Annual Report, 1999

Improving the SCEC Crustal-Motion Map: GPS Data Processing

Duncan Agnew

The funding to UCSD for involvement in the data processing aspect of the CMM was to participate in the final production, presentation, and checking of the CMM. Instead, the time funded (and then some!) was spent on coordinating field surveys made after the Hector Mine earthquake, in order to obtain good estimates of coseismic offsets, and a base for future measurements of postseismic deformation. Processing of the initial data collected after the earthquake and comparision of it with analyses (by MIT and UCLA) of earlier data also provided the basis for estimating coseismic offsets, shown in Figure 1 (from the AGU presentation) The pattern of these suggests that the largest slip was on the central part of the fault, in agreement with surface offsets, though not with modelling of seismic waves.

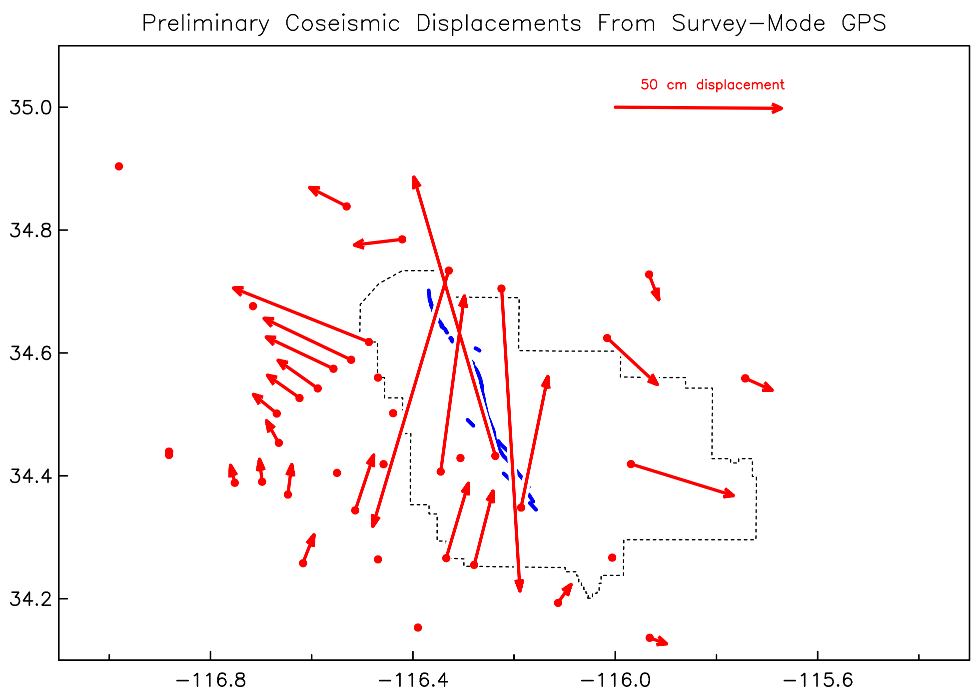

Figure 1. Coseismic displacements for Hector Mine event. Dots without arrows have data but are not yet analyzed.

Annual SCEC report, 1999

Improving the SCEC Crustal Motion Map

Zheng-Kang Shen and David Jackson, (UCLA): Group E

Collaborating with the colleagues at MIT and UCSD, we have made substantial progress toward producing next round of Crustal Motion Velocity Map 3.0. Particularly we have achieved the following:

1. Test of the data processing shell script *sh_gamit*. Assisted by the MIT group we have installed the shell script package on our system and worked closely with the MIT group beta testing its package for PC Solaris system. We have tested it under various working conditions, including reprocessing 40 days of 1992 and 10 days of 1994 data and comparing our results with MIT's. We are sure now that the package works as it is supposed to.

2. Actual data processing. We have finished processing all the data archived at the SCEC data center for 1997 and 1998. All together 91 and 120 days of data have been processed for each of the 2 years respectively. The post-processing statistics show rms of 1.6, 2.5, and 11.5 mm for the north, east, and up components respectively for the 1997 processing, and 2.4, 2.5, and 8.6 mm for north, east, and up components respectively for the 1998 processing.

3. Updating crustal motion map. We have made an update of the crustal motion velocity map. This update does not have all the ingredients we want to have for v3.0, particularly the uniformly reprocessed GPS solutions done this year were not included yet. However, it does represent a substantial progress from the 2.0 release. It has included results from several recently processed experimental solutions, such as the Landers 1997-1998, Ventura Basin 1993, Cholame 1989, Caltrans District 7 1992, and the post-Northridge joint survey 1994. The survey mode GPS solutions were combined with MIT's combination of the SOPAC global daily solutions, and then combined with the VLBI and EDM velocity solutions produced by the MIT and JPL groups respectively. The coseismic effects due to the Joshua Tree, Landers, and Northridge earthquakes were modeled. About 400 station velocities were derived with their horizontal uncertainties < 4 mm/yr (Fig. 1), about 40 sites more than that in our 2.0 release. About 2/3 of the sites have their uncertainties $<$ 2 mm/yr.

4. Strain rate estimation. Using preliminary results of the updated crustal motion map mentioned above, we estimated the strain rate field in southern California (see Shen et al., JGR 1996 for interpolation method). Although the updated strain rate field (see figure in Strain Rate Modeling proposal by Shen and Jackson this year) does not show drastic difference from its predecessors (e.g. Jackson et al., Science, 1997; Shen et al., SCEC Annual Report, 1998), the new result does show a narrower strain rate concentration along the Cholame section of the San Andreas. The resolution of the strain rate estimate in that region has also been improved significantly.

Publications Resulting from This Project:

Shen Z.-K., D. Agnew, Y. Bock, D. Dong, T. Herring, K. Hudnut, D. Jackson, R. King, S. McClusky, and M. Wang, Southern California geodetic crustal deformation (abstract), EOS, Am. Geophys. Union, Fall Meeting Suppliment, 80, F267, 1999.

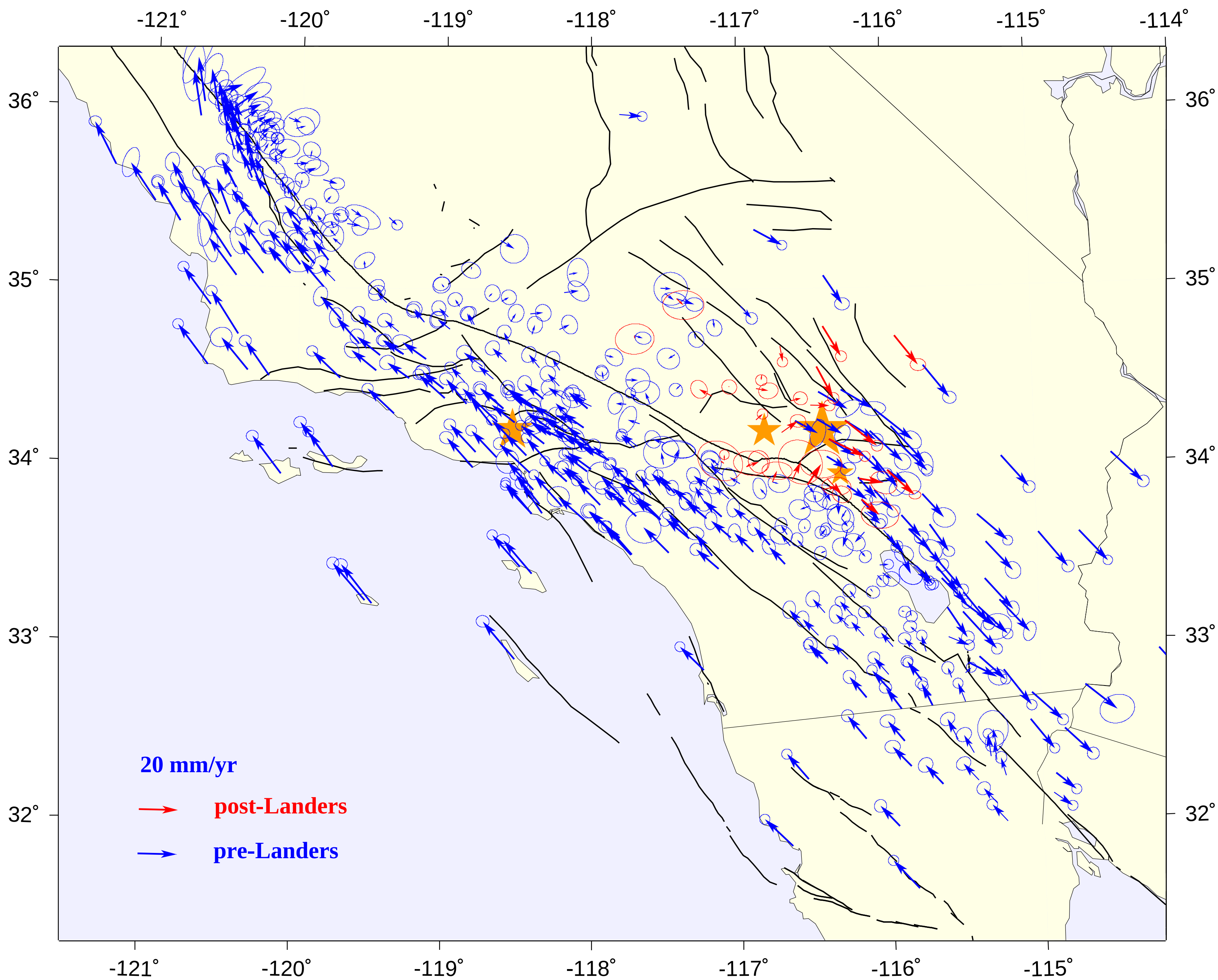

Figure 1. SCEC crustal motion map update. Arrows represent horizontal velocities with respect to half of the North America/Pacific relative plate motion. Error ellipses represent 95% confidence. Stars represent recent earthquakes whose coseismic effects are modeled. Red arrows are the sites whose velocities possibly changed after the Landers earthquake.