

Rupture and Fault Zone Observatory

Yehuda Ben-Zion

Southern California Earthquake Center and Dept. of Earth Sci. USC

The problem of earthquake generation remains unsolved because of its inherent complexity and the lack of direct observations **within rupture zones** (almost all data are low-passed-filtered elastic far-field radiation)

Key Questions

Pre rupture

-What processes produce the conditions that allow large earthquakes to occur, and how are they manifested in data?

Improved Forecasting

During rupture

-What rheology governs brittle failure and permanent deformation within and around rupture zones?

Improved physics of fault failure and GMPE

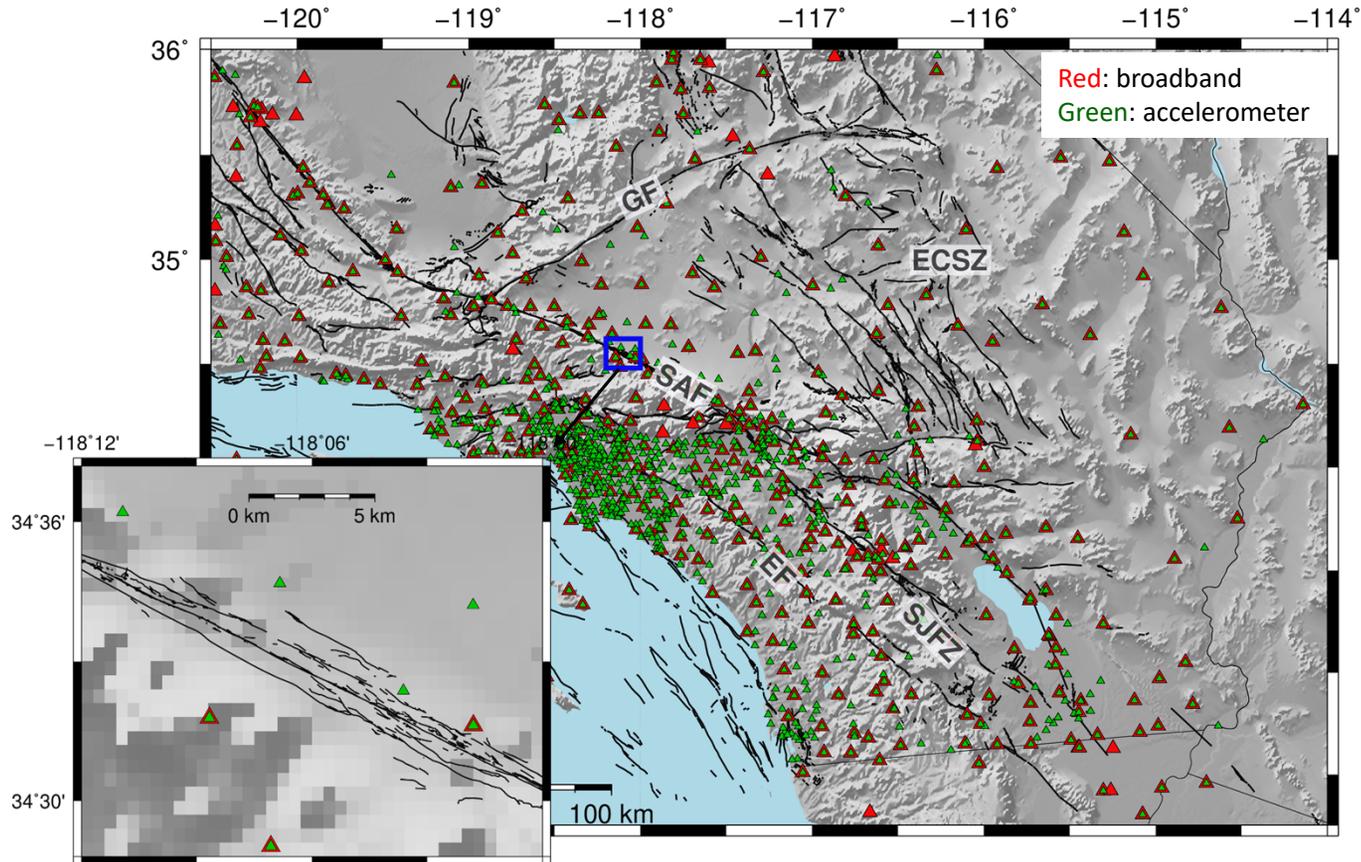
Post rupture

-What are the immediate and evolving post seismic processes (afterslip, viscoelastic, poroelastic)

Improved quantification of strain energy budget on faults and crustal rheology



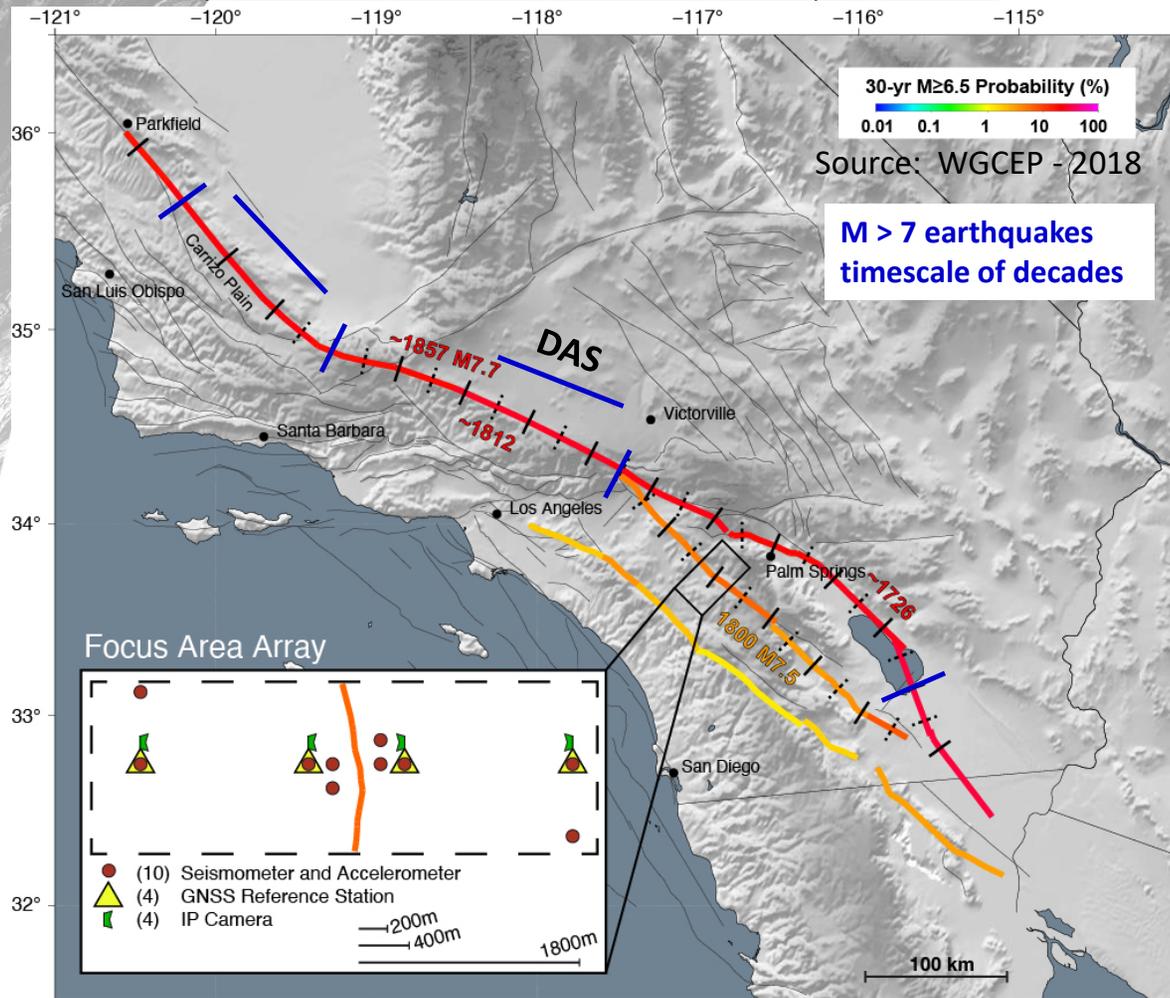
Regional SoCal seismic network (April 2021)



There are ~420 BB and ~1000 accelerometers, **but very few stations within 1 km from main fault surfaces.**

The lack of stations within-fault-zones is global. There are currently near-zero in-situ constraints on earthquake rupture processes!

Rupture and Fault Zone Observatory (RuFZO)



M > 7 earthquakes
timescale of decades

RuFZO data

Pre rupture

-Evolving localization, temporal changes
episodic local failures, other signals?

During rupture

-Full evolving dynamic strain field (**shear and dilatational**), dynamic/static strain/stress drops

-Dynamic rupture width and velocity, slip velocity (including space-time variations)

-Seismic energy flux (partitioning between radiation and dissipation)

-PGA/PGV/PGD within and near rupture zone (needed for improved GMPE)

-Robust Early Warning signals (including directivity)

Post rupture

Detailed transition from seismic to aseismic deformation, including volumetric components; evolving postseismic fields

Between ruptures

-High resolution 4D information around main faults; integration with regional data will improve event locations, focal mechanisms, slip inversions,

Plus

-Surprise discoveries and applications

IRIS UNAVCO
Joining Forces

SC/EC
AN NSF+USGS CENTER

Thank you