GeoGateway: A System for Analysis of UAVSAR Data Products

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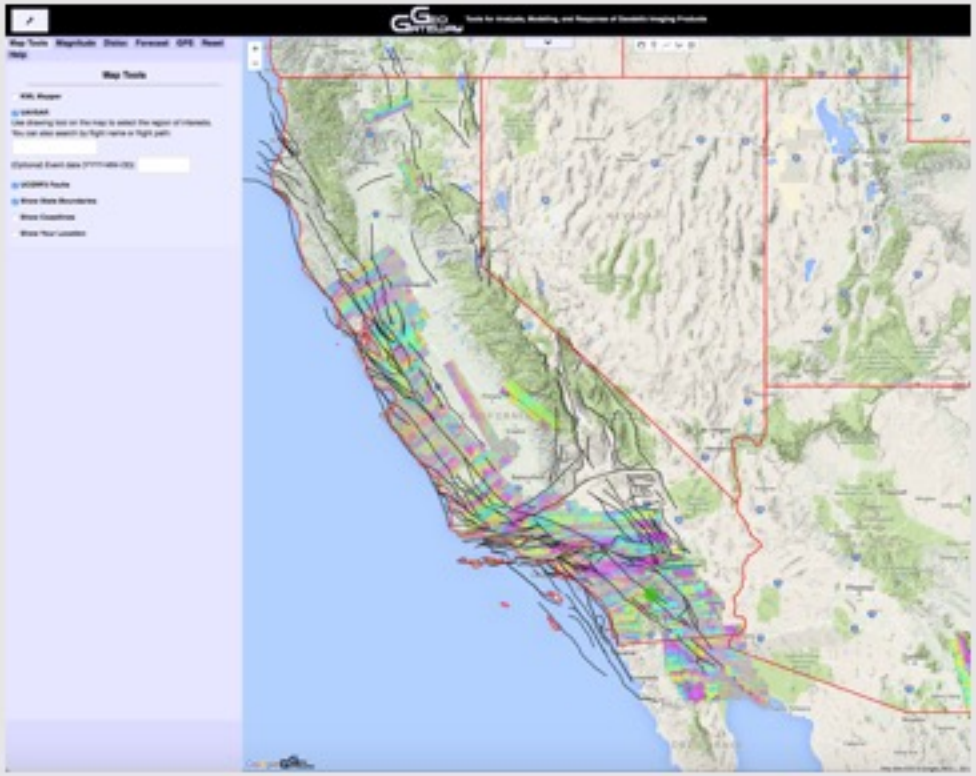
GeoGateway

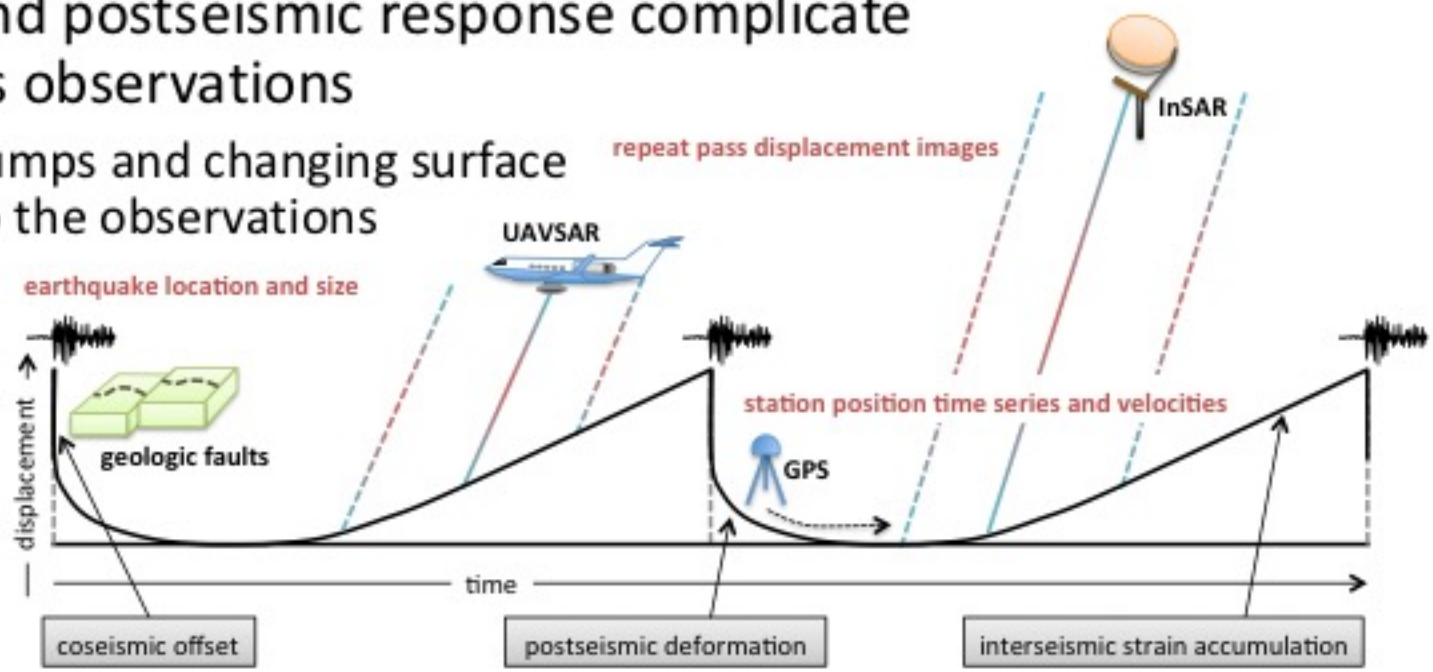
Data product search and analysis gateway for scientific discovery, field use, and disaster response



- For studying earthquakes and crustal deformation
- Analysis, modeling, and response of geodetic imaging products
- Web-enabled map-based
  - Useable on computers, tablets, and mobile devices

Motivation

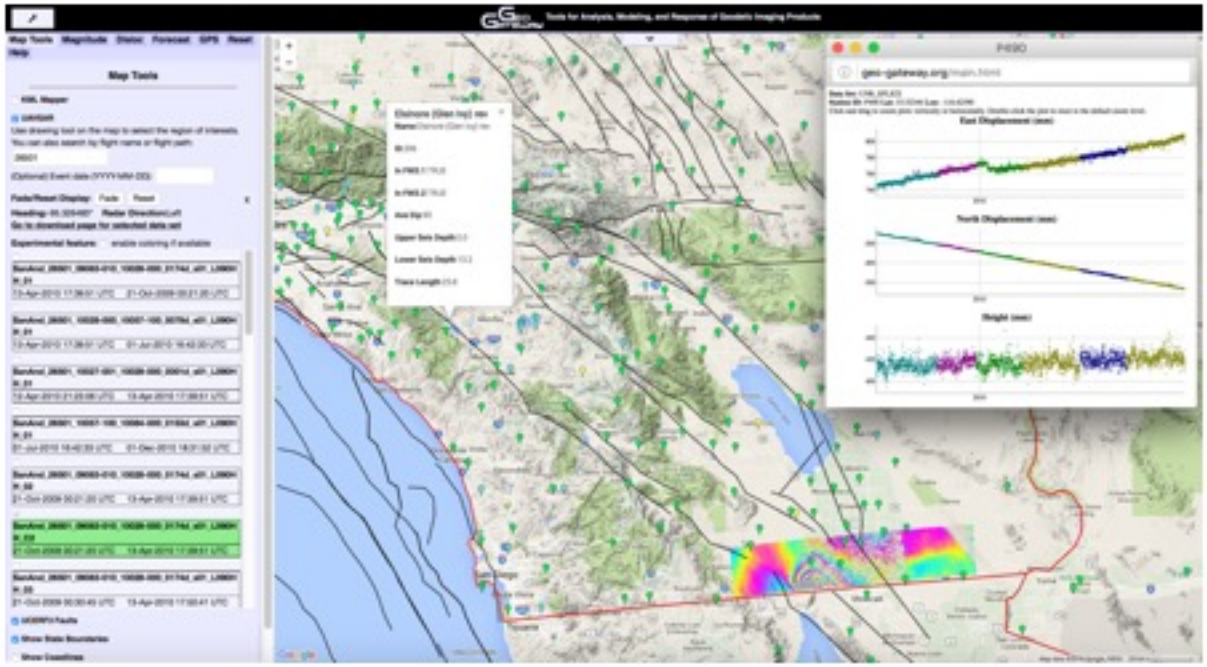
- Crustal deformation is spatially and temporally non-uniform
  - Strain accumulates before events, is released in earthquakes, and rapidly changes following them
- Earthquake processes occur over a wide range of scales
  - Multiple data types probe different aspects of the earthquake cycle
- Earthquakes and postseismic response complicate heterogeneous observations
  - Add episodic jumps and changing surface deformation to the observations



User Needs

Users require

- Data overlay and visualization
- Interactive analysis features
- Data product download

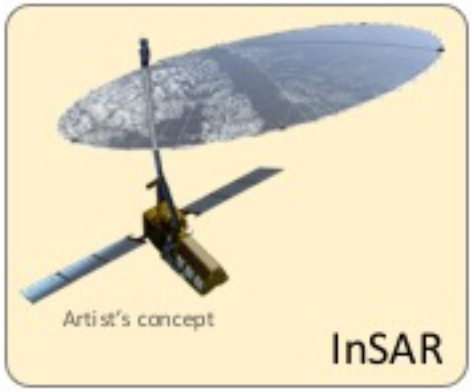


Data products

- NASA's UAVSAR
- Spaceborne interferometric radar (InSAR)
- Geologic earthquake faults
- Global Positioning System (GPS) position time series
- Seismicity
- Topographic imaging

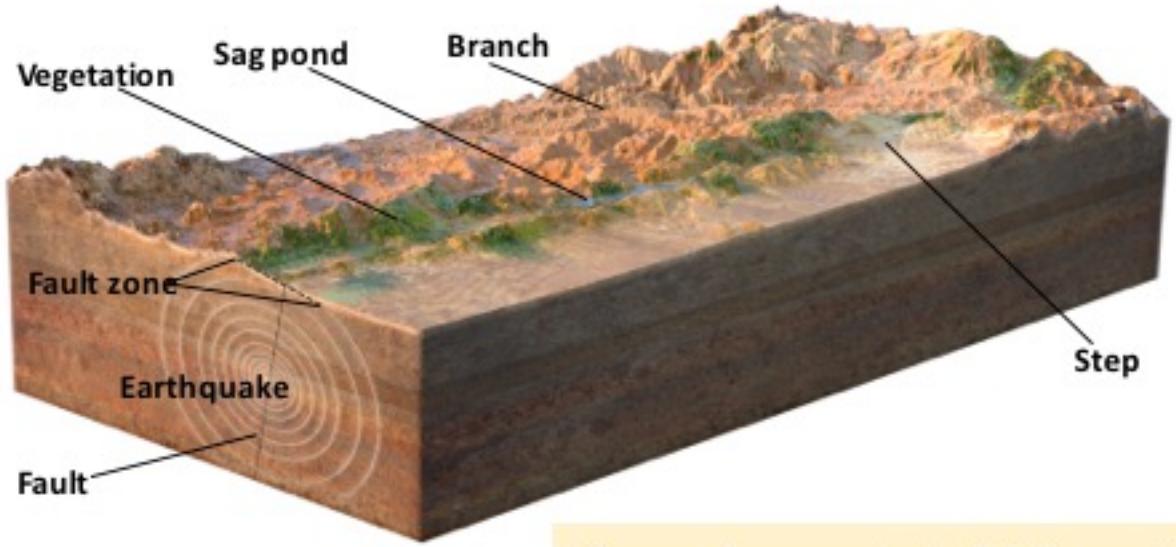
Geodetic Imaging

- Measurement of crustal deformation
  - Associated with strain accumulation and release
- Data
  - Global Positioning System (GPS)
    - Point positions, time series, offsets, and velocities
  - Interferometric synthetic Aperture Radar (InSAR)
    - Spaceborne line of site
  - UAVSAR airborne InSAR



Topographic Imaging

- Earthquakes and erosion shape our landscapes
- Allows study of fault zones from decimeter to kilometer scale
  - Damage structure and surface characteristics
  - Lineations, fault asymmetry, and topographic fabric and complexity
  - Correlate geomorphic metrics with earthquake rupture characteristics



To be implemented

Complements InSAR and GPS geodetic imaging

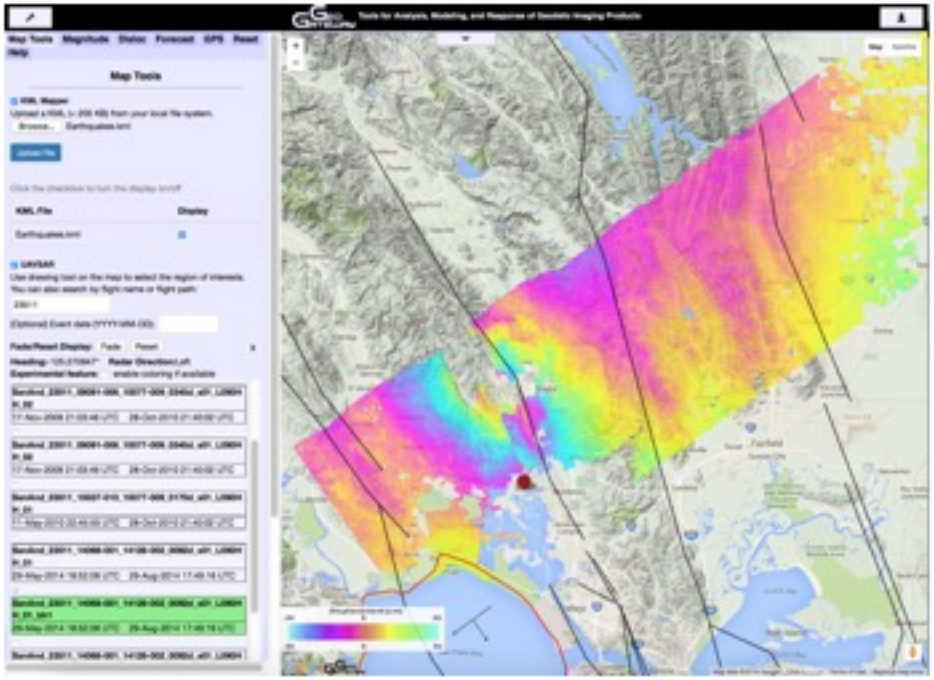
Other Data

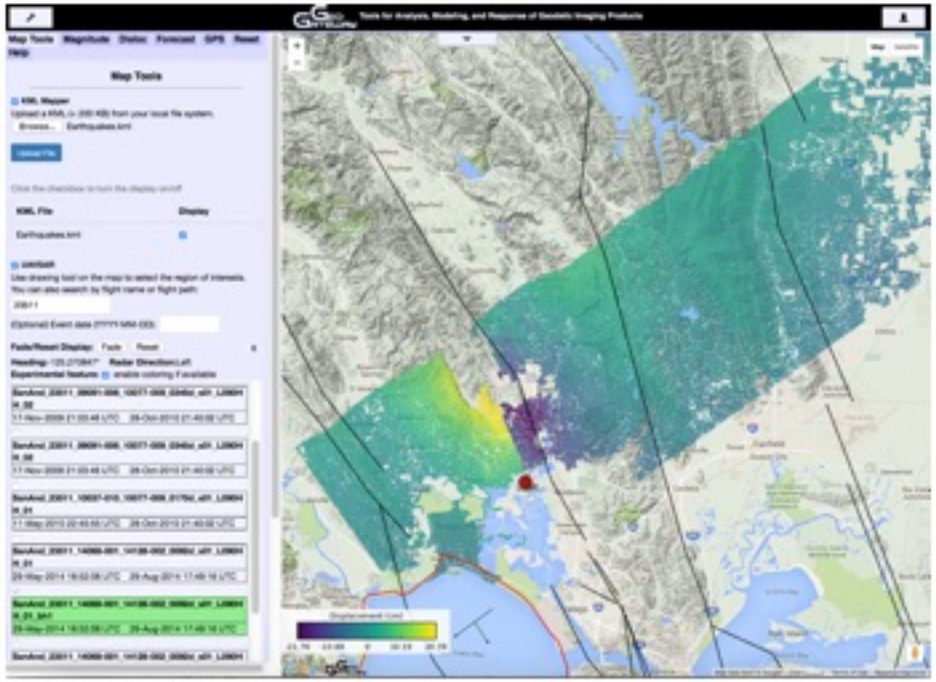
- Seismicity
  - Location and size of events
- Geologic faults
  - Locations of past ruptures
  - Displacement history
  - Fault geometry

For model constraints and data interpretation

Presentation of UAVSAR Data Products

- Users can view interferograms in their original fringes or using a single range color map
- Allows for more intuitive interpretation of the data products



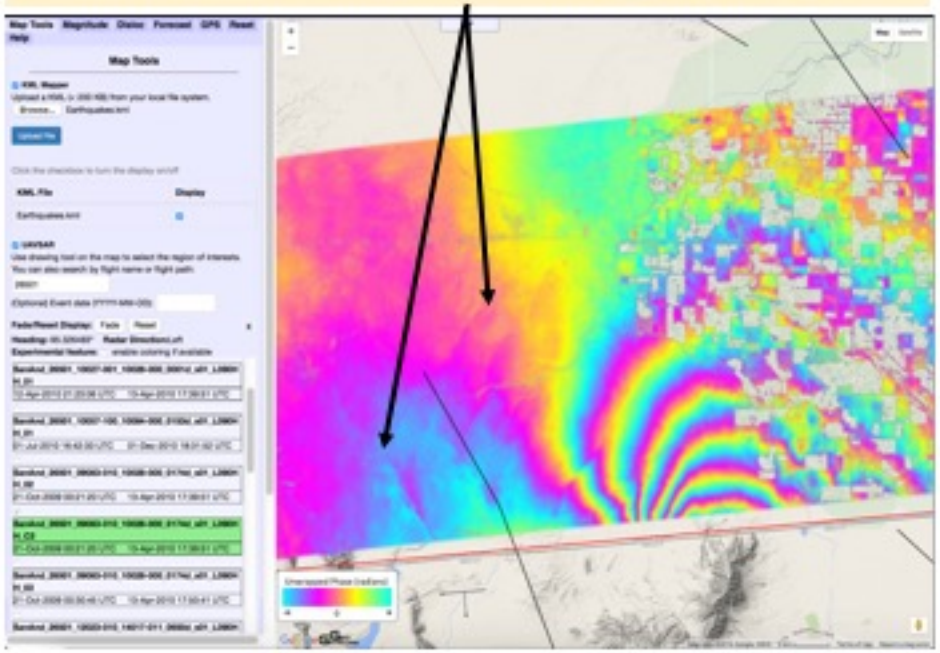


2014 M6.0 South Napa Earthquake

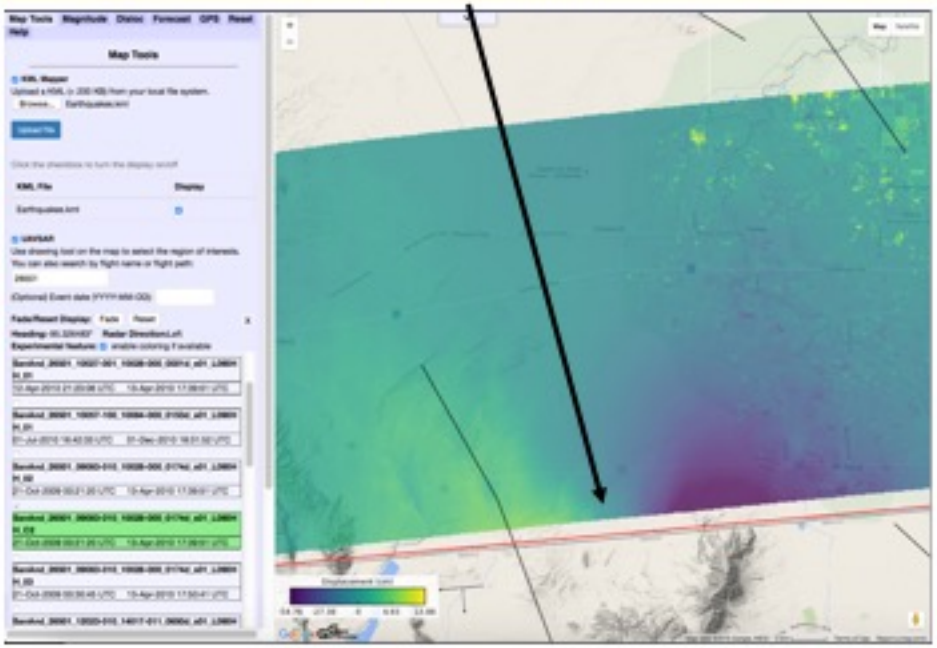
Color Mapping

Fringes can be useful for detecting subtle motions or for counting to estimate line of sight motion

Conjugate and off-fault faulting easier to see



Large offset from main rupture easy to see

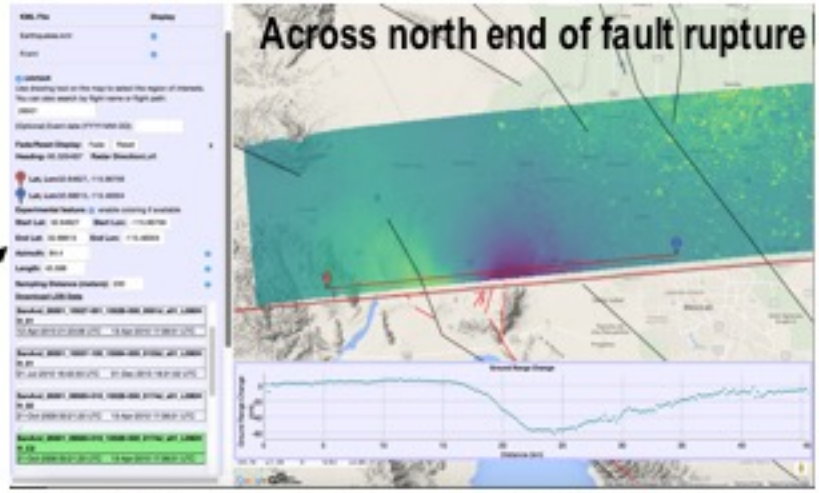


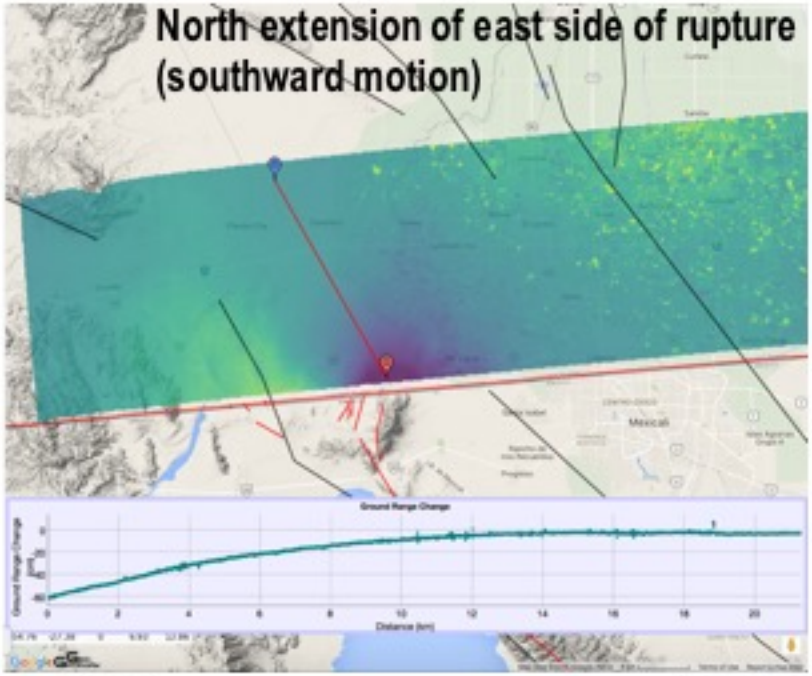
2010 M7.2 El Mayor – Cucapah Earthquake

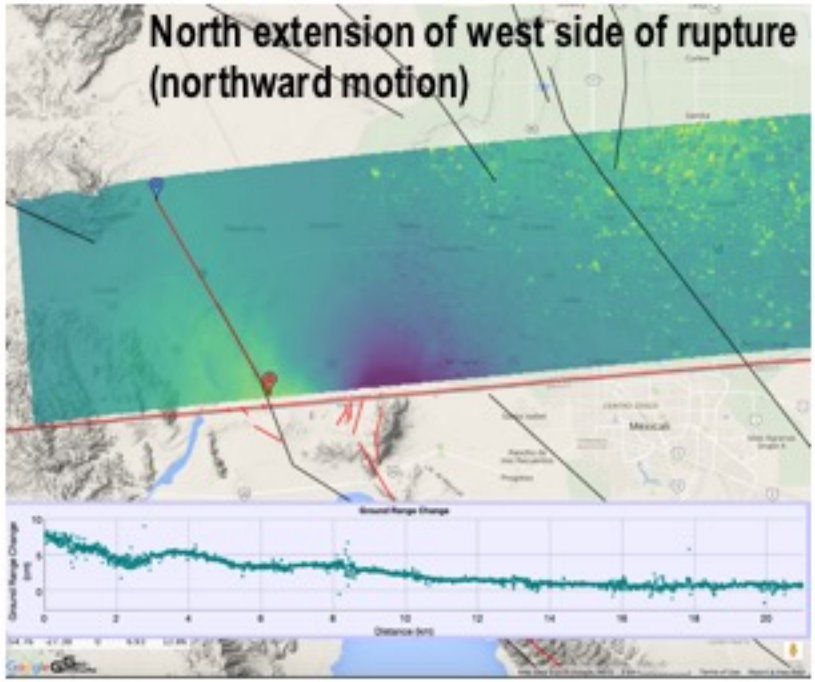
Example: 2010 M7.2 El Mayor – Cucapah Earthquake

GeoGateway line of sight tool allows understanding of surface motions

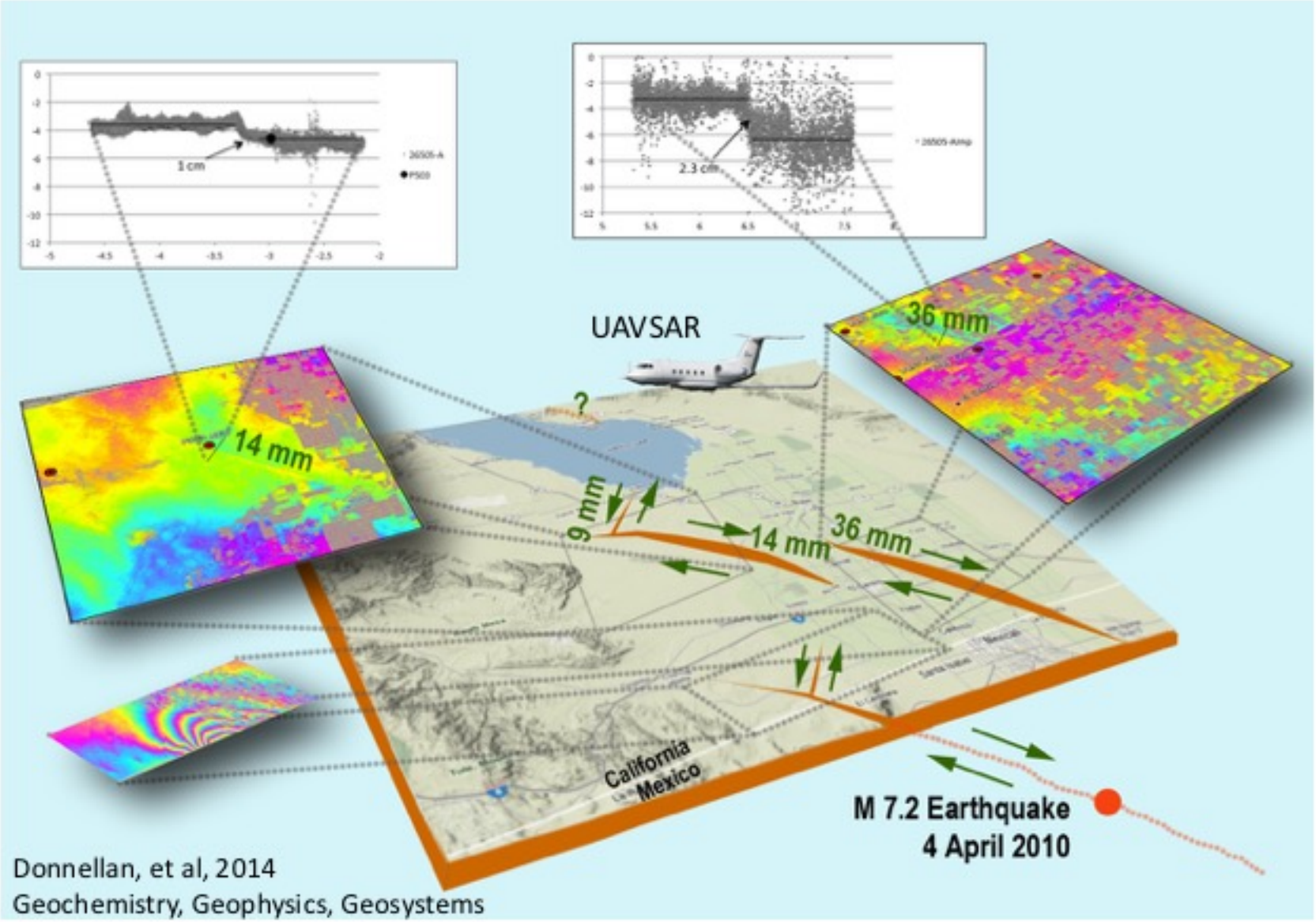
Users can select end points, sampling interval, and download profile for further analysis





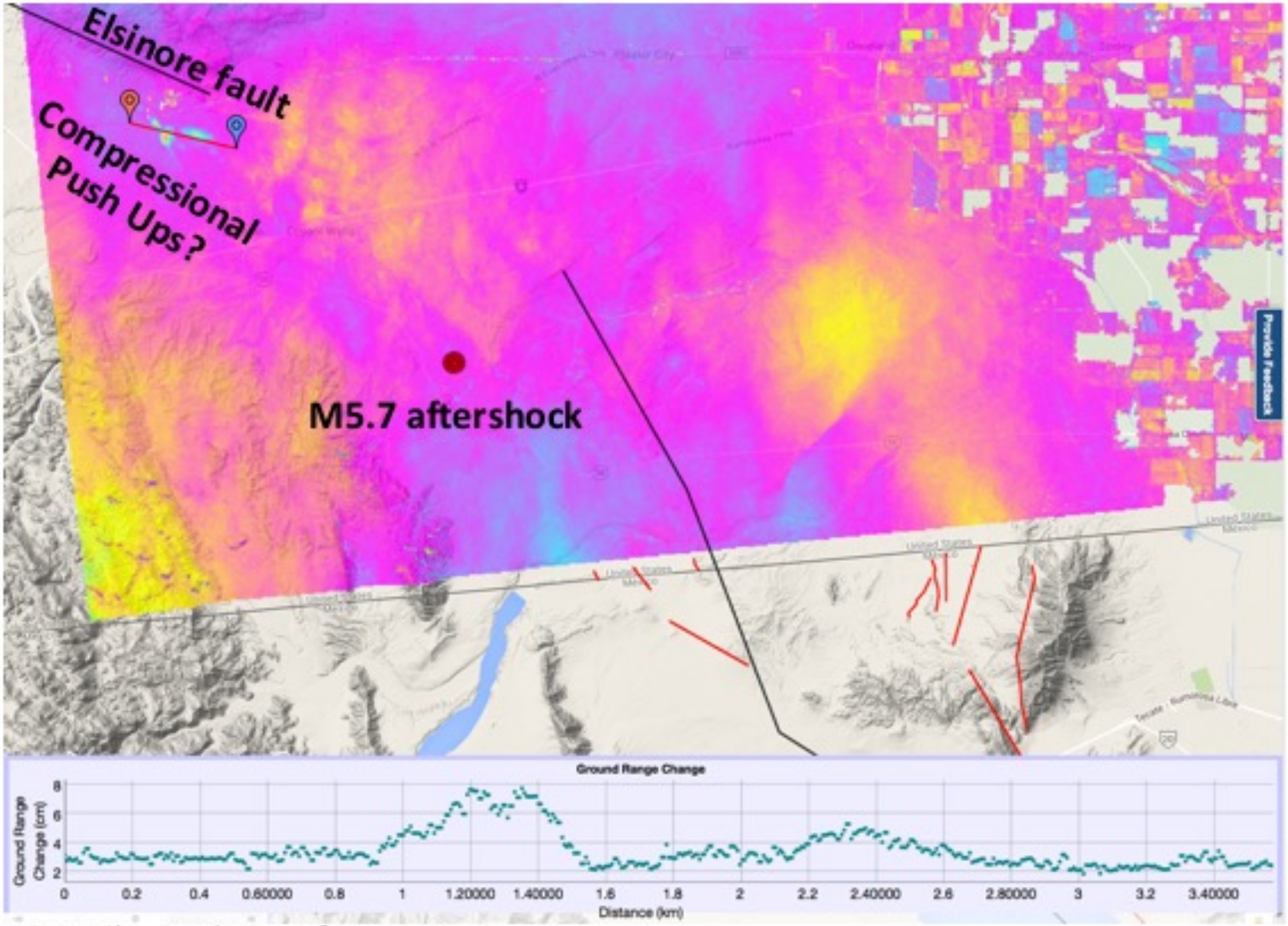


Triggered Slip from El Mayor – Cucapah Earthquake



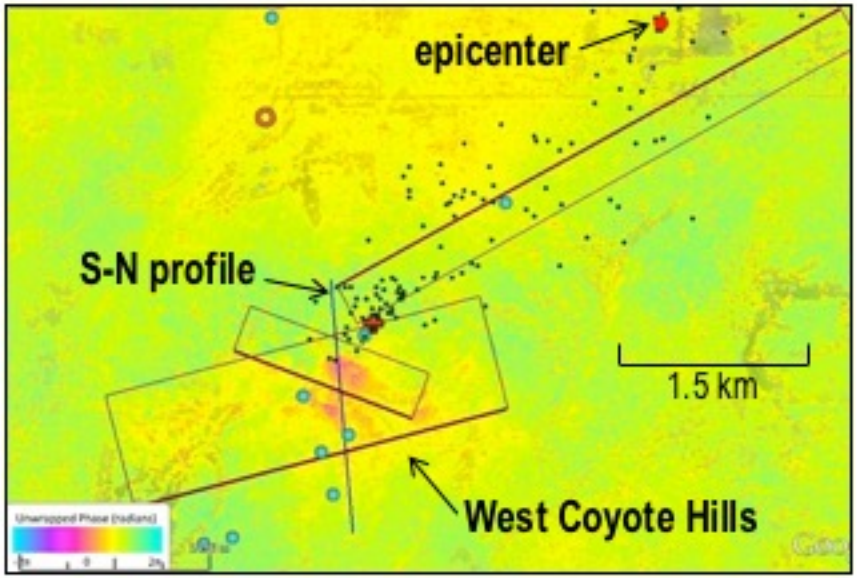
Donnellan, et al, 2014
Geochemistry, Geophysics, Geosystems

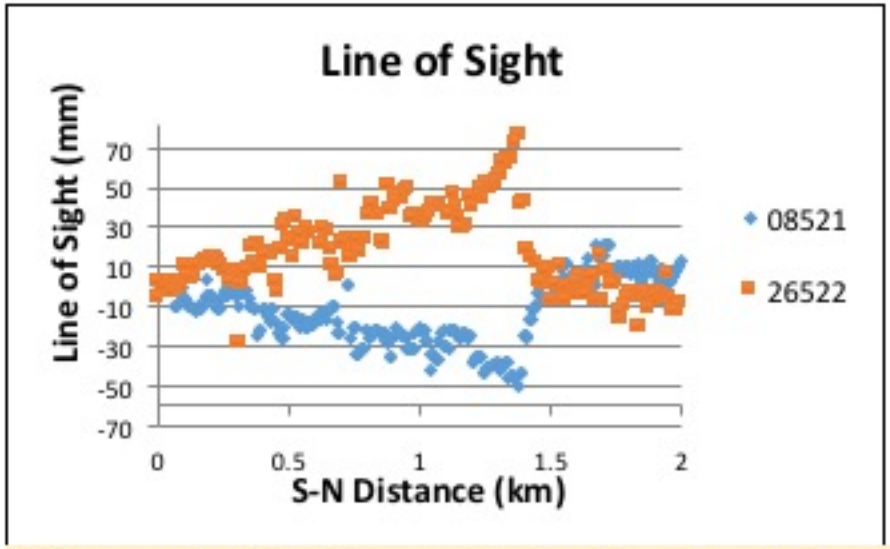
Postseismic Motion and Aftershock



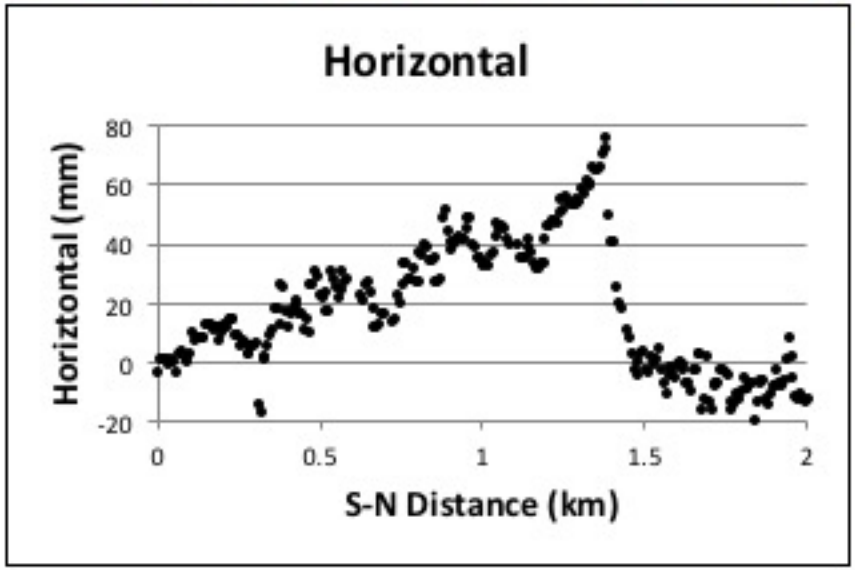
13 April – 1 July interferogram

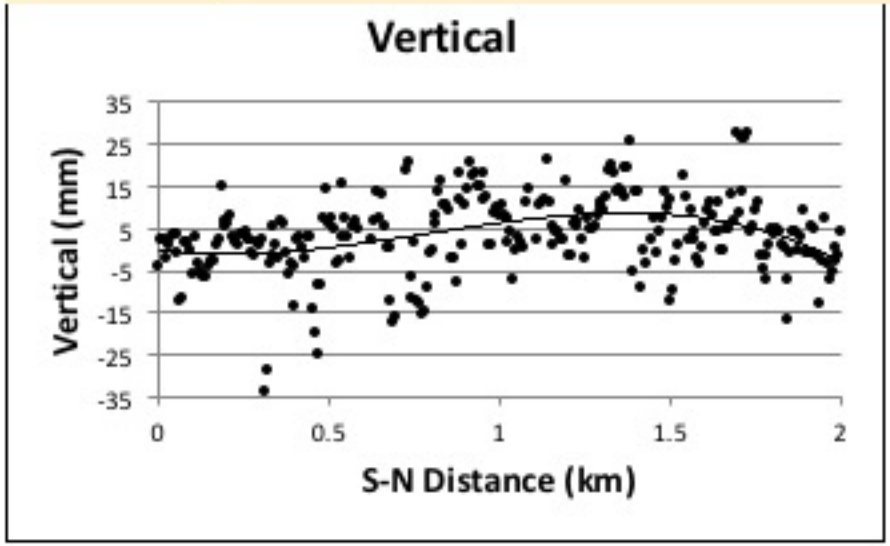
2010 M5.1 La Habra Earthquake West Coyote Hills





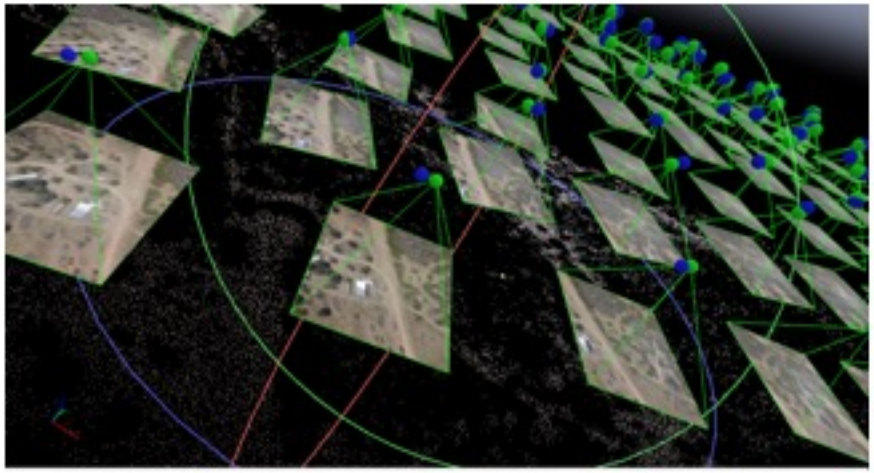
Offline analysis to determine horizontal and vertical motion

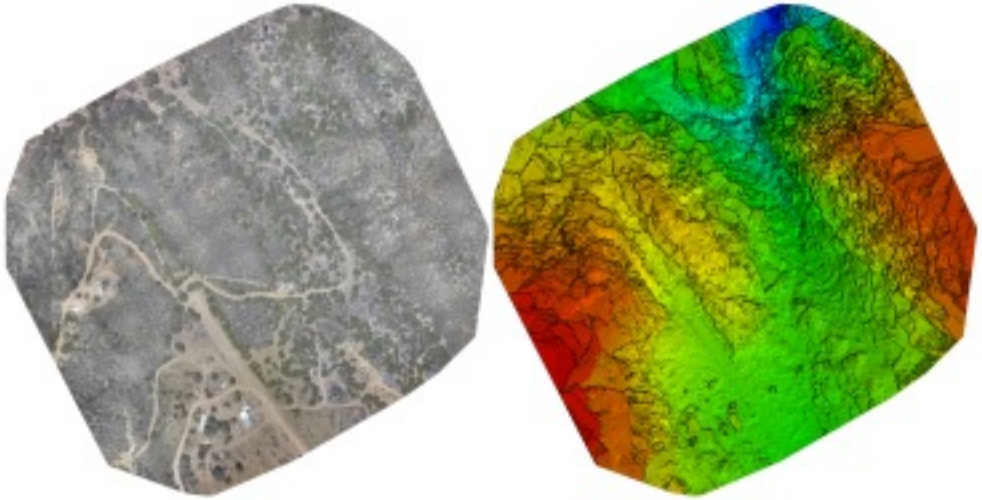




New Data Product: Topographic Imaging

- Use small uninhabited aerial vehical (sUAV) to collect multiple images while staring at a target
- Reconstruct topography from the multiple images

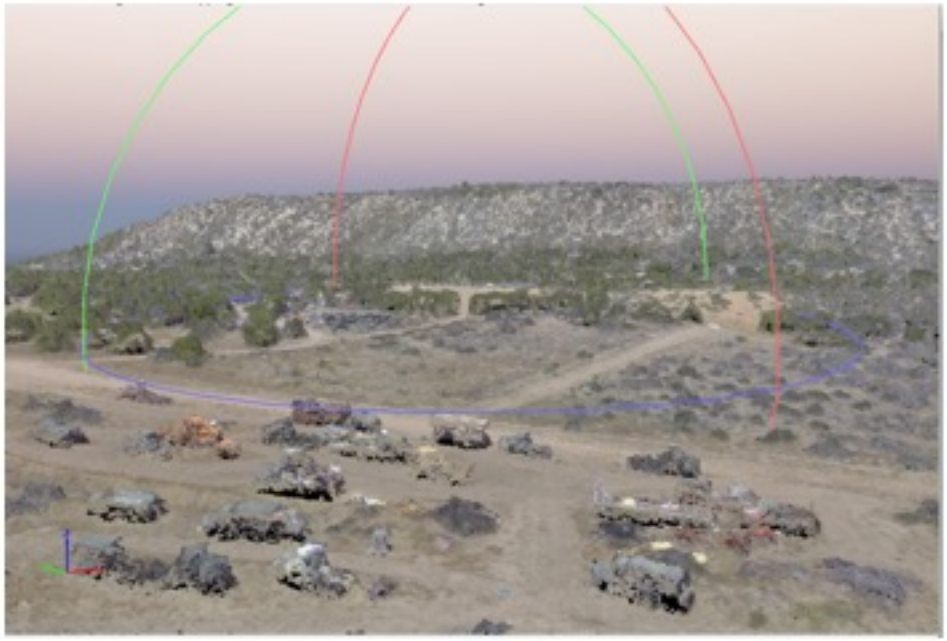


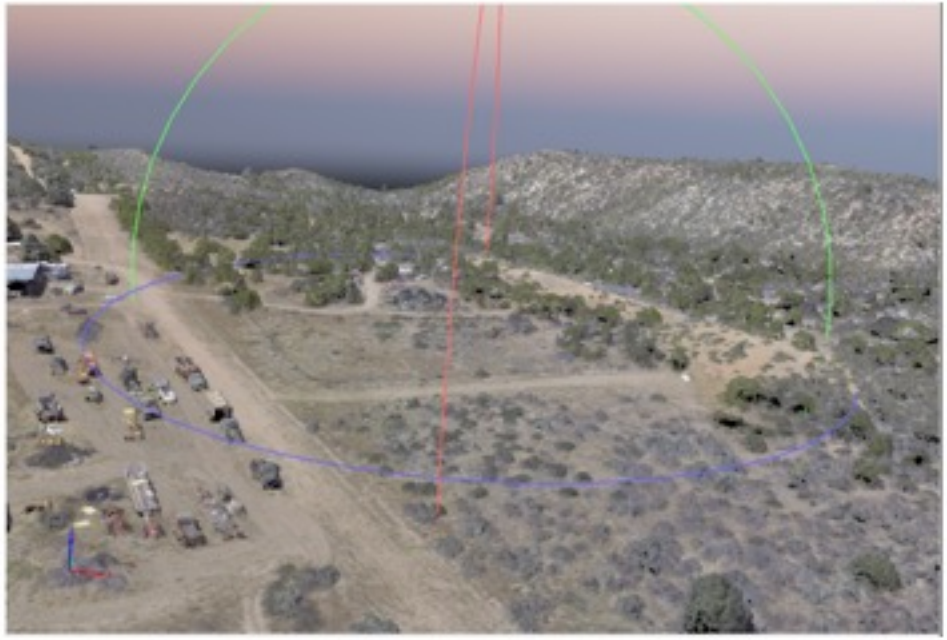


In partnership with Ramón Arrowsmith, Arizona State University http://opentopography.org

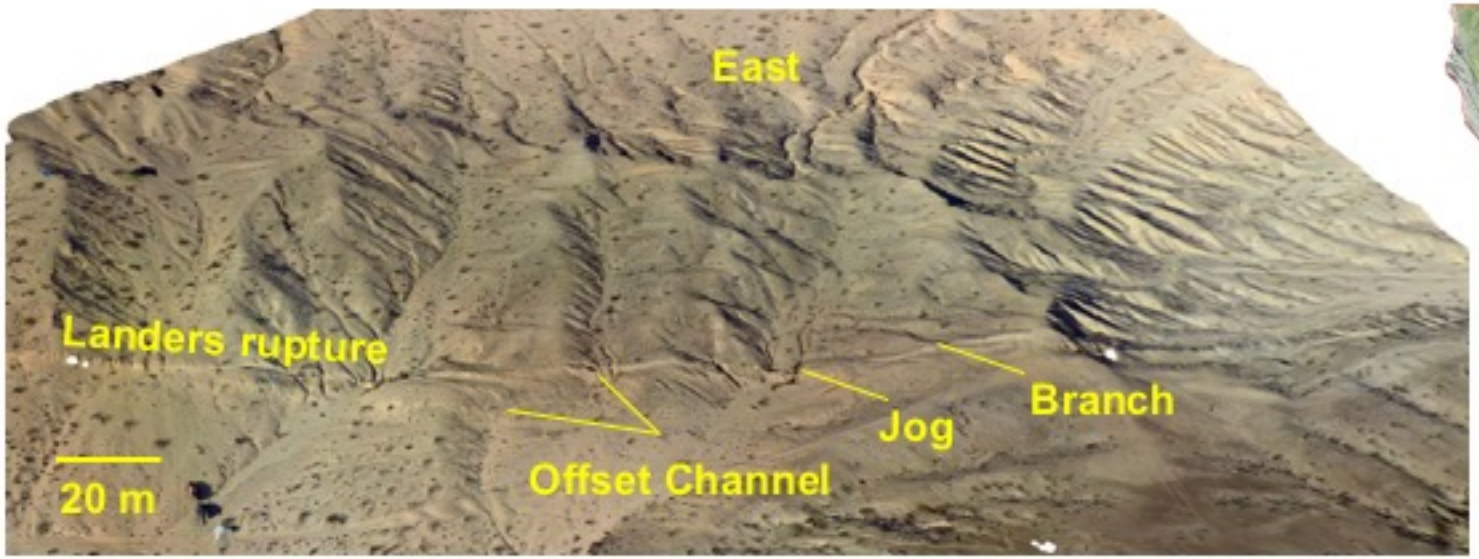
Example: San Jacinto Fault Zone

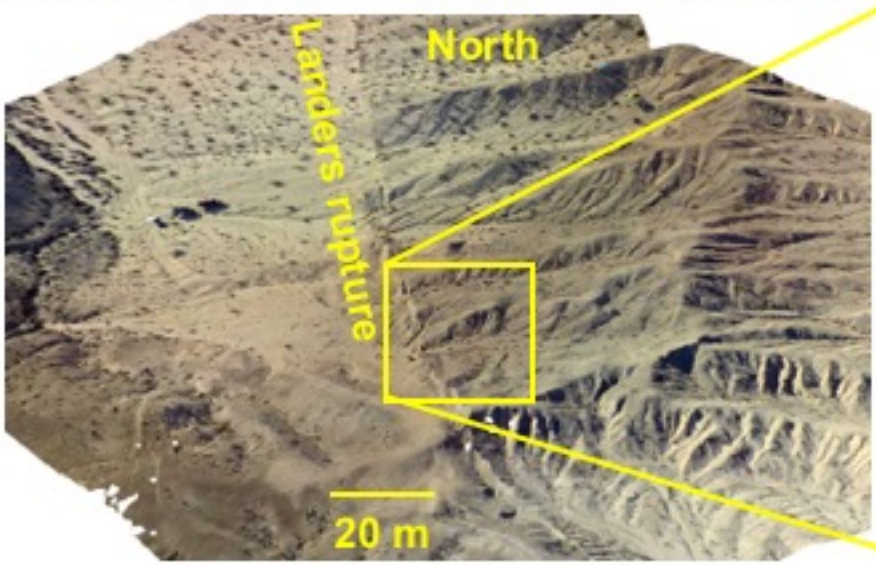
- Anza gap is capable of producing a M7.3 earthquake
- Color draped topographic imaging provides information about fault zones

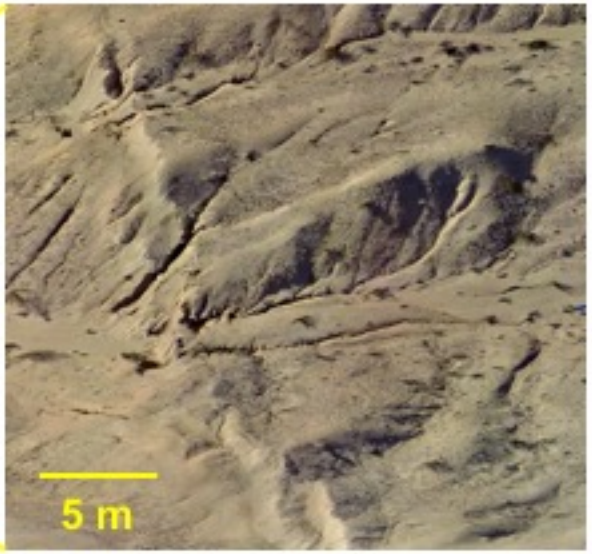




M7.3 1992 Landers Earthquake Rupture







Summary

- The goal of GeoGateway is to streamline and improve the efficiency of scientific analysis
  1. Simplify the discovery of geodetic imaging products
  2. Enable researchers to explore and integrate data products through online or offline analysis
  3. Allow researchers to easily share, publish, and collaborate on results of these online experiments
- Relies on producers of data products
- Focuses on the infrastructure for analyzing, interpreting, and modeling the data products
  - Adding rating system for data products
  - Targeted toward data fusion of heterogeneous products

http://geo-gateway.org