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Progress this year can be summarized as:

Completion of Eastern California/Walker Lane kinematic modeling, including the publication of *Kinematics of the southern Walker Lane Belt and motion of the Sierra Nevada block* (*Hearn* and Humphreys, 11/99, JGR). Figure 3a-b shows some of these results (for the preferred model). From the standpoint of SCEC's mission, resolution of Sierra Nevada-Great Valley block motion is the most important result. Since the San Andreas system lies between the rigid Pacific plate and the Sierra Nevada-Great Valley block, knowledge the motion of the bounding rigid bodies provides strong constraint on the strain (and clues on the stress behavior) in the vicinity of the San Andreas in central California. New geodetic data are consistent with geologic kinematic information east of the Sierra Nevada: the southern Sierra Nevada block is moving 3-5 mm/yr more westerly than in previous models. This motion results in more contraction normal to the San Andreas fault (from ~2.5 mm/yr near Gorman to zero near Cape Mendocino).

Post-seismic stress evolution. *Liz Hearn* has been studying the various transient behaviors excited by an earthquake. In general, this evolution takes the coseismic stress (the half-space solution) toward the layer solution, which involves a transfer of load to the elastic upper layer (which is, essentially, seismogenic layer) as the underlying visco-elastic material relaxes. Motivated by a desire to model the actual data produced by the post-seismic stress and strain response of actual earthquakes, our goal is a development of methods to model these more complicated situations. Towards this end, we developed finite element code that incorporates capabilities to handle: finite, arbitrarily shaped faults; body forces (important in dip-slip ruptures); sub-seismogenic creeping faults; and laterally variable rheological properties (described either statistically or deterministically). Results are being prepared for submission in GRL (submission within a few months) and JGR (submission within the year).

Regional kinematics and dynamics. Southern California deformation can not be understood well without incorporating information from surrounding regions. Figure 3c-d shows results of regional kinematic modeling (from *Hemphill-Haley* and Humphreys, in prep. for submission to JGR in 1-2 months; this work represents half of Mark Hemphill-Haley's Ph.D. thesis). In considerations of southern California, the most important aspect of this research is the kinematic constraint that it brings to the southern California region, especially to the east (i.e., Basin and Range) and west (i.e., Pacific Plate) of southern California.

Figures 1-2 represent some of our work on the stress field of North America (from *Coblentz* and Humphreys' ongoing research), and this work is most relevant to the research proposed this year. The significance to SCEC of our current research is largely in estimation of stresses applied to southern California; details of stress calculations within California are the subject of our proposed research. Figure 1 shows our new mesh, which is refined enough to represent well the basic variations in potential energy. With this mesh we are calculating stress contributions arising from the full set of possible stress contributors. Figure 2(i, left frame) shows the calculated stress at selected nodes (using viscous elements in finite element calculations) for ridge push forces acting on the eastern and northern margins of the North America Plate. These forces push North America against the Pacific Plate, creating a plate wide compression that is important throughout North America (including southern California). Figure 2(i, center frame) shows the calculated stress at selected nodes arising from potential energy variations ("topographic stresses"). These stresses drive extension away from high potential energy (topography), and overcome the plate-wide compression , and overcome the plate-wide compression excited by ridge push. The "plate" and "topographic" stresses are due to potential energy, and hence can be well estimated. Figure 2(i, right frame) shows (schematically) the stresses caused by basal drag. In addition to Pacific North America interaction, the descent of the Transverse Ranges density anomaly is important. Since the total stress field is a combined result of the individual contributions, and modeling is done with a (spatially variable) Newtonian viscosity, the scaled sum of the individual contributions is found easily. This is represented in Figure 2ii. This predicted stress is then compared to the observed stress (Figure 2iii).