Computational Infrastructure for Mitigating Earthquake Hazard by Integrating and Modeling GPS, InSAR, Seismicity, and Fault Observations

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Understanding earthquake processes and hazards relies on integrating multiple data sources. These data come from widely distributed sources and cover different time and spatial scales. Fault data typically cover average slip rates over millions of years, but serve to provide a realistic geometry for models as well as estimates of present day fault slip rates. Seismicity data show patterns that indicate active or potentially active regions or faults. Spaceborne geodetic data provide information about deformation rates between earthquakes and amounts of slip as a result of earthquakes. Global Positioning System (GPS) data tend to be collected at sparsely located ground stations, but provide a nearly continuous time series of deformation, indicating both secular and transient deformation characteristics. Interferometric Synthetic Aperture Radar (InSAR) from both spaceborne and airborn (UAVSAR) platforms provide spatially continuous images of surface deformation in between and during earthquakes. When combined, these different data sources can provide information about how faults interact and focus attention on where future earthquakes may be, increasing our understanding of the earthquake hazards. Integrating the multiple data sources requires a seamless distributed computing environment for efficient model development and exploration. QuakeSim is a project to integrate distributed heterogeneous data sources into a computational modeling and data pattern analysis exploration environment. It is important to work with reasonably new projects such as the Plate Boundary Observatory (PBO) and UAVSAR to ensure that their data sources and output are in standard formats such that different systems can easily ingest the data. This then provides infrastructure for future missions to produce data products that can be readily integrated into modeling and analysis systems.