Geodetic and Geologic Observations of the Earthquake Deformation Cycle: Implications for Fault Mechanics, Crust/Mantle Rheology, and Earthquake Hazards

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The earthquake deformation cycle includes, (1) the slow buildup of strain during the inter-earthquake period (strain accumulation), (2) possible pre-seismic, precursory deformation, (3) 'instantaneous' coseismic fault offsets, and (4) anomalous postseismic deformation (i.e., in relation to slow pre-earthquake strain accumulation). Geodetic observations of fault-related deformation have been made since the 1970s using ground-based geodetic systems, and these early measurements provided a wealth of information on earthquake mechanics. During the past 20 years, substantial new data on the earthquake cycle have resulted from the proliferation of Global Positioning System (GPS) networks in seismically active areas. Such GPS networks provide more complete observations of deformation during all phases of the earthquake cycle, but are restricted to time scales that are short in comparison to earthquake repeat times. New geologic approaches to measuring fault offsets (particularly dating techniques) are providing more precise estimates of long-term fault slip rates that include multiple earthquakes. Further information on historic and pre-historic earthquakes results form study of historic records and fault trenching. Integrating and comparing results from these different approaches are providing new constraints on the mechanics of strain accumulation and release, and crustal/mantle rheology, which in turn provide an improved physical basis for earthquake hazard mitigation.

For this session, we invite geodetic, geologic, and historic studies, as well as modeling and laboratory studies of the earthquake deformation cycle. Observational studies that include comparisons of fault slip rates from geodetic and geologic investigations, and modeling studies that utilize a single earth model to account for the full earthquake deformation cycle are particularly encouraged.