

Post-Earthquake Rapid Scientific Response

*Workshop summary &
looking ahead to SCEC5*

“Information is pouring out of the earth”

- Greg Beroza

- Focus on science questions that motivate post-earthquake research.
- Data gathering and instrument deployment.
- Inputs needed from other disciplines.
- Time frame of response and data collection.
- Scenario Events
 - Rural vs urban with surface rupture
 - 1812 or 1857-type San Andreas rupture
 - Others... blind faults, offshore faults

Seismology Questions

- How well did simulations perform?
- **Are there anomalous ground motions?**
- What ground motions most correlated with damage?
- **Testing assumptions of triggering and interaction.**
- Track OEF timeliness, accuracy and effectiveness.
- **Capture of a large aftershock.**
- Understand fault-zone structure and healing.

Seismology Data Collection

- Rapid deployment to capture aftershocks.
- Targeted deployment to investigate strong ground motions.
- **Aftershock slip models for OEF.**
- Completeness to $\sim M(-1)$.
- **Large-N arrays**



Geodesy Questions

- What is the coseismic displacement?
 - Displacement field, source model
 - Coulomb stress & aftershock model
- What is the postseismic displacement rate and pattern?
 - Afterslip vs. viscoelastic relaxation
- Exploration of fault-zone properties, healing, and shallow slip deficit.

Geodesy Data Collection

- Multiple deployment strategies...
 - across-fault for slip as function of depth
 - at fault tip for afterslip vs. visco-elasticity
 - at existing benchmarks with known pre-earthquake rate.
- Rapid deployment shaped by...
 - decay of post-seismic signal
 - modeling of expected signal
 - availability of suitable benchmarks
 - satellite overflight schedule

Geology Questions

- What fault was it? Was it “unknown?”
- What is the slip (& deformation) distribution and its evolution in time?
- What drives variability: error, fault-zone properties, or energetics of rupture?
- Is the directivity of rupture recoverable from paleoseismic investigations?
- Distribution of secondary effects (landslides, liquefaction, shaking indicators, triggered slip).

Geology Data Collection

- Field measurements of ephemeral features that record slip (& afterslip).
- Imagery of all types as rapidly as possible:
 - Aerial photography
 - Image-differencing
 - InSAR (UAV and satellite)
- 3D imaging (LiDAR, SfM) to enhance measurement and preserve information.

Earthquake response is a community effort

SCEC is already a *community of trust* that is poised to respond.
What will SCEC5 do to learn the most it can from the next earthquake?

- Tremendous efforts needed from many scientists
fieldwork, data analysis, modeling, planning
- Pooling and optimization of instrumentation
- Coordination of efforts
- Community initiatives and data collection
 - *Large-N seismic deployment*
 - *LiDAR surveys*
 - *Fault-zone drilling*
- Open and rapid sharing of information & data
- Education and outreach – science in action