October 13, 2022 Rupture and Fault Zone Observatory Breakout Session on "Subsurface Fault Zone Structure"

Science Questions:

1. What do we see when we look into fault zones? Velocity structures, wave propagation properties, seismicity distributions?
2. What are the implications of these products? What is the time variability of these signals?
3. How could we observe these using a purpose-built observatory? What do we need in the observatory?

In the context of each science question:

1. Signals that inform us about the science questions
2. Properties of the observatories that are required to record these signals
3. How to involve the next generation and training

Your Name, contact info (optional)	Comment (or Questions)
Jamie Steidl	Do these results suggest that perhaps we should be doing half the number of fault crossing arrays, and instead make the arrays wider, even spanning both the SJF and SAF? ● Yehuda Ben-Zion - It would be useful to have one very long array that leverage on the existing stations! ● Jamie Steidl - Agreed, and crossing the EF as well, perhaps more than one. ● Yehuda Ben-Zion - Right Jamie, and we can also try to include in the long line a few existing shallow borehole sites ● Elizabeth Cochran - For multiple types of seismic studies, it is useful to have good azimuthal coverage. So, perhaps some closely spaced arrays or grids would be useful to include. ● Jamie Steidl - Yes, perhaps a combination of short, long linear and nested grid arrays to get a different spacings, where the individual linear arrays on SAF, SJF, and EF in themselves make a grid at the largest spacing.
	Discussion of "simplicity" of fault segments, importance of Elsinore fault, rupture/surface rupture of M6 events, …
Yehuda	Question to Ellis and the geodesists attending: what combination of

Ben-Zion/Jamie Steidl	geodetic sensors can be combined with InSAR to clarify key properties and processes? and what configuration of geodetic instruments spatially provides supports the scientific questions. ● Jean-Philippe Avouac - Would like to see across fault borehole installed fibers, along fault too ● Ellis Vavra - In terms of complementing SAR, I think the spatial distribution of any instruments is important. The urban/desert areas are great, but steep topography and agriculture are tricky (especially for small signals). One could look at time-averaged InSAR coherence to try to identify sites that might benefit most from denser GNSS sites and/or regular campaign surveys.
Jean-Philippe Avouac/Pieter Share	EM monitoring - some issues with instrumentation, not there yet but working on it ● Cliff Thurber - Was there some EM monitoring at Parkfield in 2004? - Not sure
Santiago Rabade	Is there any plan to have temporal node deployments during Rufzo to have larger and denser seismic arrays? ● Frank Vernon - Yes, this is part of the plan. ● Pieter Share - Presenting the ongoing work at the San Jacinto fault and results from dense node deployments
Jamie Steidl	Point that any installation/array may attract additional sensors/instruments that can be supported depending on prioritization and limitations (e.g. on power, telecommunications, etc)
Craig Nicholson	Multiple paleomagnetic results indicate that measurable near fault strain is taken up by small-scale (block) rotations. To what extent can these be quantified or are these rotations expected to be evaluated using high-res InSAR or something? ● Dan Gittins - With complementing SAR I would also say that using creepmeters and strainmeters is still useful. The crucial things with these instruments would be location. Many of the issues I have been tackling recently are boiling down to the issue of relative instrument location to where the creep is occurring ● Ellis Vavra - Great question Craig! I think that may be challenging to characterize with to smaller signals, but has been done to an extent with co-seismic rupture and near-field deformation from pixel-tracking https://agupubs.onlinelibrary.wiley.com/doi/abs/10.1029/2020JB020551
Pieter Share	Next generation workforce development opportunities with this

	observatory ● Yehuda Ben-Zion - Many confusing/interesting signals to understand in the data set, great opportunity ● Frank Vernon - Integrating data types, supported through integrated data handling and archival - will happen at all levels ● Jamie Steidl - Funding for interns, starting at undergraduate level (Seconded by Elizabeth Cochran) ● Field opportunities ● Kasey Aderhold - Good experience for cohort building by attending USArray data short course aimed at early graduate students