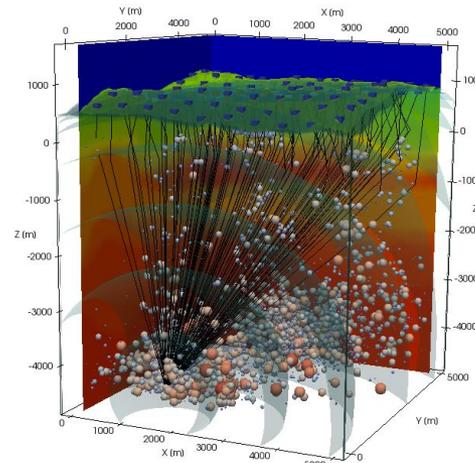


Approach: Tomographic Imaging of Flow Pathways with Time-Lapse Microseismic Monitoring

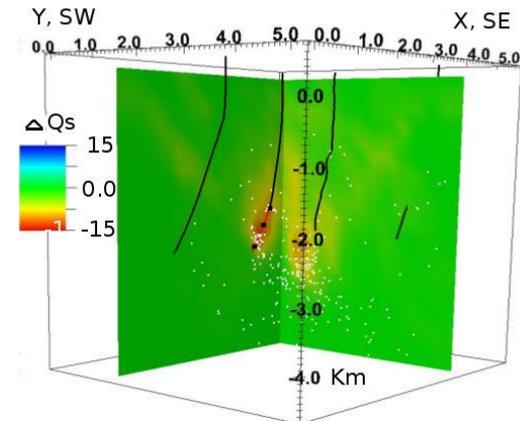
Step 1 - Deploy a dense array of semi-permanent seismic stations in Study Area



Step 2 - Carry out monitoring program for ~12 months; recover data at ~3 months intervals

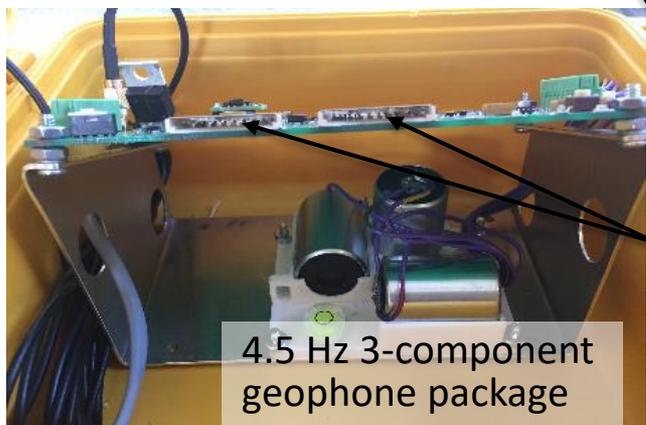
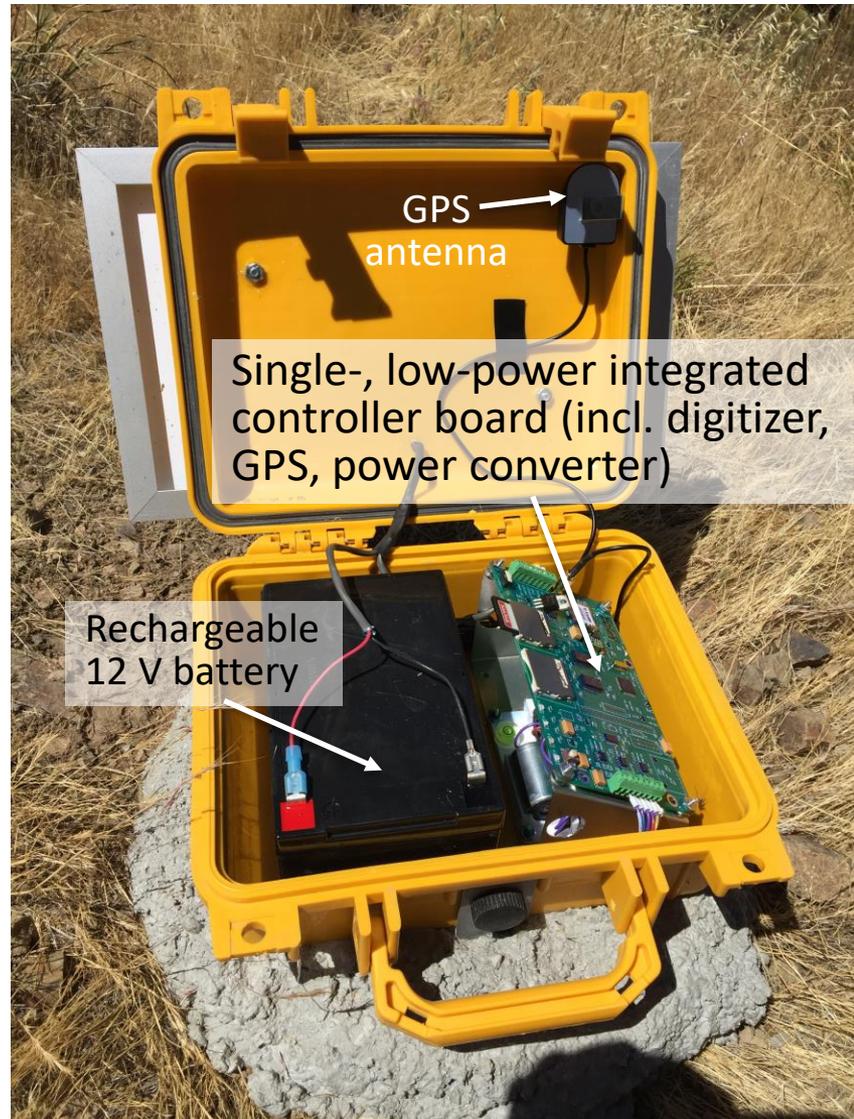
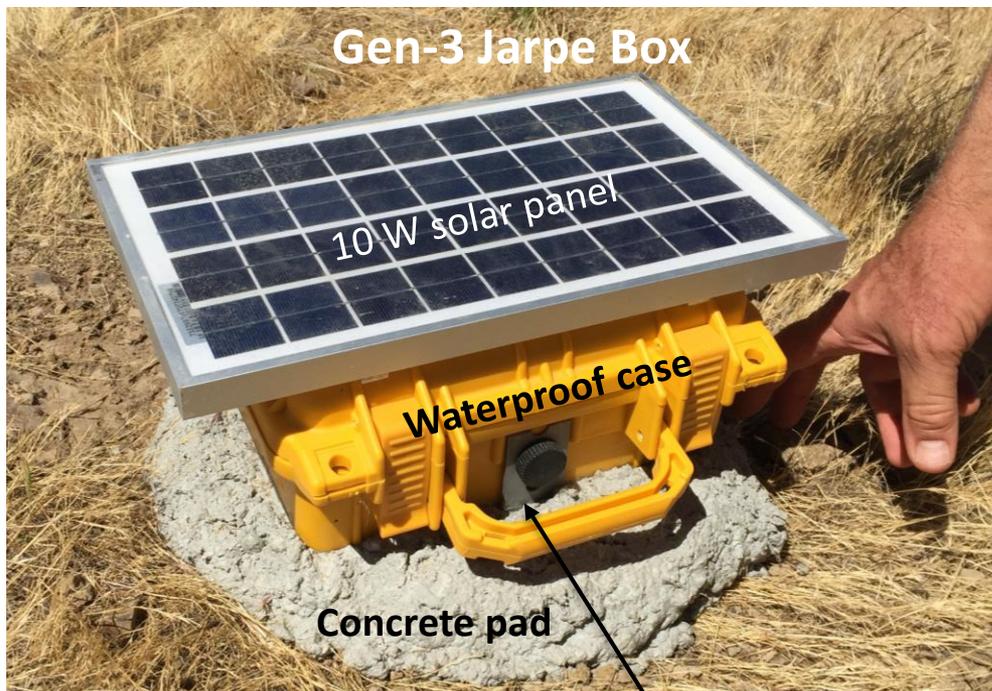


Step 3 - Perform travel-time & attenuation tomography; convert tomograms to rock & fluid properties



Hutchings et al. (2018)

Gen-3 JB: Self-Contained Portable Seismic Recorder

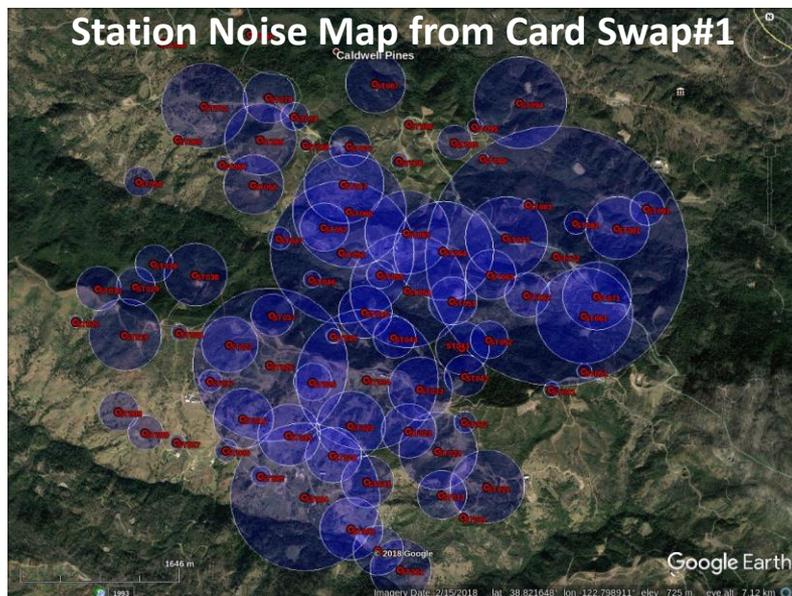


Box-to-concrete anchoring via metal fins at front and back of box

SDHC memory card slots (3-6 months continuous 3-comp data recording)



Field Program Status



- Two (of four planned) data collection campaigns were conducted since inception of the 92 station network on May 11, 2018:
- **Card Swap #1 (executed June 11-13, 2018)**
 - First retrieval of SDHC cards from 86 stations (~1 month of data)
 - Checked status of health of stations
 - Upgraded firmware to correct for potential GPS-related problems
 - Data are being processed for tomography
 - **Card Swap #2 (executed Sept. 20-21, 2018)**
 - Second retrieval of SDHC cards from 92 stations (~3 months of data)
 - Four stations required replacement
 - Data are being processed for tomography
 - **Card Swap #3 (planned for Dec. 2018)**
 - **Card Swap #4 (planned for Mar. 2019)**

**High Shear Wave
Velocity Features
&
Microseismicity
from Card Swap #1**

