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 SCEC 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