

Bawden, Gerald W. (U.S. Geological Survey, Water Resources Division, Sacramento, CA)

SEPARATING HYDROCARBON AND GROUND WATER PRODUCTION EFFECTS FROM TECTONIC CONTRACTION MEASUREMENTS ACROSS THE METROPOLITAN LOS ANGELES, CALIFORNIA

After the destructive 1987 Whittier Narrows and 1994 Northridge earthquakes revealed that blind thrust faults threaten metropolitan Los Angeles, an array of 250 continuously recording GPS stations (Southern California Integrated GPS Network – SCIGN) was deployed to detect and monitor the displacements associated with deep slip on both blind and surface faults. GPS time-series data (1992-2001) collected from SCIGN were combined with Interferometric Synthetic Aperture Radar (InSAR) imagery to detect surface displacements in the metropolitan Los Angeles region. After surface displacements associated with fluid pumping and known strike-slip faulting were estimated and removed, the GPS data indicated that about 4.4 ± 0.8 mm/yr of $N36 \pm 5^\circ E$ -oriented uniaxial contraction occurred across Los Angeles, perpendicular to the major strike-slip faults. These results suggest that the contraction is primarily accommodated on the thrust faults rather than on northeast-trending strike-slip faults. The extensive pumping of hydrocarbons and ground water throughout metropolitan Los Angeles obscures and in some cases mimics the tectonic signals expected from the blind thrust faults. For example, in the 40-km long Santa Ana basin, seasonal ground-water withdrawal and artificial recharge of the aquifer system, produces ± 55 mm of vertical and ± 8 mm of horizontal summer-to-winter seasonal oscillations. Increased ground-water production in the Santa Ana basin since 1995 has resulted in approximately 20 mm/yr of subsidence.

For more information see:

<http://quake.wr.usgs.gov/research/deformation/modeling/socal/la.html>