

RPC 2020



Virtual Research Presentation Conference

CONNECTING MUNDO MUDPOT ACTIVITY WITH RECENT SALTON SEA EARTHQUAKE SWARM

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Program: Spontaneous Concept

Assigned Presentation #RPC-065



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Introduction

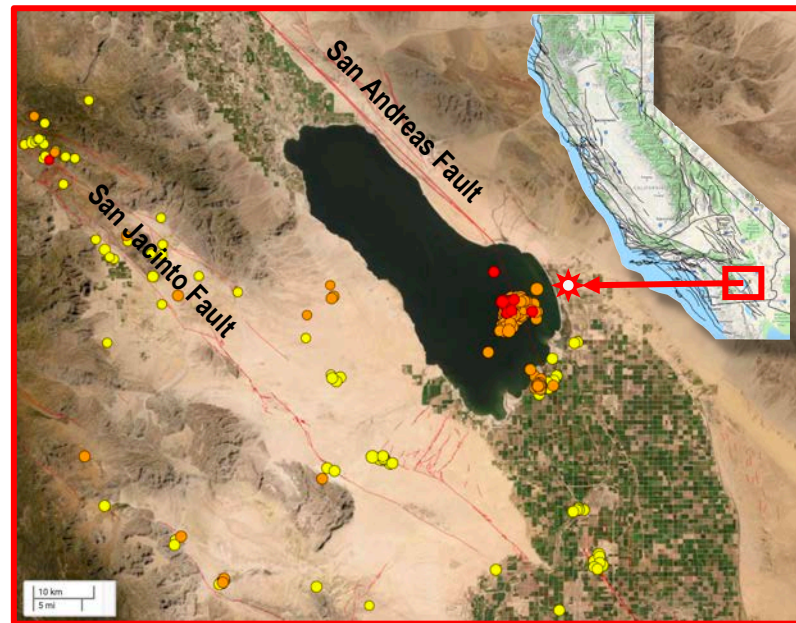
Abstract

In 2016 an ambient temperature CO₂ driven mud spring, east of the Salton Sea, began expanding and moving southwestward threatening critical infrastructure. It formed in 2005 and remained stable until 2016. The rate of southwest movement of the mudpot is now 20 m/yr or 5.5 cm/day. On 10 August 2020 an earthquake swarm, in line with the spring trajectory began in the Salton Sea raising questions whether the mudpot and seismic activity are linked. Seeps are observed in a parking lot ahead of the direction of motion. Sand blows or gas vents in the parking lot southwest of the seeps have increased in number over two years. Motion of the spring appears to slow at time, but jumps forward roughly at the same time as Salton Sea earthquake swarms maintaining the average velocity suggesting a continuously moving deep source with shallow barriers that can impede the motion. Measurement of crustal deformation suggests increased northwest/southeast extension away from the mudpot along an axis parallel to the earthquake swarm lineations and spreading centers in the Gulf of California. Spreading east of the Salton Sea may slow down southern San Andreas fault motion transferring plate boundary motion westward to other faults.



Problem Description

- a) The moving Mundo Mudpot has damaged and threatens critical infrastructure and provides a unique opportunity to better understand tectonic processes.
- b) Imagery of varying quality has been collected infrequently over the mudpot. High-resolution stereophotogrammetry fused with other data sources will quantify rate of motion and geophysical processes.
- c) NASA's Earth Surface and Interior program asks: "What is the nature of deformation at plate boundaries and what are the implications for earthquakes?" and these high resolution topographic measurements are directly relevant to NASA's Surface Topography and Vegetation Targeted Observable.



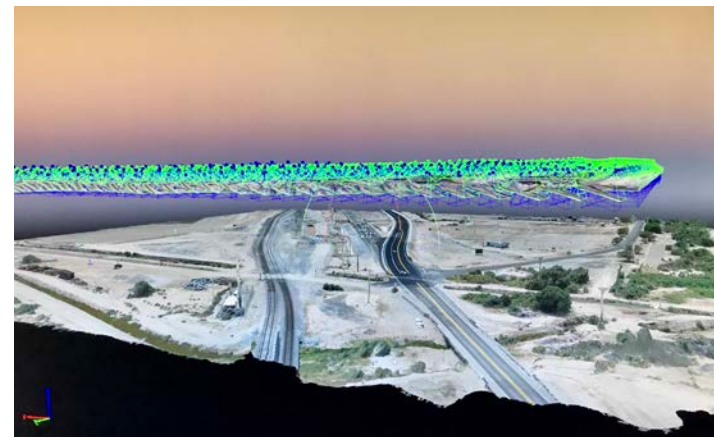
Methodology

a) Experiment description

- Create repeated stereophotogrammetric images of the Mudpot area by collecting near-surface airborne imagery
- Determine the current trajectory and rate of motion of the Mundo Mudpot for comparison with regional seismicity and crustal deformation
- Relate the timing of changes in mudpot activity to the recent earthquake swarm and crustal deformation or strain transients

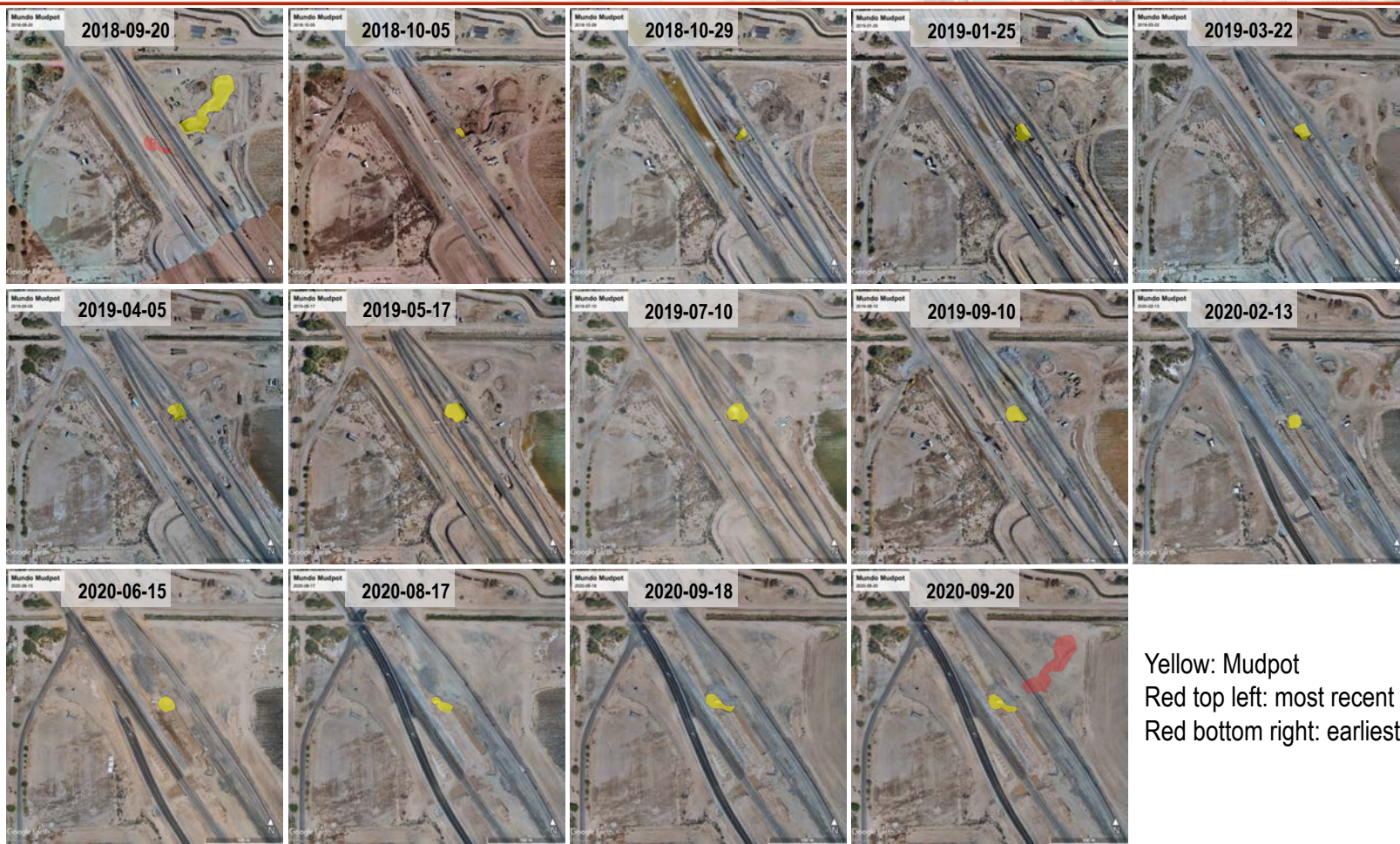
b) Innovation, advancement

- These are the first observations of a moving mudpot; Most are stationary
- High-resolution imagery and topography provides details of mudpot and surrounding area (for example sand blows were discovered in the imagery)
- Fusion with crustal deformation and seismicity places the mudpot processes within a tectonic context



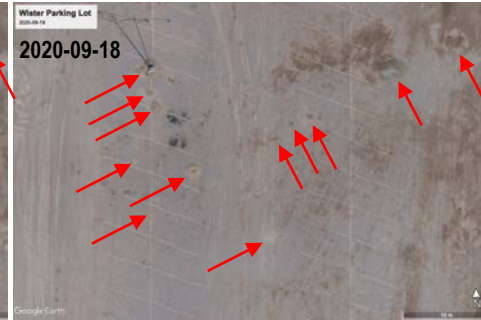
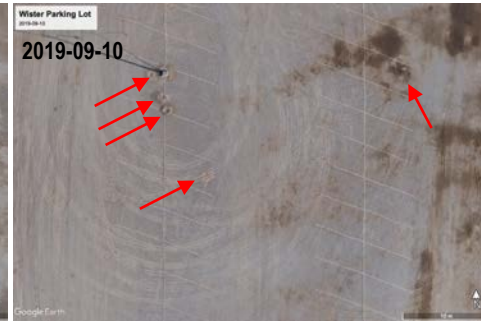
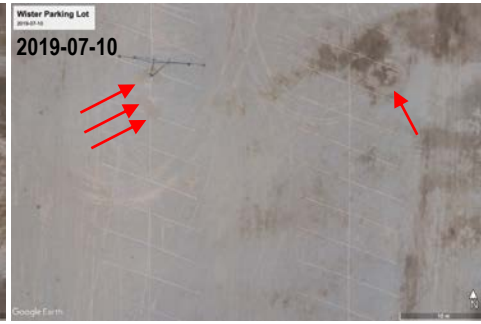
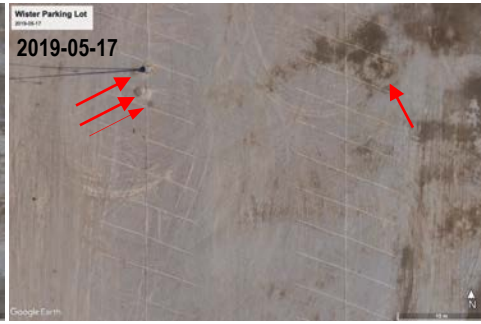
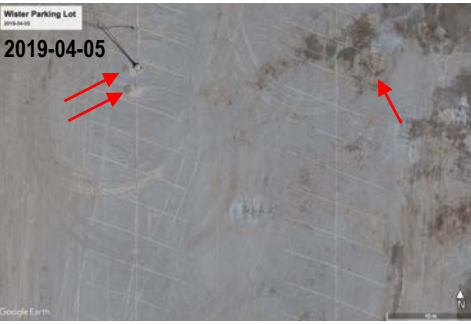
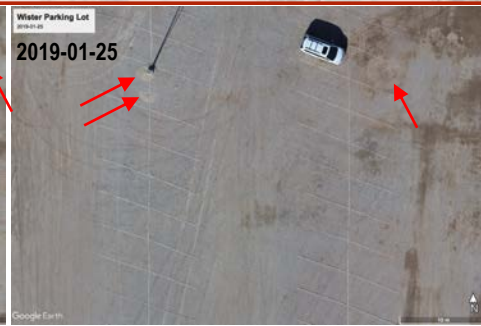
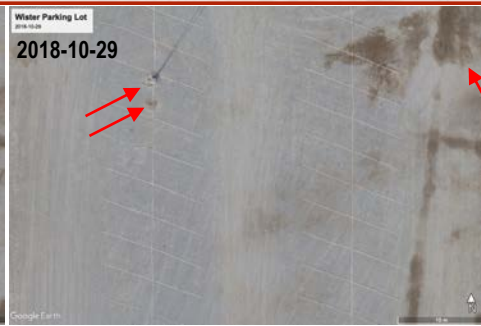
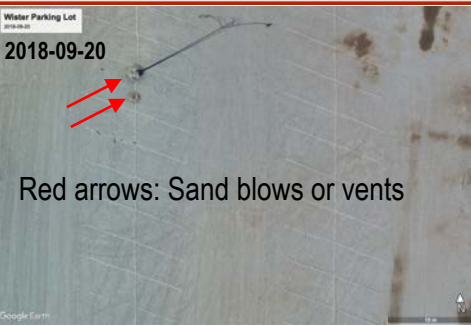
Mudpot in proximity to railroad and Highway 111





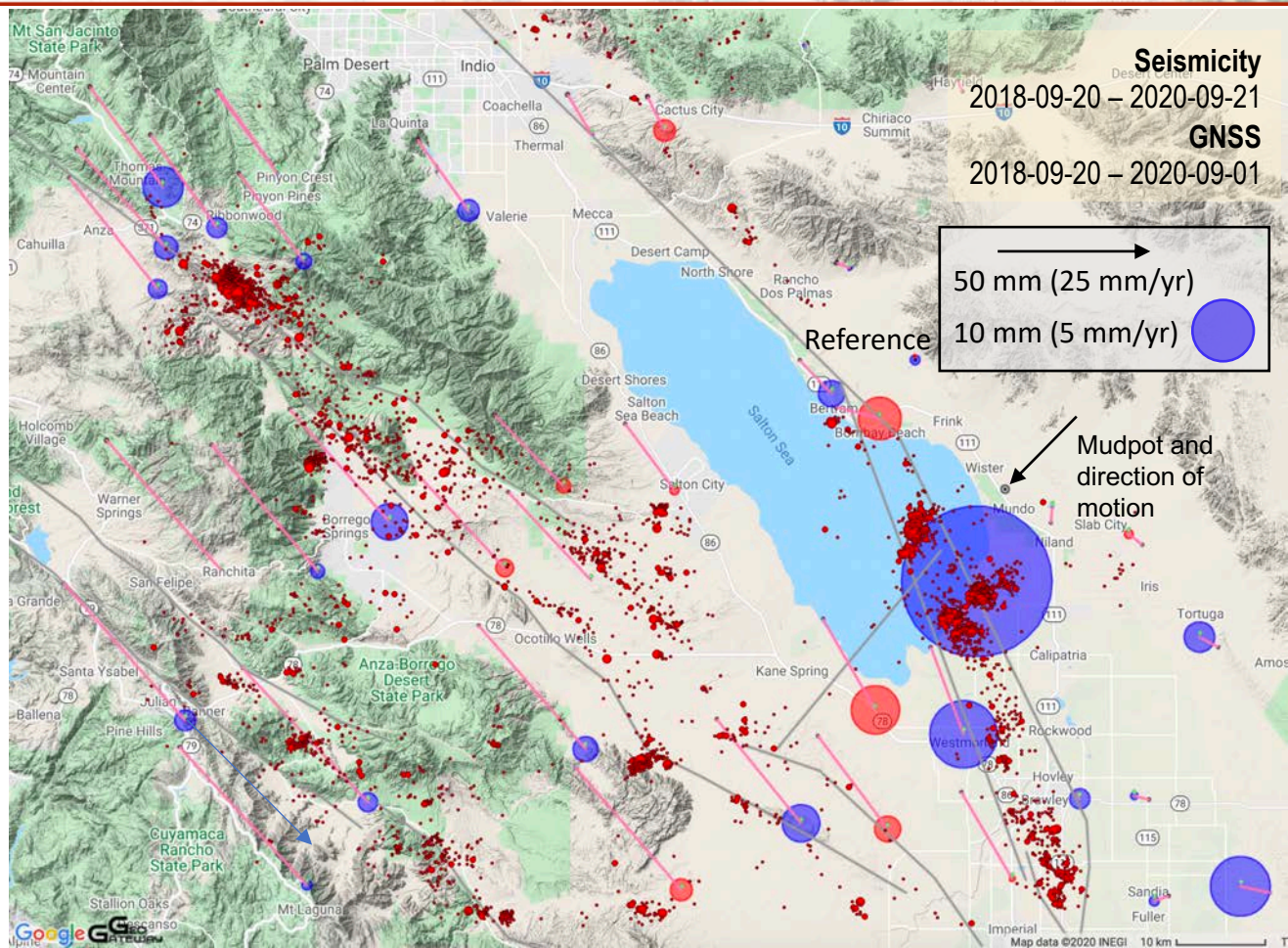
Sand blows or vents require further investigation

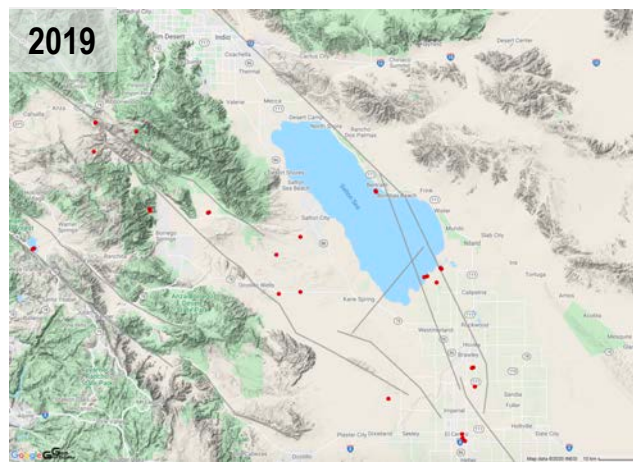
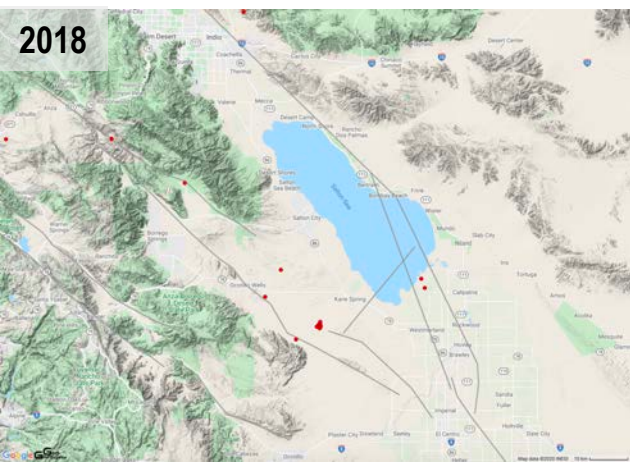
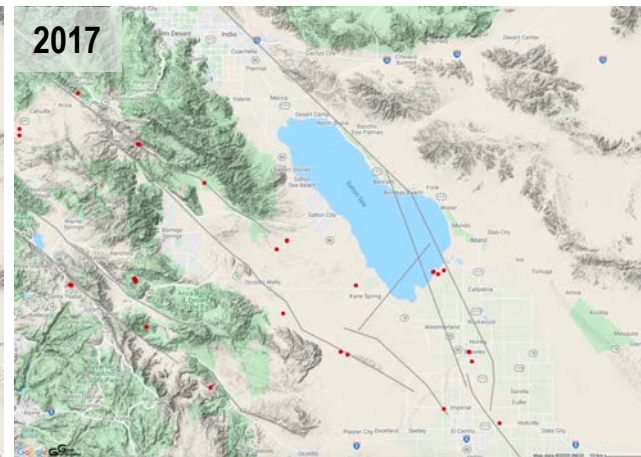
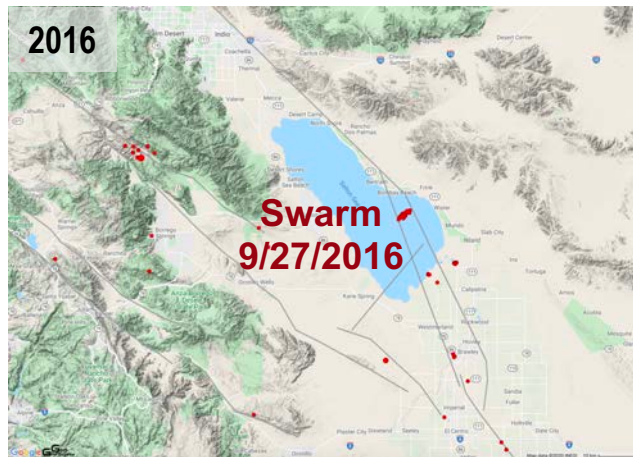
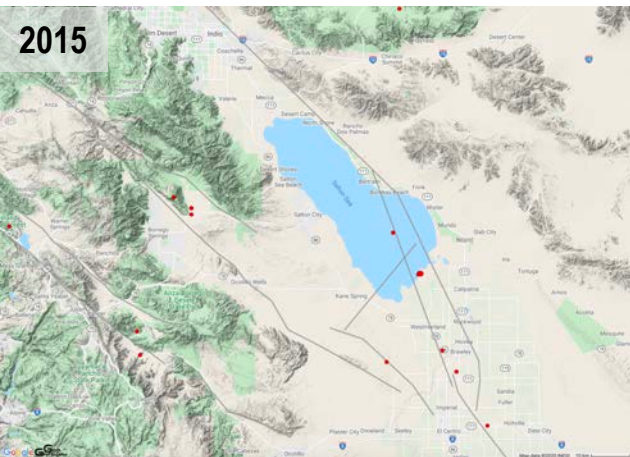




GNSS Displacements and Seismicity

9/2018 – 9/2020





Results

a) Accomplishments (Goals were met)

- Mudpot motion correlates with earthquake swarms and follows same trend
- Increased northwest/southeast extension over background deformation occurred in the past two years
- Apparent gas vents are present ahead of the moving mudpot

b) Significance

- Mudpot might be part of an incipient spreading center related to Gulf of California tectonics
- Extension may slow rate of slip on southern San Andreas fault
- This may transfer current plate boundary motion westward onto other faults, which could increase earthquake hazard on them

c) Next steps

- Measure CO₂ and H₂S levels at vents versus surrounding to verify
- Publish paper
- Continue measurements

