**Tearing Across the Pacific-North American Plate Boundary Near Los Angeles**

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**Abstract**

Paper can be up to 4500 words total

**Introduction**

The frequency and coverage of geodetic observations in southern California has burgeoned over the last two decades, providing a wealth of information about crustal deformation in the region. Twenty years ago sparse GPS networks, measured infrequently constrained the motion between the Pacific and North American plates (Feigl et al, 1993) and elucidated actively deforming regions such as the Ventura and northern Los Angeles basins (Donnellan, et al., 1993a,b, Argus et al., XXXX). The Southern California Integrated GPS Network was established in the late 1990s (Hudnut??? et al., XXXX) providing continuous observations of positions and velocities at 250 stations scattered throughout Southern California. These observations provide detailed time histories of motions at individual sites, but it is only possible to infer the general distribution of slip throughout the region.

More recently, beginning in October of 2009 airborne InSAR measurements from NASA’s UAVSAR platform (Hensley et al., XXXX) provide extremely detailed images of spatial distribution of surface motions averaged over the time duration between observations. UAVSAR observations have been acquired approximately every 4–6 months in east west swaths about km wide across the Los Angeles and Southern California region, including across the San Andreas fault and Eastern California Shear Zone (Sauber et al., 19xx).

The GPS and InSAR measurements are complementary, with continuous GPS observations providing a precise time history of station motions and UAVSAR filling in the pattern of crustal deformation across the region. GPS provides daily point positions with an absolute accuracy of about 2 mm horizontal and 3 mm vertical and about 1 mm/yr over five years (Argus et al, XXXX). UAVSAR measurements provide line of site changes between the ground surface and the aircraft with adjustments made for the slight changes in position of the aircraft between passes.

These complementary measurements provide a rich dataset for understanding regional strain across southern California as well as changes in crustal deformation resulting from earthquakes. While geologic observations provide the average fault history over tens of thousands of years, the geodetic observations provide a snapshot of the present day tectonics of the region.

**Geologic Setting**

The San Andreas fault takes up a substantial amount of motion between the Pacific and North American Plates (ref?; Figure 1). It runs from the eastern shore of the Salton Sea in southern California northward beyond San Francisco where it turns offshore (ref?). For most of its length it follows a northwest trend, striking approximately 340° for most of its length. The slip rate along these sections of the fault averages x mm/yr (ref) and the total plate boundary motion is 53(?) mm/yr (Minster and Jordan, xxxx). The fault has a more east-westerly orientation, striking 205°, north of Los Angeles for a stretch of about 100 km between Palm Springs and Gorman. This section of the San Andreas fault is known as the Big Bend of the San Andreas fault (ref).

The presence of the Transverse Ranges and change in orientation of the San Andreas fault complicate the Pacific-North American plate boundary tectonics. The Eastern California Shear Zone, responsible for the 1992 M 7.3 Landers earthquake (ref) and the 1999 M 7.1 Hector Mine earthquake (ref), stretches along the northward extension of the far southern section of the San Andreas fault. The crust in the Eastern California Shear Zone is thin at about 5 km (ref) and relatively warm (ref).

The tectonics south of the Big Bend of the San Andreas fault are more complicated. The San Gabriel Mountains between the Big Bend and Los Angeles are primarily granitic (ref) and are relatively cold and brittle, as a result of a local mantle down welling underneath the Transverse Ranges (Humphries and Weldon, 19xx). The Los Angeles basin, just south of the San Gabriel Mountains is about x km wide, and stretches east west for about x km. Approximately xx km of sediments fill the basin (ref). The northern Los Angeles basin is rapidly shortening at a rate of about 7 mm/yr (Argus et al, xxxx) as is the narrow Ventura basin, which lies north of the San Fernando Valley and stretches westward to Ventura (Donnellan et al., 1993a,b). Numerous east-west striking thrust faults take up the shortening of these basins. These faults include the Sierra Madre fault, which runs along the extent of the southern margin of the San Gabriel Mountains (ref), the Whittier fault further south in the basin and just east of Los Angeles (ref), and the north dipping San Cayetano and south dipping Northridge and Oak Ridge faults that bound the Ventura basin (refs). Additional thrust faults also take up the regional shortening.

The San Jacinto, Elsinore, and Newport-Inglewood faults are major strike-slip faults located west of and sub-parallel to the main strike of the San Andreas fault. The geologic slip rates on these faults are xx mm/yr, xx mm/yr, and xx mm/yr respectively. Details of the mechanics of the faults in the Los Angeles region are not well known, particularly for present-day, complicating assessment of earthquake hazard for the region.

**Historical Earthquakes**

Lisa???

1812??, 1857 San Andreas, 1933 Newport-Inglewood, 1972 San Fernando,

**Geodetic Observations**

**Distributed Plate Motion Based and Fault Slip Inversions**

**Tearing of the Pacific-North American Plate and Implications for Earthquake Hazard**

**Conclusions**

**References**

~40 references expected

Up to six figures or tables

Table 1. Fault slip parameters based on inversion of GPS and UAVSAR observations and comparison to geologic estimates.

Figure 1. Regional setting showing faults and topography of southern California. Historic ruptures are outlined in bold where known or marked by a star with date and magnitude noted.

Figure 2. GPS velocity field averaged over the 19xx – 20xx time period relative to the Pacific Plate (ref).

Figure 3. UAVSAR observations in southern California. Repeat pass interferograms are unwrapped. Color change indicates line of site changes of the ground surface relative to the aircraft. One color cycle represents x cm of motion.

Figure 4. Detailed interferograms for for selected regions. Panel a) El-Mayor/Cucaphah earthquake, b) Rialto-Colton fault, c) Los Angeles basin, …

Figure 5. Regional map depicting partitioning of tectonic motions across southern California.