Earthquake and Volcanic Disaster

What are important research achievements?

- Better understanding of earthquakes and volcanoes through improved data sets
- Important success in limiting human toll of volcanoes through better monitoring
- Discovery of widespread slow earthquakes
- Improvements in hazard mapping
- Important improvements in earthquake, volcano, and tsunami technical warning systems
- Performance-based/displacement-based design as a new approach in earthquake engineering

What are research gaps and needs?

- Need better/denser data exploiting new and cost-effective sensor technology
    - Geophysical monitoring to support early warning for volcanoes
    - Many dangerous volcanoes should be better monitored
    - Need more near-source geophysical (seismic, geodetic, etc.) data
    - More public and private buildings should have seismic instrumentation with accessible data
    - Instrumentation has finite life and needs to be renewed
    - Need to develop cost-effective methods for measurements in the ocean
- Need capability to manage, distribute, and exploit larger data sets
- Need to understand the hazards posed by extreme, rare events (earthquakes, volcanoes, landslides, tsunamis)
- Need better understanding of man-made events (e.g. induced earthquakes)
- Need to characterize and effectively communicate uncertainties, particularly for rare events.

Identify needed disaster planning

- Development, improvement, and communication of hazard maps
- Encourage sharing of expertise in hazard map development
- Development of needed infrastructure for communication in remote areas
- Need to account for non-structural elements in building response
- Scenario-based exercises (e.g., ShakeOut)

International collaborations (sharing capabilities and opportunities) are important

- Comparison and testing of hazard maps among countries.
- Open sharing of all data types
- Understanding of Earth processes across regions accelerates progress
- Opportunities for sharing advanced facilities among nations – e.g., shake tables, HPC

Interdisciplinary studies are important

- Reframe the science from the point of view of those charged with managing risk
- Need approaches to manage risk when hazard probability is low, but consequences high
- Cascading disasters (earthquake-volcano-fire-tsunami-landslides-power plants-health)

require inter-disciplinary efforts

- Need to understand the socio-economic ripple effects of earthquakes and volcanoes
    - Iceland – air traffic
    - Tambora – famine
    - Tohoku-oki – global nuclear power, CO2 emissions
    - Haiti cholera and riots
- Need approaches that encourage a culture of safety
- Attention to development of appropriate responses to new technologies (e.g., warning systems)