The SCEC Community Geodetic Model V1: Horizontal Velocity Grid

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The SCEC community is constructing and updating a suite of models for the Southern California region to facilitate cross-disciplinary research (CFM, CVM, CGM, CSM, and CRM). Here we are concerned with the development of the Community Geodetic Model (CGM). Eventually the CGM will consist of vector deformation time series at ~1 km resolution, and better than seasonal sampling. As a first step we are constructing a 0.01˚ resolution grid of horizontal vector velocities and 2-D tensor strain rate covering the areas of interest to SCEC scientists (Figure 1). Our approach is to first assemble 15 available velocity and strain rate models for the SCEC region. There were 4 main approaches to model construction: isotropic interpolation, interpolation guided by known faults, interpolation of a rheologically-layered lithosphere, and model fitting using deep dislocations in an elastic layer or a half space. We then evaluate the 15 strain rate models in terms of roughness, cross correlation, seismicity rate, and SHmax to select a subset of 9 usable models. Since all the models are based on slightly different geodetic data and use a variety of reference frames, we re-gridded velocities from the 9 models at a 0.01˚ grid spacing. This is accomplished by forcing each velocity model to match the best available GPS velocity data for the region. The 9 velocity models were averaged (Figure 1) and their standard deviation was also computed (Figure 2). Standard deviations are generally small (< 0.5 mm/yr) in areas of good GPS coverage; areas of large standard deviation illustrate where InSAR velocities will contribute most. This uniform velocity is a first step in the development of the full 3-D time dependent CGM. This result is important for seismic hazard evaluation as well as InSAR time series analysis. As new GPS and InSAR data become available this SCEC community model will continue to evolve. The full compilation of the GPS velocity data, the contributed models, and the consensus products will be available on the SCEC web site.

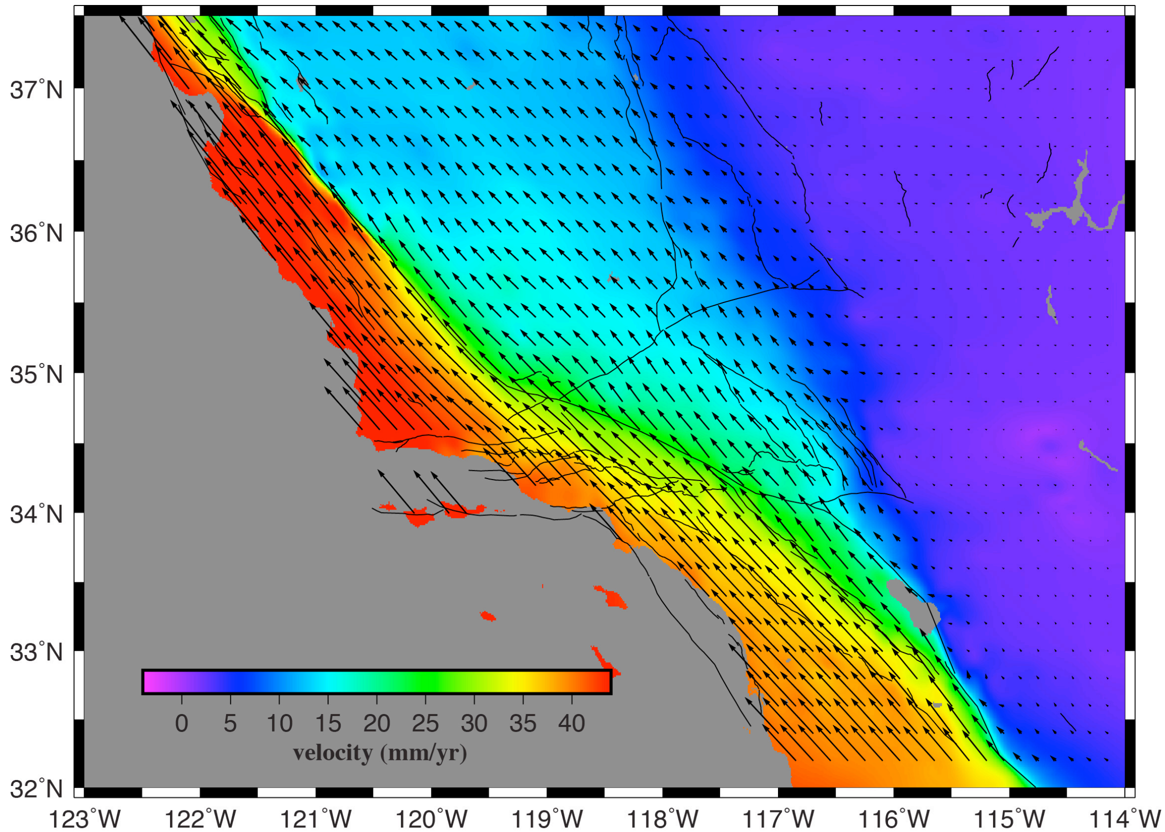

Figure 1. Mean velocity is the average of 9 models. Colors show velocity magnitude and arrows show direction. Black lines are faults from California and Nevada.

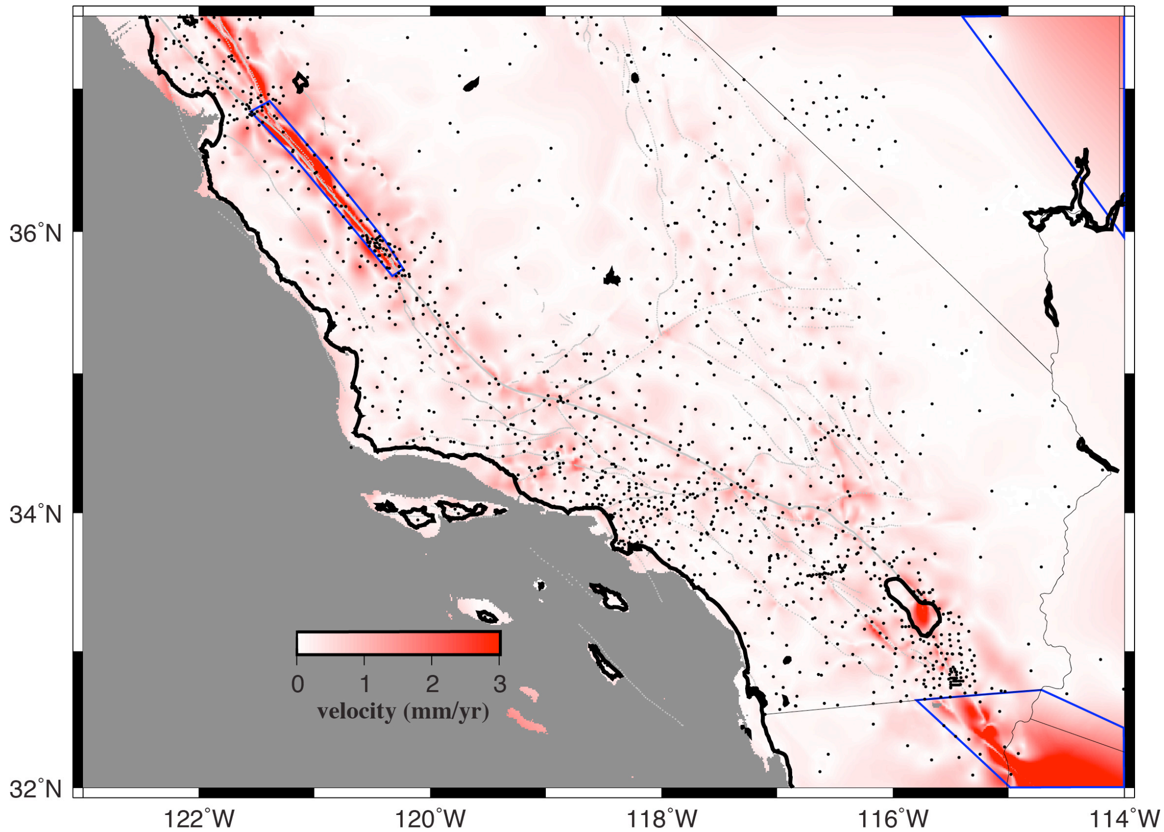

Figure 2. Standard deviation of the velocity of the GGM velocity. Note the deviations are small in the locations of the GPS constraints (black dots), especially in areas where the velocity model is smooth. Dotted gray lines are faults from California and Nevada.