FaultScan - Monitoring Body Wave Velocity Changes Across the San Jacinto Fault (2022-2025)

Dan Hollis[1,2], Frank Vernon[1], Florent Brenguier[3], Yehuda Ben-Zion[4], Quentin Higueret[3], Aurélien Mordret[3], Coralie Aubert[3] and Yixiao Sheng[3].
1 – IGPP/University of California San Diego, 2 – Sisprobe SAS, 3 – ISTERRE/University of Grenoble-Alpes, 4 – University of Southern California

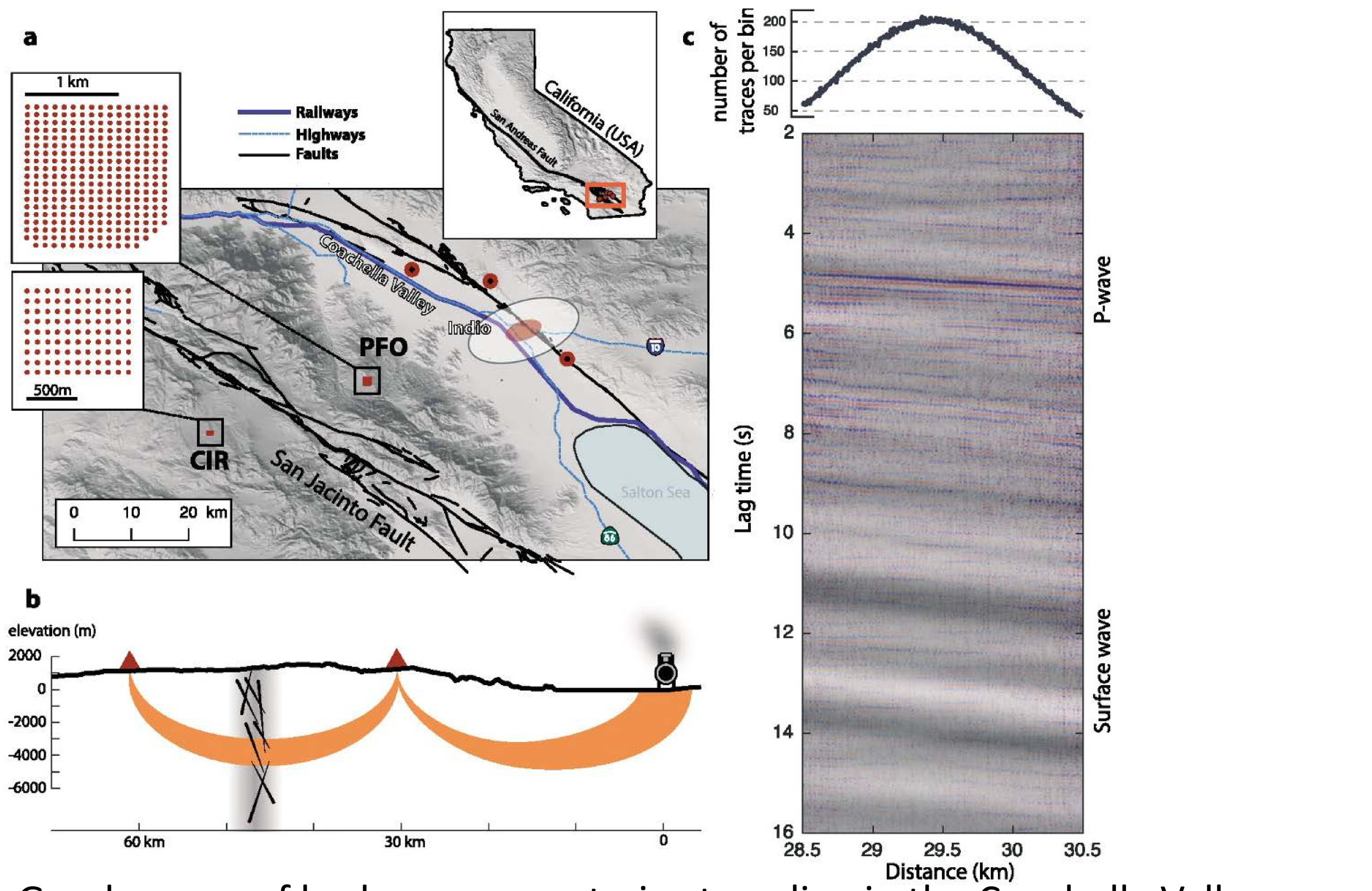
ABSTRACT

University of Grenoble-Alpes, UC San Diego/IGPP and University of Southern California are collaborating on a three-year project to measure body wave velocity changes across the San Jacinto Fault. This project, named FaultScan, uses seismic noise data from a network of nodal seismometers (nodes) and the Southern California Seismic Network (SCSN) to monitor velocity changes at seismogenic depths. Preparatory field studies for this project started in 2018 and the main project, scheduled to start in 2020 but delayed due to the coronavirus pandemic, started in 2022. In April 2022, we deployed a 298-node array at the Piñon Flat Observatory (PFO) in the San Jacinto Mountains, about 17 miles south of Palm Springs. The PFO array will record continuously for three years until early 2025. The purpose of the project is to observe transient deformation within the vicinity of active faults and detect hidden fault movements. For the San Jacinto Fault monitoring, an excellent source of body wave energy comes from train traffic in the Coachella Valley to the east of PFO that provides ideal body wave energy and raypath geometry for measuring velocity perturbations at nearly seismogenic depths using the PFO array and SCSN stations.

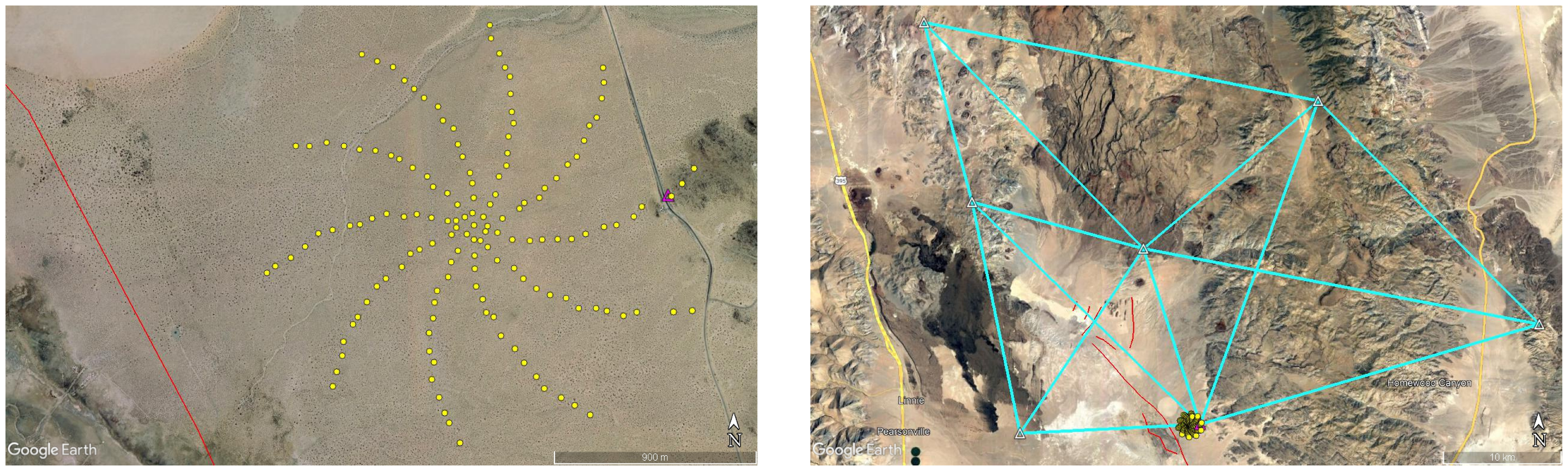
European Union and other funding for the FaultScan project allowed for the purchase of 480 advanced 5 Hz, three-component nodes with 5-month recording life on battery power and 9 months with solar power. The additional 182 nodes remaining after the 298 nodes currently deployed at PFO are used to maintain the PFO array, and for short-duration projects or calibrating SCSN stations to do velocity monitoring of other faults. One of these SCSN station calibration projects was done in early 2022 at a SCSN station (CI-CLC) in the Ridgecrest, CA, area for a monitoring side-study of faults responsible for the 2019 Ridgecrest earthquakes. Future side-study projects under consideration include deployments in the Antelope Valley and Napa Valley.

We welcome potential collaborators and interested parties to participate in potential side-studies and PFO array maintenance.

298-node Pinon Flat array station locations. Distance between stations is nominally 100m.



Good source of body waves are trains traveling in the Coachella Valley. b) shows raypath of body waves used to monitor San Jacinto Fault.



Calibrating SCSN station. Left: 150 station nodal array (yellow dots) deployed for 3 months to calibrate body waves received at SCSN station CI-CLC (purple triangle). Red line is ground break from 2019 Ridgecrest earthquakes. Right: Potential body wave monitoring raypaths (light blue lines) available using local SCSN network stations (white and purple triangles).

Picture of GeoSpace GSB3 nodal station. From left to right: 3C 5Hz geophone sensor, 64GB GSB3 data logger, and BN25 lithium-ion battery. Together the system has 140 days of autonomy.

References

Brenguier, F., Boué, P., Ben-Zion, Y., Vernon, F., Johnson, C. W., Mordret, A., Hollis, D., et al. (2019). Train traffic as a powerful noise source for monitoring active faults with seismic interferometry. *Geophysical Research Letters*, *46*. https://doi.org/10.1029/ 2019GL083438.

Brenguier, F., Boué, P., Ben-Zion, Y., Vernon, F., Johnson, C. W., Mordret, A., Hollis, D., et al. (2019). Turning Vehicle Traffic into a Powerful Seismic Source for Monitoring Active Faults**.** *Science.*

Pinzon-Rincon, L., F. Lavoué, A. Mordret, P. Boué, F. Brenguier, P. Dales, Y. Ben-Zion, F. Vernon, C. J. Bean, and D. Hollis (2021). Humming Trains in Seismology: An Opportune Source for Probing the Shallow Crust, Seismol. Res. Lett. XX, 1–13, doi: 10.1785/0220200248.

ISTerre Institut des Sciences de la Terre

UGA Université Grenoble Alpes

erc

USC

Cecil H. and Ida M. Green INSTITUTE OF GEOPHYSICS AND PLANETARY PHYSICS