Fault Trace Mapping of the Central SAF from Lidar Topography

Poster #258, JHP
2022 SCEC Annual Meeting

Joseph Powell , Chelsea Scott , Ramon Arrowsmith
School of Earth and Space Exploration
jhpowel3@asu.edu

Overview

-Fault trace mapping from San Juan Bautista to Parkfield within the creeping section of the San Andreas Fault (SAF).
-Preformed by comparing 3-D differencing and surficial geomorphic mapping.

Motivation

-To increase the spatial accuracy of mapped fault traces along surficial and bedrock contacts.
-Compare decadal topographic differencing to millennial geomorphic signals.

Results

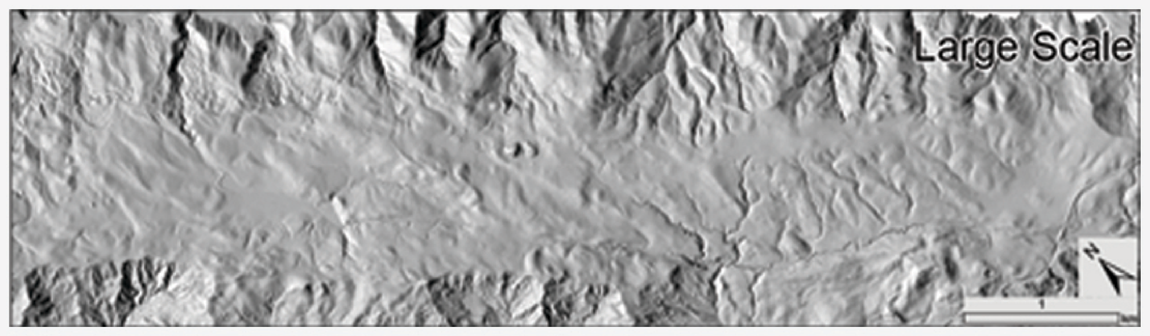
- ~2,000 mapped geomorphic indicators.
- Primary and Secondary fault trace mapping following the Federal Geographic Data Committee standards.

P or S, Quality
P, 1 — S, 1
P, 2 — S, 2
P, 3 — S, 3
P, 4 — ID Points

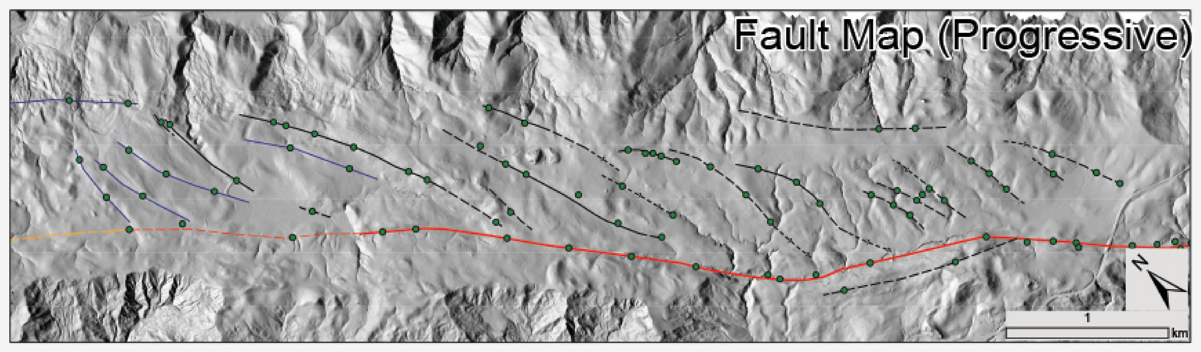
shear strain
Value
0.3
-0.3

How to fault map

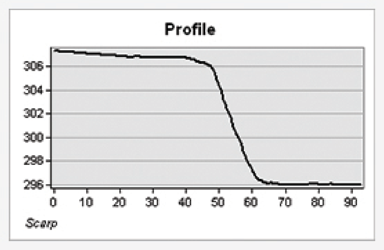
Look at the whole area



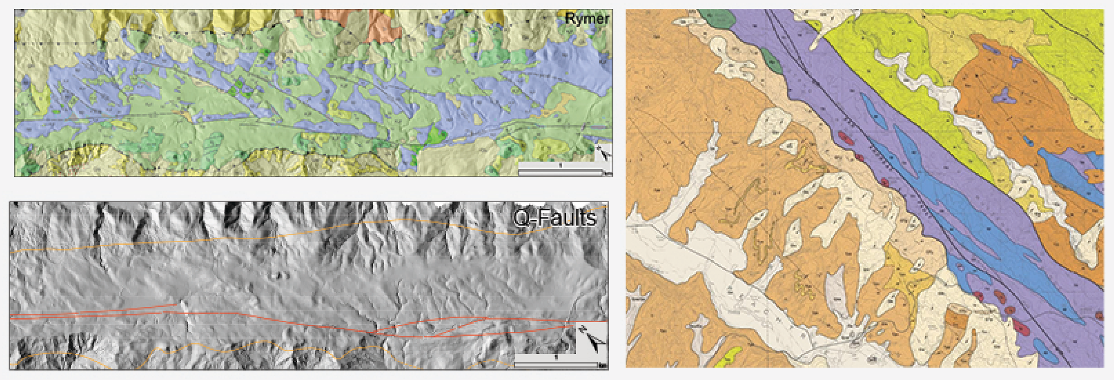
↑
Do another pass over the whole area to be sure that the mapping makes sense.
|
Note indicator strength, fault geometry,and decide the quality of each trace



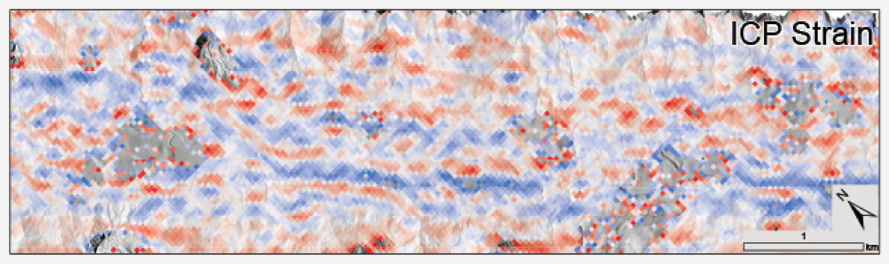
Find locations that appear to have strong indicators

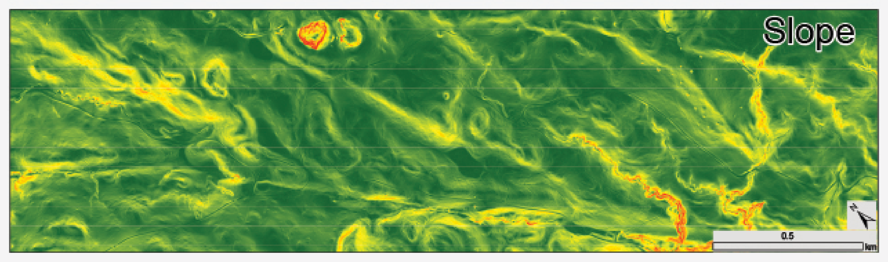


Study the area



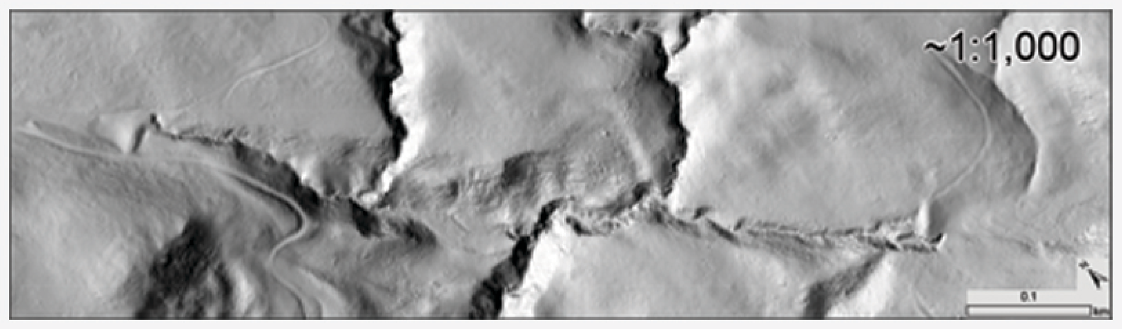
Zoom in and study data





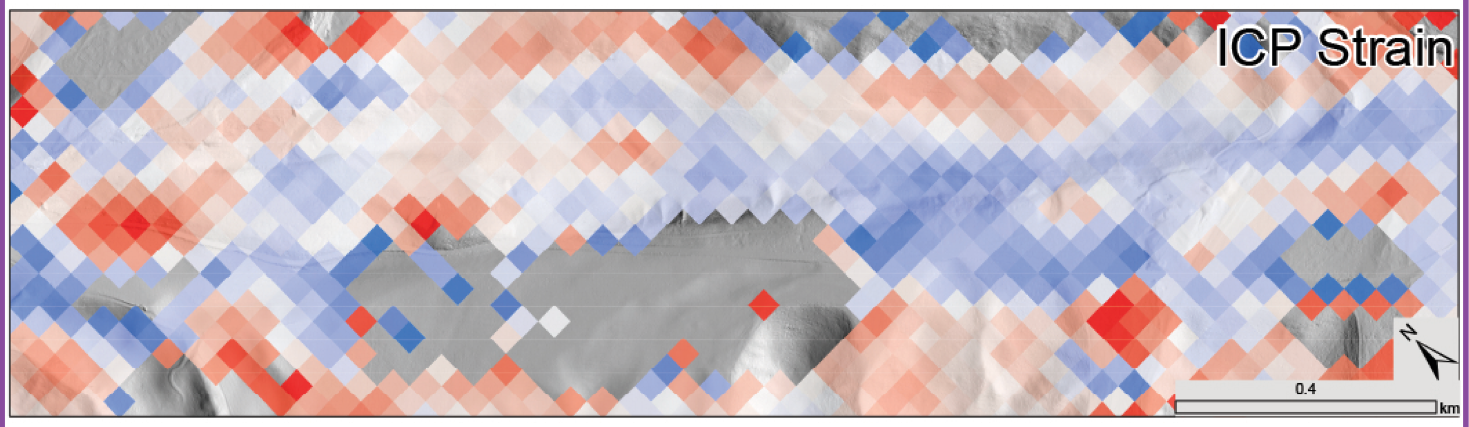
Focus on strong indicators first
↓
Locate geomorphic indicators to tag and push fault line mapping

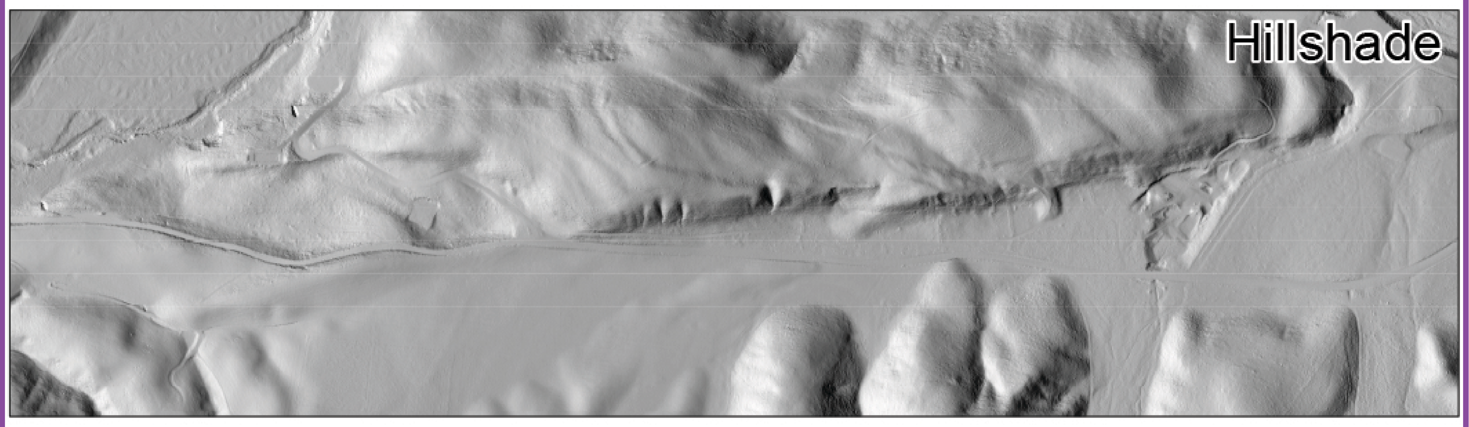
Map rough draft fault lines and progressively refine them

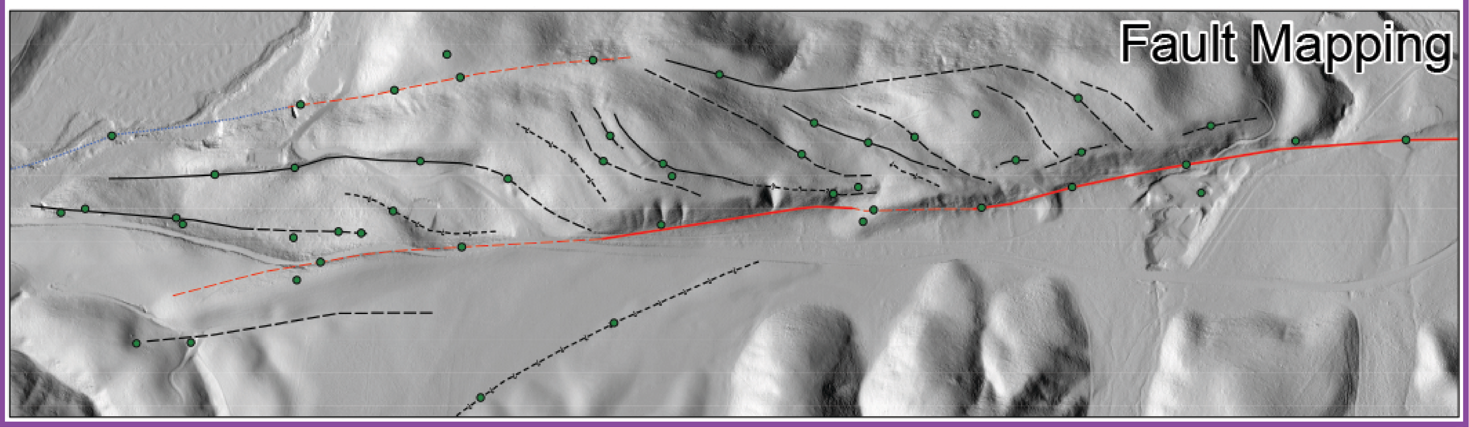


Paicines Ranch

-Right lateral step within the Primary trace resulting in Secondary faults showing a sigmoidal pattern.
-At this scale the 3-D differencing becomes less useful, though the Primary trace is predominant.
-A strong scarp shows the Primary trace. Secondary geomorphology relies on scarps, liniments, and weak signals.

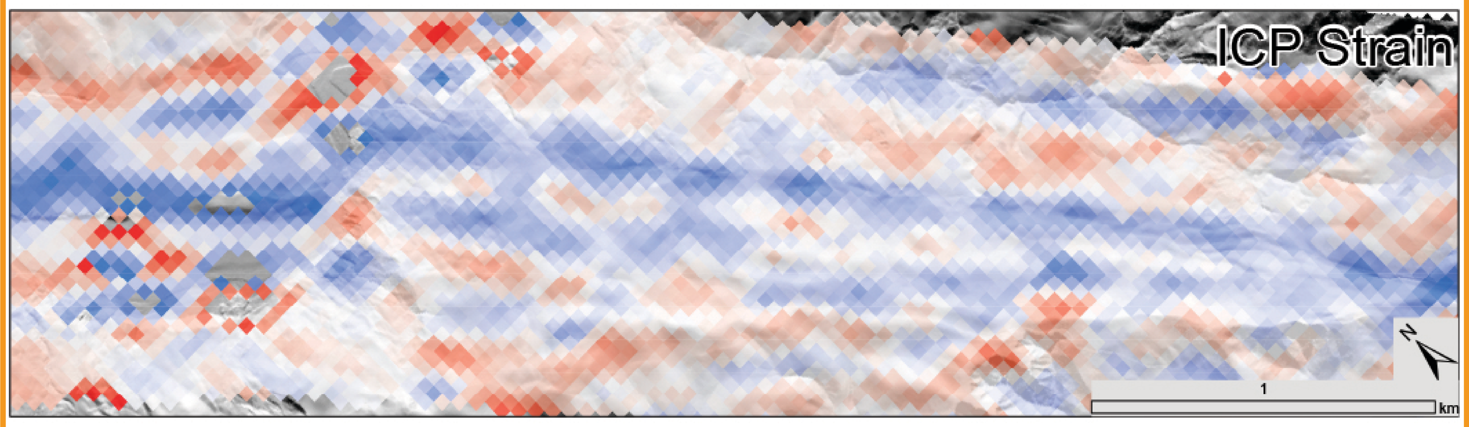


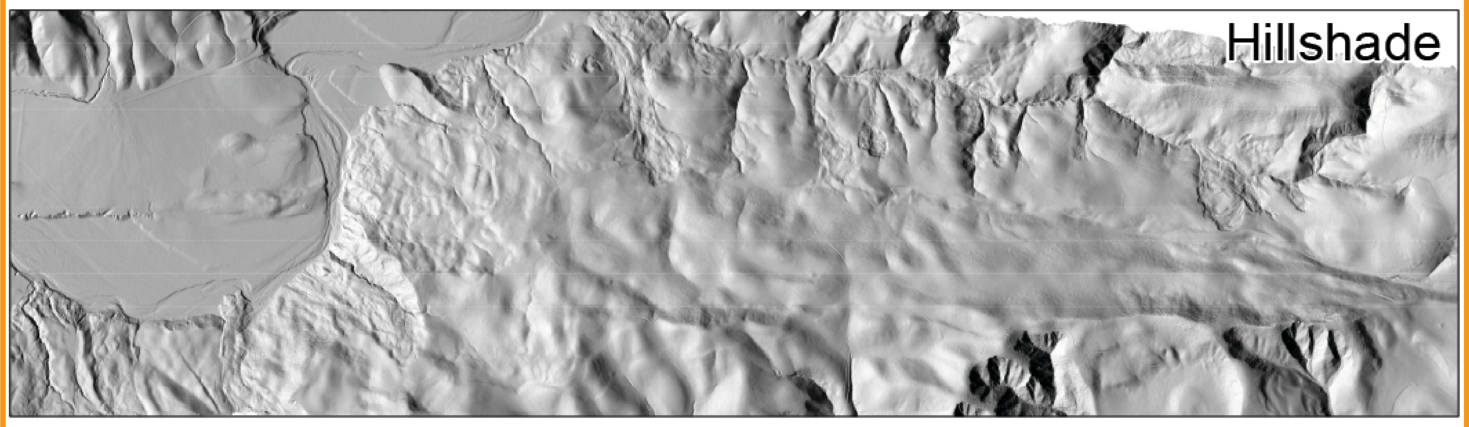


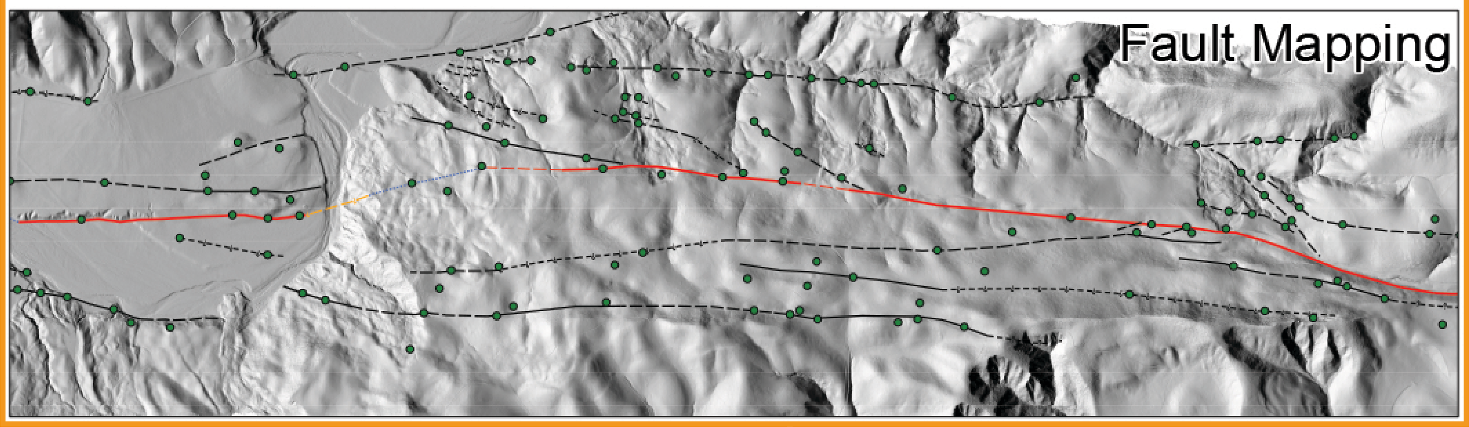


Peach Tree

-The 3-D differencing shows clear Primary and Secondary fault trace locations. Detailed mapping relied on surficial mapping.
-Secondary traces run parallel to the Primary trace and are preserved by surficial geometry.
-Both Primary and Secondary traces have sections highly influenced by fluvial activity along with buried sections.

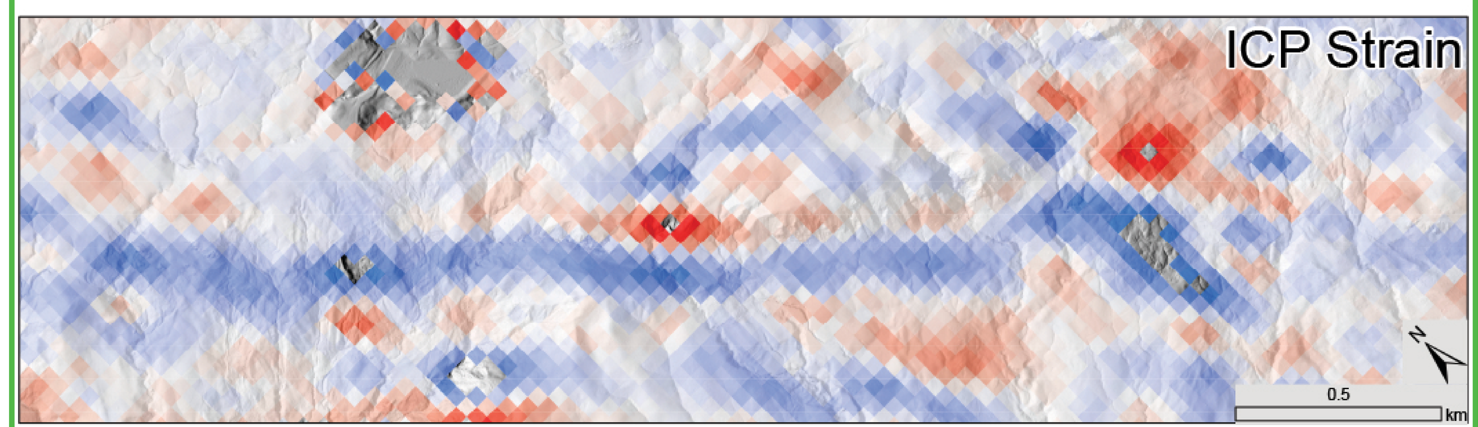


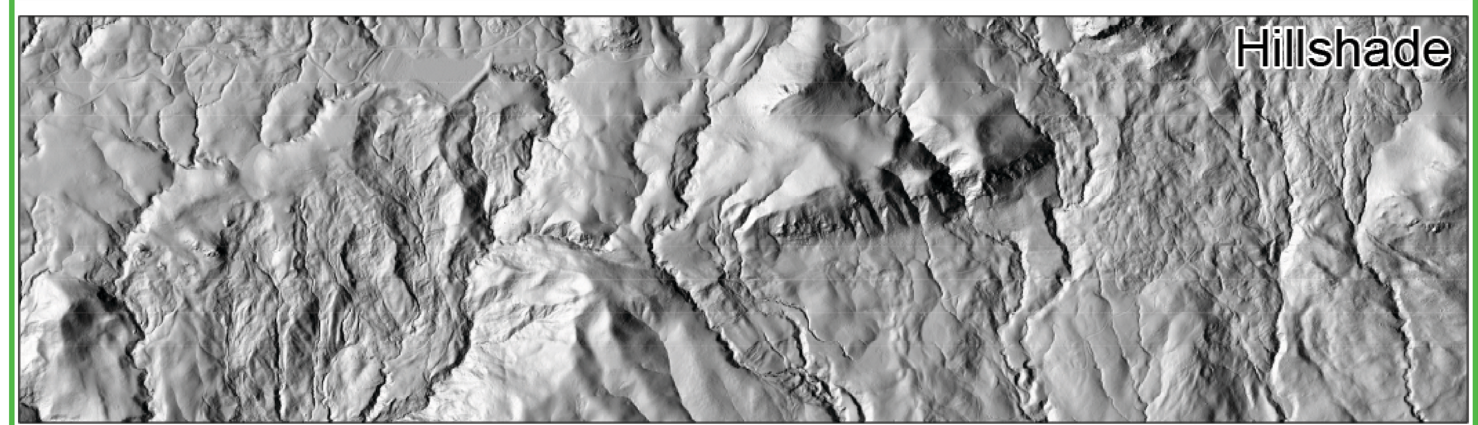


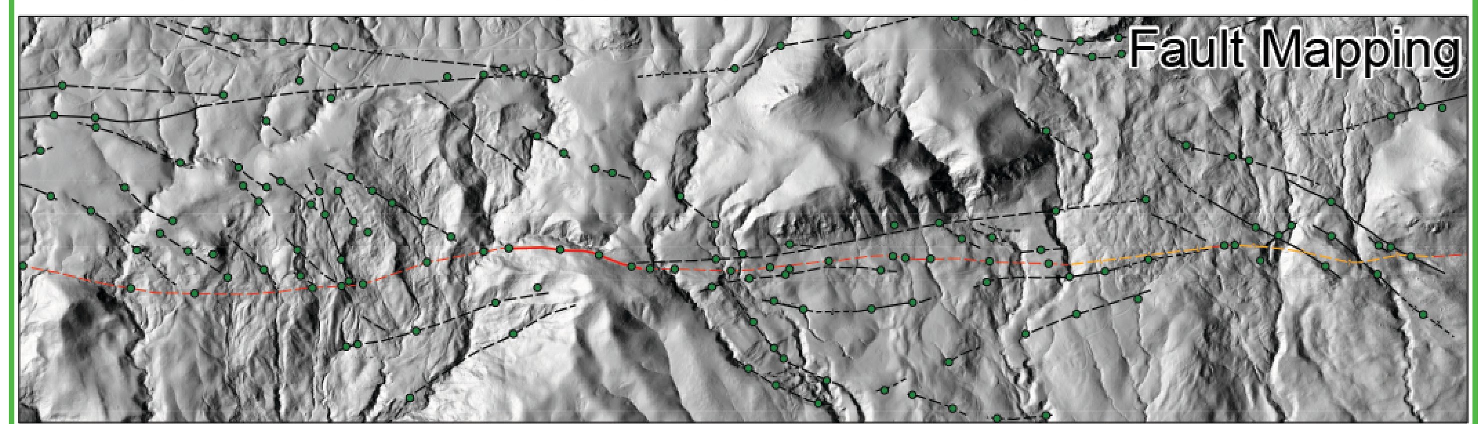


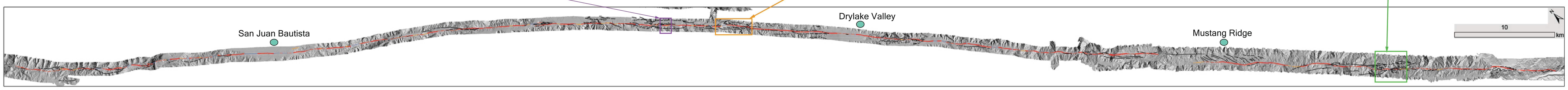
Slack Canyon

-Heavy geomorphic alteration has erased most of the strong indicators from the Primary trace within this area.
-Surficial land flow allows for an increase in strength and saturation of the presentation of secondary indicators.
-3-D differencing has a strong signal for the Primary trace and









The ASU Mapping Team would like to extend a heart felt thanks to Steve Delong for his hard work and dedication to this project. His guidance and diligence have been an inspiration and influence towards the growth and development of the student mapper. This project would not have been possible without the funding through the EDMAP program with the USGS. We would also like to extend gratitude to Morena Hammer, Jack Willard, Nicholas Cunetta, and Rachel Adam for their contributions toward this project.

Scott, C. P., DeLong, S. B., & Arrowsmith, J. R. (2020). Distribution of Aseismic Deformation Along the Central San Andreas and Calaveras Faults From Differencing Repeat Airborne Lidar
Delong, S. B., Hilley, G. E., Rymer, M. J., & Prentice, C. (2010). Fault zone structure from topography: Signatures of en echelon fault slip at Mustang Ridge on the San Andreas Fault
Page, B. M., Thompson, G. A., & Coleman, R. G. (1998). Late Cenozoic tectonics of the central and southern Coast Ranges of California.
Map showing recently active breaks along the San andreas and related faults between the Northern Gabilan Range and Cholame Valley, California, Brown 1970
Geologic map along a 12 kilometer segment of the San Andreas Fault Zone, Southern Diablo Range, California, Rymer 1981
Geologic map of Monarch Peak Quadrangle, Dibblee 2007