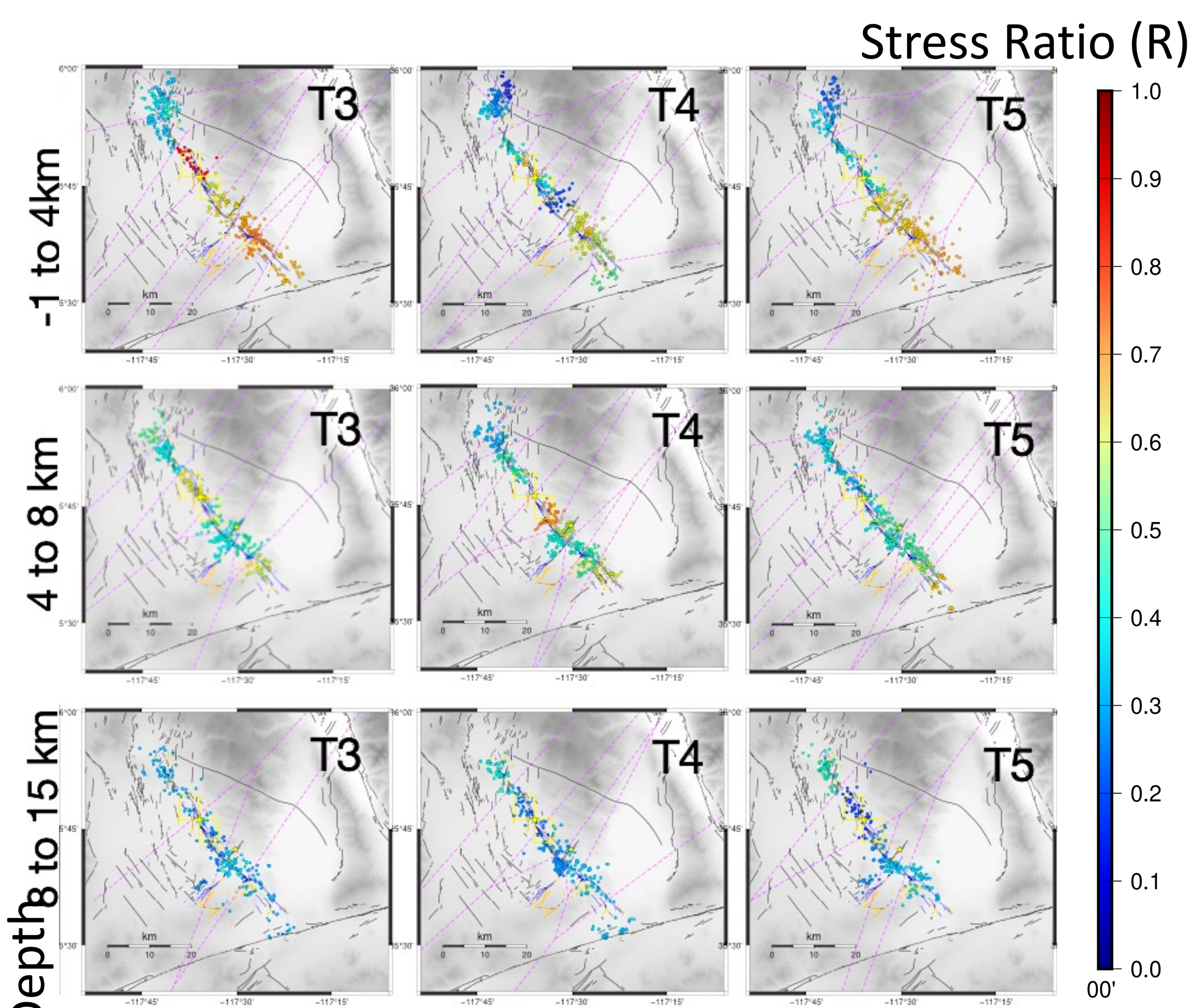
National Aeronautics and Space Administration

Spatiotemporal Variations of Stress and Strain in the Crust near 2019 Ridgecrest Earthquake Sequence

Author: Niloufar Abolfathian, JPL Postdoctoral Fellow (329A)
Advisor: Eric Fielding (329A)

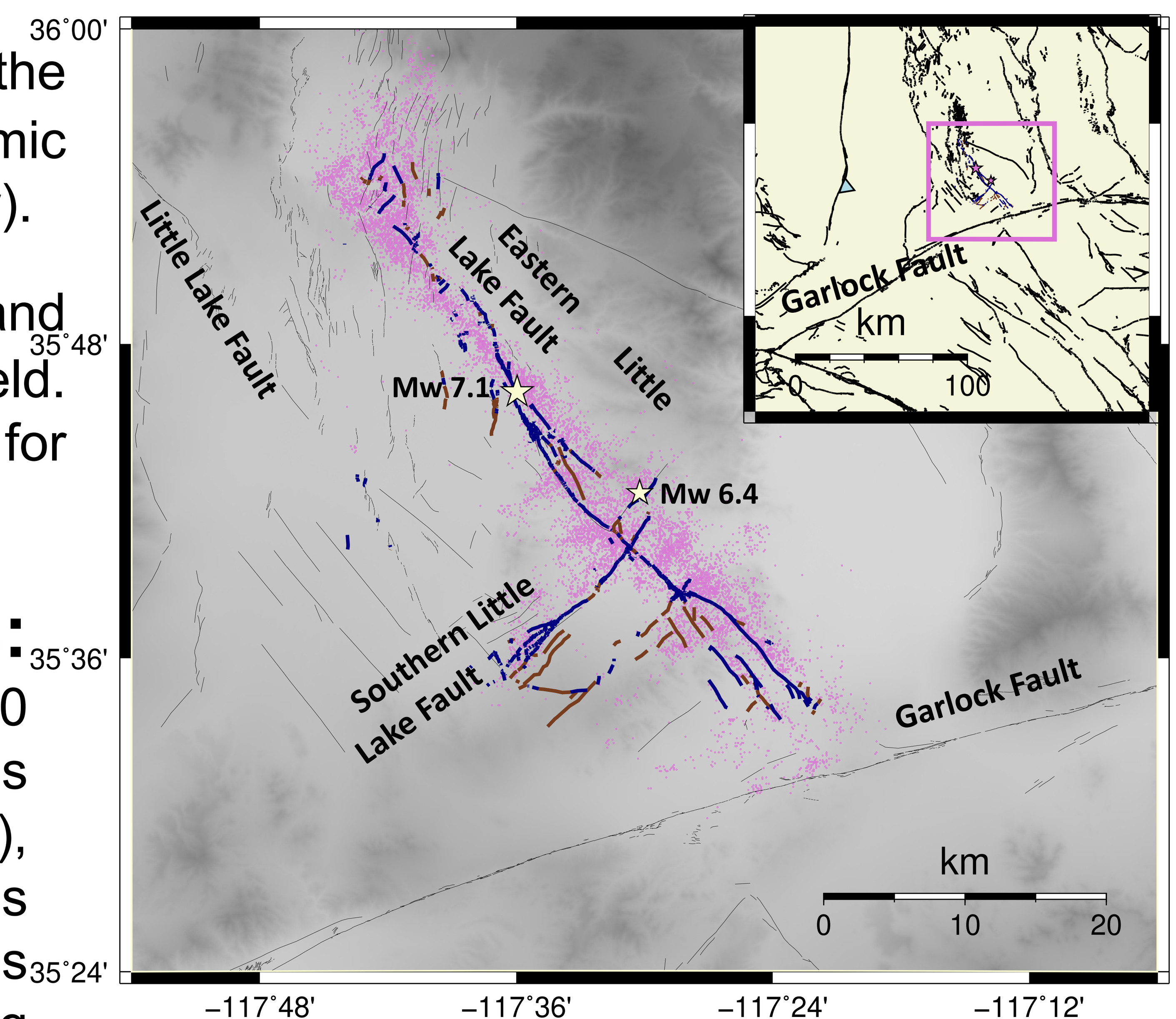
Introduction: We analyze ~2.5 years postseismic deformation of the 2019 Mw 6.4 and 7.1 Ridgecrest earthquake sequence employing both seismic and geodetic data including InSAR (Interferometric Synthetic Aperture Radar).

Objectives: 1) Integrating the obtained stress field, strain-rates and afterslip, and inferring the associated correlations from stress and strain field. 2) Detecting zones with higher stress accumulations that will be potential for seismic hazard.



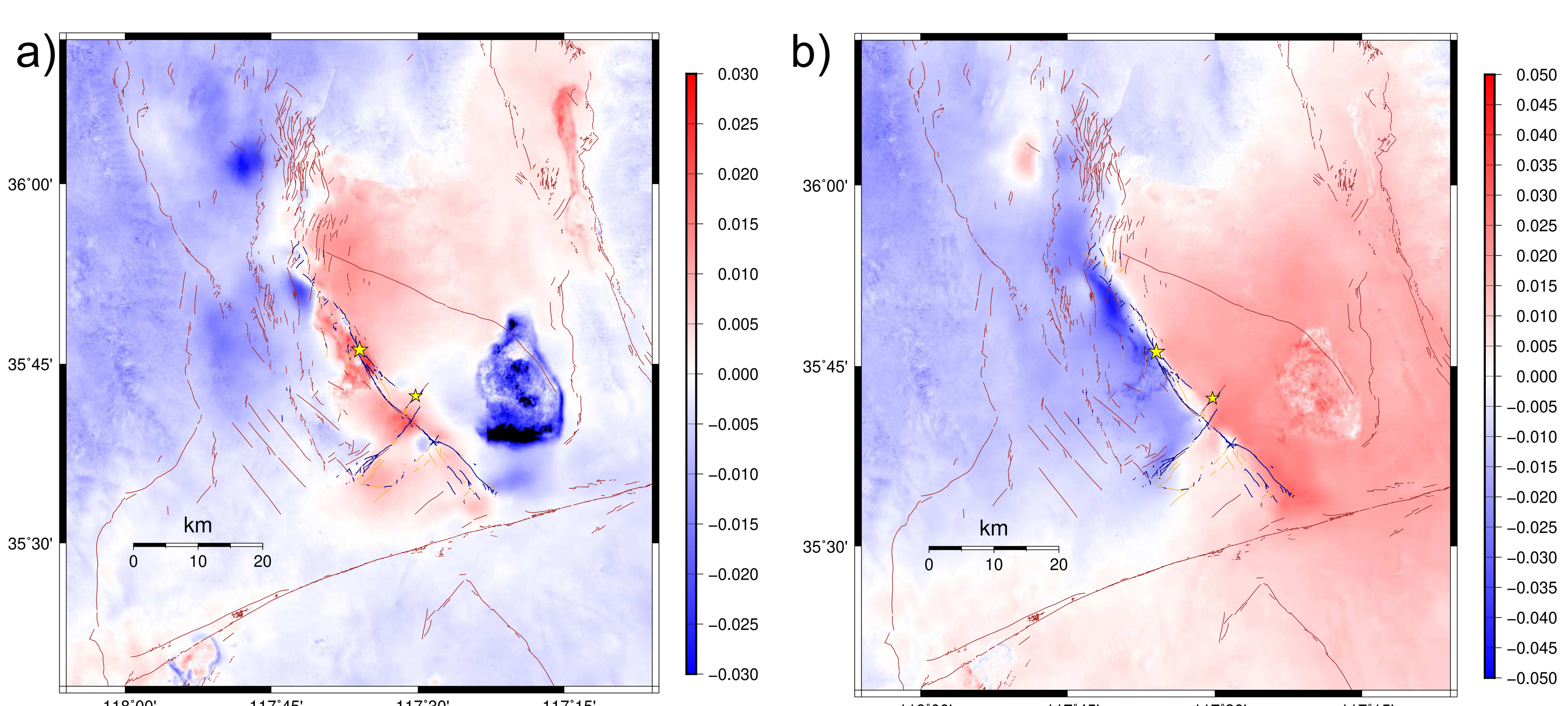
Stress Inversions: Inverting more than 11,000 fault plane solutions estimating Stress Ratio (R), showing the main stress regime. Stress ratios varies between 0 and 1 changing from transtentional stress field towards transpression with values close to 0.5 showing pure strike slip faulting.

$$R = \frac{\sigma_1 - \sigma_2}{\sigma_1 - \sigma_3}$$



Name	Selected dates	Times periods
T3	2019.07.11 up to 2019.07.21	~10days
T4	2019.07.21 up to 2019.08.21	~30 days
T5	2019.08.21 up to 2019.11.01	~70 days

Surface Deformation: The Caltech-JPL ARIA (Advanced Rapid Imaging and Analysis) project process InSAR data from the Copernicus Sentinel-1 satellites. The ARIA Geocoded UNWrapped interferogram (GUNW) products for two tracks (ascending tracks 64 (A64) and descending track 71 (D71)) are obtained, recording more than 100 interferograms from each of the tracks every 6 to 12 days. Figure shows a) Vertical displacement (m) from combination of tracks A64 and D71. b) Horizontal displacement towards east (m)



Summary: The spatiotemporal stress field evolution during the postseismic period shows the largest variations in the upper 4 km of the crust, indicating the heterogeneous brittle region and the least variations deeper than 8 km indicating higher viscoelastic component near the brittle-ductile transition zone.

The largest uplift and the largest displacement in the afterslip model are located near the mainshock hypocenter.

Higher uplift and stress ratio variations near the Mw 7.1 hypocenter indicate that different mechanism might be effective in this area, which caused the nucleation of the Mw 7.1 mainshock. Higher poroelastic deformation is one of the potential mechanisms for this case.

The thickness of the brittle crust and the depth of the brittle-ductile transition zone will determine the depth at which large earthquakes (Mw > 6) nucleate.

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Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

www.nasa.gov

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Publications:

Author Contact Information:
niloufar.abolfathian@jpl.nasa.gov