Workshop Report: "Modeling Advances in SCEC Geodesy", September 9, 2012
Workshop Conveners: Rowena Lohman and Jessica Murray

This workshop addressed three major SCEC4 Tectonic Geodesy modeling activities: the Community Geodetic Model, Geodetic Transient Detection, and a new Geodetic Source Inversion exercise.

Community Geodetic Model 8:00 – 9:30 AM

This portion of the workshop focused on a new SCEC4 initiative, the Community Geodetic Model (CGM). The CGM will be a time-dependent geodetic data product that provides a reference frame for a variety of SCEC research including development and testing of the Community Stress Model, transient detection algorithms, and studies of time-varying deformation. The initial focus of this effort will be on bringing together GPS and InSAR time series to exploit the complementary spatial and temporal features of these two data types. Ultimately other data types (such as strain data) may be incorporated as appropriate and if feasible.

Following an introduction by Jessica Murray, Kaj Johnson discussed the contribution that the CGM could make to deformation modeling used in seismic hazard assessments like UCERF3. Increased spatial density of observations in some locations could help better constrain block models and quantify distributed strain within blocks.

Murray and Scott Baker, respectively, provided overviews of existing GPS and SAR data coverage and the prospects for data availability (particularly SAR data) going forward. Three additional presentations (by Alejandro Gonzales, Brendan Crowell, and Yuri Fialko) highlighted recent SCEC-supported campaign GPS efforts in southern California and Baja, Mexico that were designed to target specific topics such as characterizing the postseismic deformation from the El Mayor Cucapah earthquake and quantifying fault creep.

Finally, Roland Bürgmann spoke about ways to integrate GPS and InSAR data into a unified data product. A variety of approaches exist, and all are to some degree model-dependent. One challenge for the development of the CGM will be to identify the most promising approaches for southern California and provide appropriate uncertainty information for the resulting product accounting for the error sources inherent in both data types.

The primary goal of this portion of the workshop was to introduce the CGM to the SCEC community and initiate discussion. A follow-on workshop involving scientists who are likely to be directly involved in developing and applying the CGM is envisioned for 2013. A goal for that workshop will be establishing timelines and a work plan for generating the CGM.

Geodetic Transient Detection 10:00-11:00 AM

The transient detection section of this workshop began with a quick summary by Lohman of the strengths and weaknesses of the existing automated algorithm that has been running at the CSEP testing center for the past year. The workshop then highlighted two approaches by Holt and Herring that are nearly at the point where they can be automated, with some discussion of the hurdles to automation that continue to exist. Ji and Herring's approach uses template signals and seeks the time series for similar instances – they are, therefore, necessarily limited to a finite set of signal types and will likely have multiple tests running simultaneously.

Geodetic Source Inversion Validation 11:10 AM -12:00 PM

Rowena Lohman introduced the motivation and concept for a seismic source validation exercise using geodetic data. In a manner similar to that used in the source inversion validation exercise run by Martin Mai, Morgan Paige and Danijel Schorlemmer, this exercise will involve the generation of synthetic data with a varying degree of complexity, which will be provided to participants.

Initially, participants will be given some knowledge about the source geometry and noise characteristics, to ensure that data input/output formats are understood and that the same conventions for Green's functions are being used. Data will be generated using progressively more complicated source geometries, slip distributions and data noise characteristics, and results can be submitted through an online interface.

Midway through the session, Brendan Meade presented an example of a new direction in source inversion validation that can be tested using this approach. By seeking the most spatially compact solution that is consistent with the data, he is able to explore a different end member model from the spatially smooth ones that are typically found in inversions that rely on regularization through roughness or minimum length constraints.